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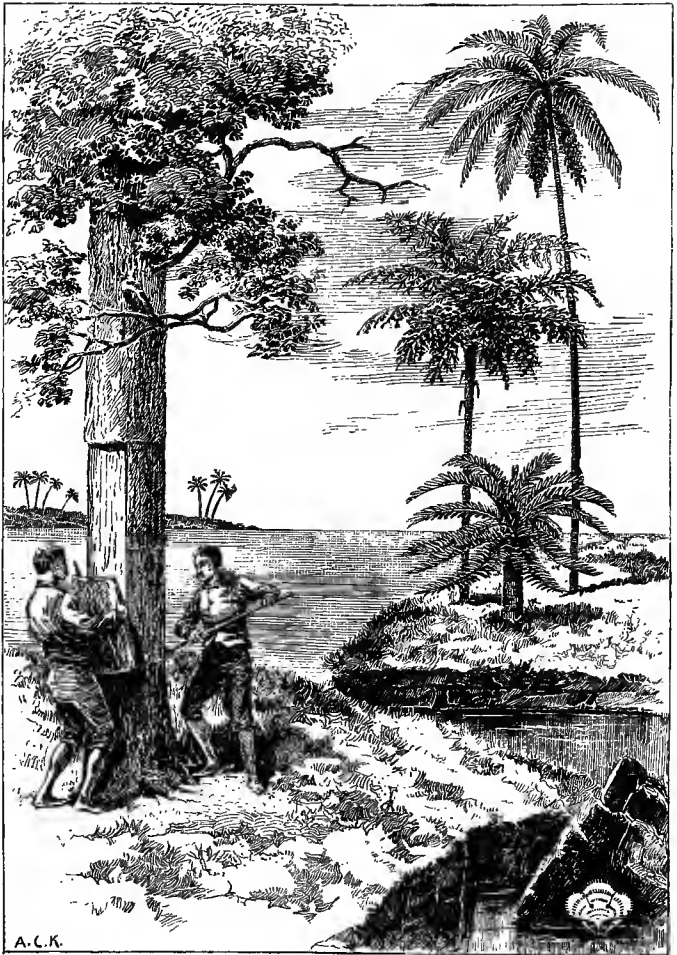
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B C D A

Glimpse of the coast of Valencia, Spain, illustrating the botanical Series and Classes. A. *Padina pavonia*, seaweed, at low tide. B. *Cyathea arborea*, tree-fern, in a private garden. C. *Cycas revoluta*. D. *Phoenix dactylifera*, Date-Palm, female tree; other trees, male and female, on the horizon. E. *Quercus suber*, Cork Oak, on the edge of a Cork Oak plantation; laborers cutting the bark, which is the cork of commerce.

BOTANY

FOR

ACADEMIES AND COLLEGES;

CONSISTING OF

PLANT DEVELOPMENT AND STRUCTURE

FROM

SEAWEED TO CLEMATIS

WITH TWO HUNDRED AND FIFTY ILLUSTRATIONS;

AND

A MANUAL OF PLANTS

INCLUDING ALL THE KNOWN ORDERS WITH THEIR REPRESENTATIVE
GENERA.

BY

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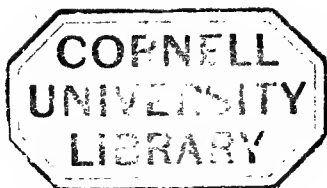
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TO
THE ILLUSTRIOUS MEMORY
OF
ANTOINE L. DE JUSSIEU.

P R E F A C E.

THE course of study in these Lessons is based upon the inductive method of A. L. de Jussieu. Beginning with Cryptogamia (the alphabet of organic life), Plant Development is gradually unfolded, from the green stain on our door-stone to the Magnolia and Clematis. Thus, at the outset, we see the principles upon which Differentiation is based. The Lesson on Fossils (including the Geological Table) exhibits the proofs of these principles. Then, with the plant world thus outlined, we begin the study of separate parts—root, stem, leaf, flower, fruit, tissues—and the forces which govern them.

The Phanerogamia are usually divided by systematic botanists into two classes,—Monocotyledons or Endogens, and Dicotyledons or Exogens; and the Dicotyledons into two sub-classes,—Gymnospermæ and Angiospermæ. This is not nature's method. The Monocotyledons are Angiospermæ (Covered Seeds) as well as the Dicotyledons; they are much more highly differentiated than the Gymnospermæ; and they are a much newer class, geologically. The most learned scientists of to-day follow nature; and in nature we find Gymnosperms associated with the higher Cryptogams in the order of development. They form *Comprehensive Types*, including the characters of Cryptogams, Monocotyledons, and Dicotyledons. They are not true Dicotyledons. Their flowers are without calyx or corolla;

the female flower is a naked ovule without an ovary ; the embryo has a long, persistent suspensor. Their wood and bark are nearly identical in structure. Their leaves resemble those of the Fern, Club-Moss, or Palm. No type of plants is more distinctly individualized. In these Lessons they are accordingly separated into a distinct class, and placed immediately after the Cryptogams. Next follow the Angiosperms, divided into two sub-classes, Monocotyledons and Dicotyledons (see Frontispiece, facing Title-Page). This is the only departure from the method of Jussieu ; and the author is confident that if Jussieu had lived to learn the lesson of the fossils as well as other late discoveries in science, he would have been first to advocate an arrangement which is so logical because it is so natural.

The Manual which forms the second part of this volume is only an outline, for a mere catalogue of the 150,000 or more species of known plants would fill a quarto ; but it is a complete outline. It should be consulted with every Lesson, and living specimens of the plants mentioned should be examined whenever they can be obtained.

The use of the microscope cannot be too strongly urged. Without it no part of the plant can be successfully studied ; and good compound instruments small enough to be put in the pocket can be bought at rates ranging from three to five dollars.

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ACADEMIC BOTANY.

SECTION I.—STRUCTURAL BOTANY.

PART FIRST.—MORPHOLOGY.

LESSON I.

FUNDAMENTAL DEFINITIONS.

1-4. Natural Science. 5. The Plant. 6. Energy and Forces. 7. Life. 8. Plant defined. 9. Primordial Cell. 10. Nomenclature. 11. Departments of Science. 12. Sex, Series.

1. Natural Science treats of all things in Nature. Nature is a synonyme for the Universe. It consists of *Elements*; of *Bodies* made out of elements; of *States or Conditions* in which elements and bodies exist; of *Forces* which govern them.

EXAMPLE: Oxygen and Hydrogen are elements; they exist in a gaseous state. These two elements (gases) unite by chemical force, and form Water. Water exists in a liquid state; it is put in motion, or brought to rest, by physical force.

2. Bodies are Inorganic and Organic.

3. Inorganic Bodies are without organs (Gr. *organon*, from *ergon*, work); that is, they have no working parts. They consist of particles, all of which are alike; and they increase by accretion or addition, not by growth. They are called *inert* because they have no inherent power to

move, but are active only when moved by outside force. Minerals (which include gases, water, metals, stones, and earths) are inorganic.

4. Organic Bodies have organs (working parts). They feed, they grow, they reproduce their kind. A plant is organic; its working parts are Root, Stem, Leaf, and Flower, or parts equivalent to them. An animal is organic; its working parts are Stomach, Entrails, Lungs, Heart, Head, or parts equivalent to them.

The science of organic bodies has two divisions: Botany, which treats of plants; Zoology, which treats of animals. These divisions constitute *Biology* (Gr. science of life), a term invented by Lamarck, who saw the truth of Buffon's declaration that "These two classes of organized beings have many more common properties than real differences."

5. The plant is the vital link between the mineral and animal. Plants feed on minerals and digest them into organic food. Animals feed on plants or on animals; none of them, except the lowest (simplest), which are plant-like in structure, can digest minerals (9, 53).

6. Energy and Forces.—Energy is the power which pervades all nature, the reservoir whence all her activities proceed,—Attraction, Repulsion, Heat, Light, Electricity, Magnetism, Life,—and these activities are called *Forces*.

A. Chemical force governs elements; its study is Chemistry.

B. Physical force governs bodies and their particles, together with their properties and relations; its study is Physics.

C. Vital force governs life, and life exists only in plants and animals; its study is Biology, under the two divisions Botany and Zoology. Vital force includes

D. Voluntary force, which governs Will; and

E. Mental force, which governs Reason. Mental force is the attribute of man alone; but there is a prophecy of it in the instinct of animals, and a foreshadowing of it in the behavior of plants, as we shall presently see.

7. Life.—Organic bodies are called *living* because they have life, which may be described—not defined—as: *The power by which organized beings feed, grow, and reproduce their kind.* Life, then, is threefold; it includes

A. *Digestion*, the power to take food and to convert this food into substances like those of the being that digests it;

B. Growth, the increase and development of the organs of living things ;

C. Reproduction, the power to generate a living body like the parent or parents that produced it. This living body is at first a minute cell called an Embryo (Gr. *embryon*, the rudiment of a living being).

8. Plant defined.—A Plant is an organized body, feeding on water, air, and earth by means of roots, stems, and leaves, or parts equivalent to them, and reproducing its kind by means of flowers or parts equivalent to them.

The old definition of a plant—"an organic body destitute of sense and spontaneous motion," etc.—has long been discarded. The various parts of plants perform the functions of animal organs. With something very much like cunning the Fly-Trap (Fig. 112), *Nepenthes* (Fig. 113), and *Sarracenia* (Fig. 114) catch insects and digest them at leisure. The *Vallisneria* flowers (Fig. 244) carry on as pretty a courtship as human lovers. The *Cyclamen* (Fig. 245), like our homely Gooba pea, shows a mother's forethought in the care she takes of her young ; and the lower seaweeds (Figs. 11 to 13) swim about with an apparently voluntary motion by which they are often mistaken for animals. These phenomena no longer surprise us ; for

9. The Primordial Cell, or life-cell, in both plants and animals, is composed of the same materials and endowed with the same power of self-motion ; differing, however, in food : the plant feeds on inorganic, the animal on organic, matter (5, 53).

10. Nomenclature.—In Botany, as in every other science, the *Nomenclature* or *Terminology*—system of names or terms—is based on the rule of the Latin Grammar, though the names may come from the Greek or any other language. This method was adopted by scientists because the Latin, being a fixed language, is not subject to change. Scientific nomenclature is, therefore, a sort of universal speech, easy to acquire, which saves the labor of translation into various tongues. It is imperative that the student of any branch of science should master the principles of its nomenclature, which are few and simple. These, with the Rules for Pronunciation, are given in Lesson XXXV.

11. Sections.—Botanical Science has two Sections or departments :

Section I. Structural Botany.—This concerns the forms, functions, and structure of organs. Its divisions are :

A. Morphology (Organography), which treats of the outward form, arrangement, and behavior of organs, whether as a whole in the plant or as individuals ;

B. Physiology, which treats of the functions of organs ; that is, of the special work they do. These functions come under three heads :

(1) *Nutrition* ; (2) *Reproduction* ; (3) *Correlation*, or those functions by means of which external objects are brought into relation with the plant, and by which it reacts upon them ;

C. Phytotomy (Histology), which treats of the anatomy of plants and their tissues ;

D. Chemistry, which treats of the elements of which they are composed.

Section II. Systematic Botany.—This concerns the study of different plants in their relations to one another. Its divisions are:

A. Taxonomy (Classification), which places plants in groups;

B. Phytology (Descriptive Botany), which gives the *diagnosis* or distinctive features of these groups and of their individual members.

12. Sex. Marriage of Flowers. Series.—Though Systematic Botany is comparatively a new science, the fact upon which it is based, that flowers, like animals, are male and female, has been known from the earliest dates of history. Herodotus (480 B.C.) tells of the female palm-trees so carefully tended by the Babylonians, who brought flowers from the male trees in the distant forests, and pollinated the flowers of the female trees, which otherwise would have remained barren. Empedocles (440 B.C.) called seeds the eggs of plants,—a term still retained by botanists. A great revival in botanical research took place in the seventeenth century of the Christian era; and the marriage of flowers was declared as a creed in the names given to the *Two Series* into which plants are naturally separated, viz.:

Series I. Cryptogamia, or Hidden Marriage (Gr. *krupto*, I hide, *gamos*, marriage): Plants with rudimentary flowers which are usually microscopic, and which produce *spores*. Seaweeds and ferns are examples.

Series II. Phanerogamia, or Visible Marriage (Gr. *phaneros*, visible): Plants with developed and usually visible flowers, which produce seeds. The Pine-tree, Wheat, and Apple are examples.

LESSON II.

THE FLOWER DEFINED—THE EMBRYO.

13. Flower defined. 14. Cryptogamia. 15. Parentage. 15 *a*. Naked and covered spores. 16. Phanerogamia. 17. Naked and Covered Seeds. 18. Embryo-sac and Vesicle. 19. Male Flower. 20. Parentage; Fertilization; Parthenogenesis.

13. *The Flower* consists of generative organs and an Axis of growth. It is the most important part of the plant.

14. Cryptogamia.—

A. The female flower has several names, all equivalent to the same thing. The common name in Seaweeds is *Oögonium*, or Egg-Seed (Gr. *oön*, egg, *gonos*, seed). In the Ferns it is *Archegonium*, or Chief Seed (Gr. *arke*, chief). These oögonia and archegonia are often contained in a receptacle called *sporangium* (plural *sporangia*), *ascus*, or pouch (plural *asci*), and several other names, to be

mentioned in their proper places. Each oögonium or archegonium contains one or more spores; each spore is the embryo of the future plant (Fig. 1). This spore, even in the highest *cryptogam* (plant of Cryptogamia), has no develop-

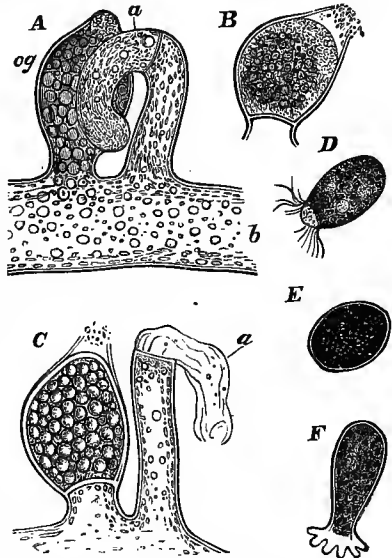


FIG. 1.—A, *Vaucheria sessilis* with oögonium and antheridium. B, oögonium open, antherozoids entering it. C, oögonium closed and ripening into an oöspore; antheridium withered. $\times 30$ diam. D, oöspore of *Oedogonium ciliatum*. E, zoöspore of *Vaucheria* after the withdrawal of the ciliæ. F, zoöspore of *Oedogonium* sprouting. $\times 350$ diam.

ment into special organs like those of the parent. It contains, however, all the materials for the immediate structure of those organs, though it remains until *germination* (the period when it begins to sprout) a simple cell with minute granules (grains) in its cavity.

B. The male flower throughout the Cryptogamia is called *Antheridium*, or little anther (Gr. *antheros*, blooming). It produces minute particles (Fig. 2) called *Antherozoids*, or animal-like anthers (Gr. *zoön*, animal). These have an active self-motion.

15. Parentage. *A. Fertilization.*—As soon as the contents of the oögonium and antheridium are mature each organ opens at the apex (Fig. 1, A, B); the spore in the

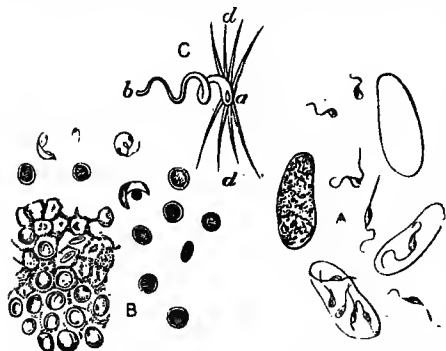


FIG. 2.—A, antherozoids of Seaweed—*Fucus platycarpus*; some free, others still in the antheridial cells. B, antheridium of moss—*Polytrichum commune*—discharging antherozoids. C, antherozoid of fern—*Pteris serrulata*; a, large extremity; b, small extremity; d, cilia, or hairs. Greatly magnified.

oögonium remains still; the antherozoids pass out from the antheridium, swim or creep to the open oögonium (Fig. 1, B), enter it, and blend with its spore. After this process—which is called *Fertilization*—the antheridium dies, its work being accomplished; the oögonium closes (Fig. 1, C); her spore develops into an *Oöspore* (egg-spore); and thus *Embryogeny*, or embryo-creation, is accomplished. At maturity this egg-spore passes out from the oögonium, which bursts to discharge it. It is now capable of sprouting and growing up into a plant, which it soon begins to do (Fig. 1, F). But even when fully grown and ready to sprout it is still a simple cell. *B. Parthenogenesis.* Often in *Vaucheria* and other seaweeds reproduction takes place in a mother-cell without foreign aid from antherozoids. This is *Virgin parentage* (Gr. *parthenos*, virgin, *genesis*, creation). In

oögonium remains still; the antherozoids pass out from the antheridium, swim or creep to the open oögonium (Fig. 1, B), enter it, and blend with its spore. After this process—which is called *Fertilization*—the antheridium dies, its work being accomplished; the oögonium closes (Fig. 1, C); her

these cases the spores (Fig. 1, D) are provided with hairs called *ciliæ* (L. *cilia*, hair), and are endued with self-motion. They are therefore called *Zoospores*, or animal-spores.

These little creatures are very social; they dance among themselves, circling merrily, but never jostling; no human dancers could be more polite; then, when the heyday of youth is over, they withdraw their *ciliæ* (Fig. 1, E), produce an outer wall, send out root-like projections (Fig. 1, F), and develop into staid mother-plants.

15 a. Naked and Covered Spores.—In the lower Cryptogamia—Seaweeds, etc.—the spores are naked; that is, they have no special cover immediately surrounding them. The plants grow broadly from a common centre, without distinction of stem or leaf; they are called *Thallogens* (Gr. *thallos*, a young shoot, *gennao*, to grow, beget), and may be called Broad-growers. In the higher Cryptogamia—Ferns, etc.—the spores are covered; the plant-growth is upward, from the top; they are called *Acrogens* (Gr. *akros*, top, end, summit), and may be styled Top-growers.

16. Phanerogamia.—A. The female flower is called an *Ovule* (L. *ovulum*, little egg); sometimes called *Nucleus*, or kernel. It usually has two coats (Fig. 3, a) called Seed-coats.

The inner coat is called *Secundine*, or second coat (though it is first formed). The outer is called *Primine*, or first coat. The opening in the Secundine is called the *Endostome*, or inner mouth (Gr. *endon*, within, *stoma*, mouth). The opening in the primine is called the *Exostome*, or outer mouth (Gr. *exo*, outside). The

apex of the ovule (Fig. 3, a, n) points to these mouths. The two coats are attached to the ovule only at its base (Fig. 3, A, ch); this point is called the *Chalaza* (Gr. tubercle); the orifice at the apex of the coats (whether there be one or two coats)

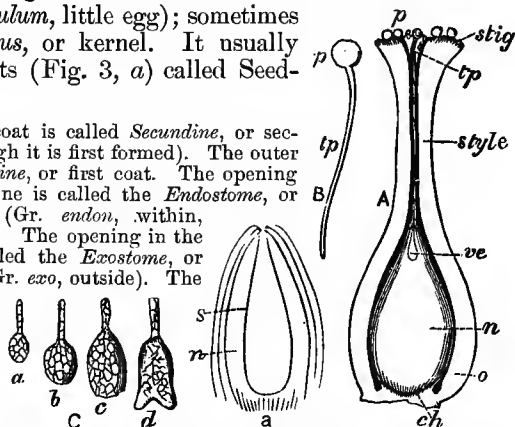


FIG. 3.—a, ovule of Smartweed (*Polygonum*), with two coats; n, nucleus; s, embryo-sac. A, pistil of same; o, ovary; styl, style; stig, stigma; p, pollen-grains; tp, pollen-tube; ve, embryonic vesicle; ch, chalaza. B, pollen-grain emitting its tube. C, a, b, c, d, embryo (now become many-celled) at different stages of growth; d, showing two cotyledons forming. The long thread-like part in the four figures is the suspensor.

the orifice at the apex of the coats (whether there be one or two coats)

is the *Micropyle* (Gr. *mikron*, small, *pyle*, gate). For accents of terms, see Glossary and Indices.

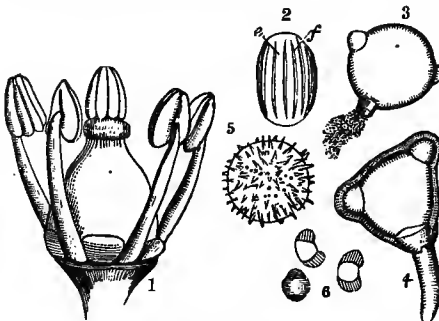


FIG. 4.—1, floral organs—stamens and pistils—of Vine (*Vitis vinifera*), corolla and calyx removed, showing the fleshy disk of the torus below the ovary. 2, pollen-grain of Milk-wort (*Polygala vulgaris*); *e*, grooves or slits in the extine, through which the intine *f* protrudes as a pollen-tube. 3, pollen-grain of Cherry (*Cerasus vulgaris*), discharging fovilla. 4, pollen-grain of Evening Primrose (*Oenothera biennis*), tubes protruding. 5, pollen-grain of Mallow (*M. Alcea*). 6, pollen-grains of Pine (*Pinus excelsa*), with two bladder-like swellings of the extine, which assist it on being borne by the wind.

—the ovule is contained in an *Ovary*, or egg-holder (Fig. 3, A, *o*). The plants in these higher divisions are therefore called *Angiospermæ*, or Covered Seeds (Gr. *aggeion*, a vessel). The upper part of this ovary is usually prolonged into a stalk called a *Style* (Fig. 3, A); the apex of the style is without the epidermis, or skin, which covers the rest of the plant; it is therefore called a *Stigma* (Gr. brand), because it is like flesh seared by a hot iron. These,—ovary, style, and stigma,—taken together, form the *Pistil*; but they are merely protective; the ovule is the only essential part. When the style is wanting, as in the Vine (Fig. 4, 1), the stigma is termed *Sessile*, that is, *seated* (on the ovary).

Sometimes the ovule is raised on a stalk called a *Funiculus* (L. little cord), as in the Pea (Fig. 5, *σ*); when this is wanting the ovule is sessile. The part of the ovary (or of the scale in Naked Seeds) to which the ovule is attached is the *Placenta* (L. cake). The point by which the ovule is attached to the funiculus (or to the placenta when the funiculus is wanting) is the *Hilum*, or Eye. The Black-Eyed Pea gets its name from its conspicuous hilum.

18. The Embryo-sac and Vesicle.—The Ovule (nucleus) contains the *Embryo-sac* (Fig. 3, *a*, *s*); this sac contains

17. Naked Seeds and Covered Seeds.

—In the lower Phanerogamia—Pines, etc.—the ovule has no cover except its own coat or coats. The plants in this lower division are called, therefore, *Gymnospermæ*, or naked seeds (Gr. *gymnos*, naked, *sperma*, seed). In the higher Phanerogamia—Grasses, Palms, Oaks, etc.

the *Embryonic Vesicle* (Fig. 3, A, *ve*), which becomes the embryo. All the other parts of the ovule, as well as of the plant, consist of many united cells; but this vesicle, before fertilization, is a simple cell, like the spore in Cryptogamia. At first it has a neck called *Suspensor*, as in the figures in C; but this suspensor soon disappears, except in Gymnosperms, in which it persists.

19. The Male Flower in Phanerogamia is called an *Anther*. It is usually raised on a stalk called a *Filament*, as in the Vine (Fig. 41,) and Cherry (Fig. 5, 5); and the two together—anther and filament—form the *Stamen* (from Gr. *istemi*, I stand). When the filament is wanting the anther is sessile. The anther has two lobes, which are at once united and separated by a ridge or line called the *Connective* (Fig. 4, 1). Usually the connective is a mere prolongation of the filament; but sometimes it is a well-defined body, as in the Almond. The anther contains a fine dust called *Pollen* (L. flour-dust). This consists of minute separate cells called *pollen-grains*. Each grain has two coats (Fig. 4, 2 to 6): the *Intine*, or inner, the *Extine*, or outer. The extine is often beautifully figured or ornamented. Each type of plant has its peculiar pollen-grains, characterized by special forms and markings. The pollen-

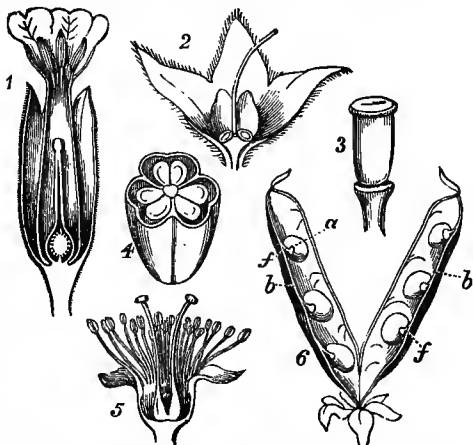


FIG. 5.—1, vertical section of fl. of Primrose (*Primula elatior*), showing many ovules on a free central placenta, stamens on a monopet. corol. 2, vert. sec. of fl. of Comfrey (*Symphytum*); corolla and two ovaries removed. 3, pistil of Barberry (*Berberis*); style short, thick; stigma shield-like. 4, transverse section of ovary of Lily (*Lilium*), three-celled. 5, vert. sec. of fl. of Cherry (*Cerasus vulgaris*), petals removed; two pistils, many stamens. 6, pistil of Pea (*Pisum*) opened; a, ovule; b, placenta; f, funiculus.

grains are minute particles, each consisting of two coats, the inner being the *Intine*, and the outer the *Extine*. The *Extine* is often beautifully figured or ornamented. Each type of plant has its peculiar pollen-grains, characterized by special forms and markings. The pollen-

grain is filled with a fluid called *Fovilla* (L. nourishment). This fovilla (Fig. 4, 3) contains particles which are the equivalents of antherozoids in Cryptogamia; but they have only a slight self-motion.

20. Parentage.—When the ovule and pollen are mature—at the flowering season—the anther-lobes open and the pollen-grains are set free. Borne by the wind or by insects, these grains reach the naked ovule of the Pine, or the stigma of the pistil in the higher phanerogams. Both of these—the Pine ovule and the stigma—have, at the apex, delicate *papillæ* (L. nipples), which are projections forming what is styled the *conducting tissue*. The pollen-grains fall on this tissue, to which they are held by a viscid fluid it secretes. This fluid acts on the pollen-grain; if it is a gymnosperm (Pine, Cycas, etc.) its extine bursts irregularly (Fig. 48, B); if an angiosperm (Grass, Cherry, etc.), its extine is provided with special openings (Fig. 4, 2 to 5); through these openings the intine protrudes in the form of a tube (Fig. 3, A, B). This tube contains the fovilla; and descending through the loose tissues of the style (Fig. 3, A, *tp*) it penetrates to the embryo-sac, and mingles its contents with the contents of the embryonic vesicle (which is equivalent, as we know, to the spore in cryptogamia). The transfer of the fovilla from the pollen-tube to the embryonic vesicle has never been detected; botanists suppose it takes place by diffusion through the cell-walls. At any rate, the appearance of the pollen-tube in this neighborhood incites the embryonic vesicle to active work; and this is called Fertilization also, though not by direct contact as in *Vaucheria*. The time required for this process varies. In Gymnosperms the pollen-grain remains dormant on the naked ovule for weeks and months before sending down its tube; and the fruit does not ripen until the following year. In the higher plants a much shorter time is required; sometimes a week elapses; sometimes a day; the pollen-tube passes down the long style of the *Pretty-by-night* (*Mirabilis*) and the *Night-blooming Cereus* in a few hours.

LESSON III.

THE EMBRYO CONTINUED—GERMINATION—TORUS.

21. Seed, Embryo. 22, 23. Fruit, Seed. 24. Cotyledons. 25. Germination. 26. Collum. 27. Axis of growth, or Torus; Houses.

21. Seed. Embryo.—The ovule, after fertilization, is technically called a *Seed*. The embryonic vesicle—which is equivalent to the oöspore in Cryptogamia—does not remain a simple cell. It rapidly multiplies its cells by division; the cells remain united (Fig. 3, C), and are gradually *differentiated*—that is, changed into different organs and parts

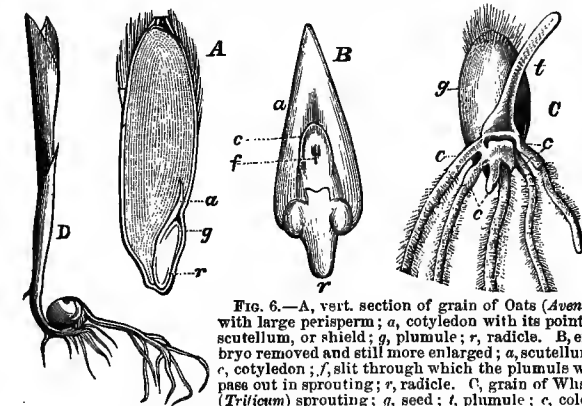


FIG. 6.—A, vert. section of grain of Oats (*Avena*), with large perisperm; *a*, cotyledon with its pointed scutellum, or shield; *g*, plumule; *r*, radicle. B, embryo removed and still more enlarged; *a*, scutellum; *c*, cotyledon; *f*, slit through which the plumule will pass out in sprouting; *r*, radicle. C, grain of Wheat (*Triticum*) sprouting; *g*, seed; *t*, plumule; *c*, coleorhiza, or root-sheath. D, grain of Indian Corn (*Zea*) sprouting; plumule with three leaves; stem sending out adventitious roots above the collum.

like those of the parent plant. Whilst this process is going on in the embryo itself, the embryo-sac becomes filled with nutrient substances which are provided to sustain the embryo at the time of germination (Fig. 6, A; Fig. 9, 2). This food is called *Perisperm* (Gr. *peri*, around, *sperma*, seed), because it usually obliterates the embryo-sac and fills the cells of the nucleus, thus surrounding the embryo, which is the soul of the seed. It is the perisperm in the grains—Wheat, Oats, Maize, etc.—which furnishes our flour and meal. [Sometimes the embryo-sac persists at a certain

stage of growth, as in the Yellow Water-Lily (Fig. 7, E); it retains its special secretion or food, whilst other food is developed in the nucleus outside of it. This outer nutriment is the perisperm; the inner nutriment is called *Endosperm*, a term sometimes (but loosely) applied to the true perisperm. The persistent embryo-sac here is called a *Vitellus* (L. yolk of an egg) because in position it resembles the yolk of an egg.] In many cases the embryo itself becomes large, completely fills the seed, and stores up the nutriment in its own proper organs, as in the Pea, Acacia (Fig. 7, A, B), Walnut, Almond, etc.

22. Fruit. Seed.—Whilst this process is going on in the embryo itself, the seed-coats grow; the outer coat thickens; in Gymnosperms (which we know have no ovary) this outer coat becomes fleshy or woody, simulating a true seed-cover. In Angiosperms (which have an ovary) the ovary grows and becomes a *Pericarp* (Gr. *peri*, around, *karpos*, fruit). In the Pea and Bean (Fig. 5, 6) the pericarp is a pod with many seeds. In the Cherry the pericarp is a stone with a fleshy exterior. Let us remember, in the beginning of our Lessons, that *the Seed itself is the true Fruit*; all other parts of the flower—

ovary, calyx, etc.—are but its envelopes, whether they be edible or not; though these too are called the fruit.

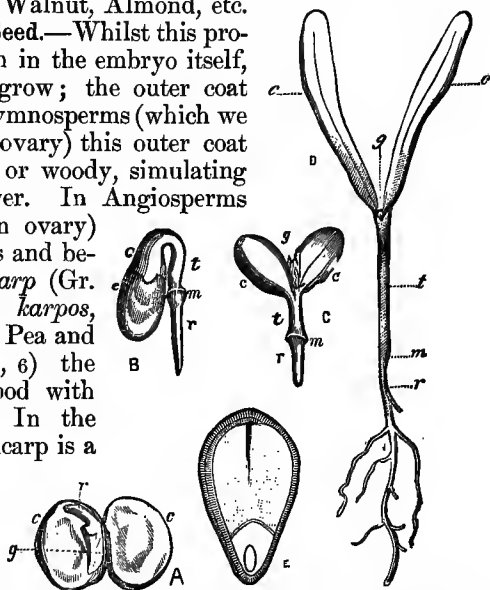


FIG. 7.—A, embryo of Pea (*Pisum*), with the two cotyledons *cc* separated to show the plumule *g*, and radicle *r*. B, seed of Silkflower (*Albizia Julibrissin*) sprouting; top of cotyledons still enclosed in the seed-coats. C, same, further advanced. Both these figures show the *collum*, or neck, *m*. D, young Maple (*Acer*); *r*, radicle; *m*, collum; *t*, caulicle; *cc*, cotyledons; *g*, plumule; caulicle, or true stem, not yet developed. E, seed of Yellow Water-Lily (*Nuphar*), showing the vitellus with its endosperm, and the outer perisperm; embryo minute.

23. We pluck the ripe fruit,—Pea, for example (Fig. 5, 6),—open the pod, and take out a seed. This seed has two coats; the inner one, thin and fine, is called the *Tegmen* (L. covering); it is the Secundine of the ovule. The outer coat is the *Testa* (L. shell); this is the primine of the ovule. It is usually harder and thicker than the tegmen, and often variously carved and appendaged, as we shall see in a future lesson. We carefully remove these seed-coats, and we find the ripe embryo (Fig. 7, A, B). We examine its parts. They are: the *Radicle*, or root, *r*; the *Caulicle*, or lower stem, *t*; the *Plumule*, or upper stem, *g*; the *Cotyledons*, *cc*. The cotyledons get their name from the Greek *kotule*, a cup, which they often resemble; being rounded without and hollowed within. The point of junction between the radicle and caulicle is the *Collum*, or neck (*m*). This is quite plain in the Acacia (Fig. 7, B, C); but in many plants it is invisible.

24. **Number of Cotyledons.**—In Gymnosperms the embryo has two, or oftener many cotyledons; in Angiosperms there are two divisions: (1) the Grasses, Lilies, Palms, etc., which have but one cotyledon, and which are called *Monocotyledons*; and (2) the Oak, Apple, Pea, etc., which have two cotyledons and are called *Dicotyledons*. In monocotyledons the cotyledon is sheathing, like a cylinder around the plumule; and it never leaves the seed nor ascends above ground in germination. In dicotyledons and gymnosperms the cotyledons often ascend, as in the Pea and Maple (Fig. 7). The cotyledons are transformed leaves; they are usually called Seed-leaves, because they nourish the young seed in germination, gradually yielding up their store as the plant grows, and then withering.

25. **Germination.**—We plant the seed. If it be a monocotyledon (Fig. 6, C, D), its plumule alone ascends above ground, and becomes a *Caulis*, or upper stem, whilst the radicle descends in the ground, and soon perishes; but other roots rapidly spring around the collum, or neck; and thus we see many fibrous roots in monocotyledons, but no central or *tap-root*. If the seed be a dicotyledon or a gymnosperm, its radicle becomes a strong tap-root, as in the Pine, Acacia, and Maple (Fig. 7, C, D), with many

branches; its caulicle often bears the cotyledons above ground (though sometimes, when they are very large and fleshy, as in the Acorn and Buckeye, the cotyledons remain under ground); its plumule lengthens into a *Caulis*, or true upper stem, with true leaves and branches. We see therefore in the embryo a miniature plant with root, stem, and leaves whilst still in the seed and attached to the mother-plant,—wonderfully developed above the spore in Cryptogamia.

26. The Collum, or neck (Fig. 7, D, *m*), is the focus of the two axes of the plant: the descending axis, which regards the root and its functions; and the ascending axis, which regards the stem and its functions. These functions are quite distinct, as we shall see.

27. The Axis of Growth of the flower (13) is called the *Torus* (L. cushion or couch). It segregates the generative organs from the body of the plant; at the same time it keeps them in communication with the plant, from which it transmits nutriment to them. In Cryptogamia it is often a mere line or point, as at the base of the organs in *Vaucheria* (Fig. 1, A, B, C). In Phanerogamia it is often conspicuous, forming a disk, as in the Vine (Fig. 4, 1). When the male and female flowers (stamens and pistils) are on the same torus, as in the Vine, Cherry, Primrose, etc., the flower is called *Bisexual* (two-sexed), and also *Monoclinous*, or one-couched (Gr. *kline*, couch). When the male and female are on separate tori (plural of torus), as in the *Vaucheria* (Fig. 1) and the Maize, or Indian Corn, the flowers are *Unisexual* (one-sexed), and also *Diclinous*, or two-couched. Diclinous flowers are called *Dicecious*, or two-housed (Gr. *oikos*, house), when the male and female are on separate plants, as in the Date, Willow, Hemp. They are called *Monœcious*, or one-housed, when they are on the same plant, but on separate tori, or couches, as in the *Vaucheria* (Fig. 1) and Indian Corn. The place which the stamens occupy on the torus is called the *Andrœcium*, or man's house (Gr. *andros*, man); the place occupied by the pistils is called the *Gynœcium*, or woman's house (Gr. *gyne*, woman); and this is always in the centre of the torus. The staminate flower is called *Sterile*, or bar-

ren, because its share in the work of reproduction is very brief, and it dies as soon as this is accomplished. The pistillate flower is called *Fertile*, because it does almost the whole work of reproduction—sometimes the whole.

Ex. . In the Maple, Pea, etc., after the pollen-grains of the stamen fertilize the ovule of the pistil the stamen dies in a few hours. The ovule develops into a fruit, requiring the entire summer to ripen. The case is the same in Cryptogamia. See Vaucheria, Figure 1, C.

LESSON IV.

THE PERFECT AND COMPLETE FLOWER—BASIS OF CLASSIFICATION—BOTANICAL NAMES.

28. Perfect Flower. 29. Complete Flower. 30. Arrangement of parts. 31. Basis of Classification. 32. Embryo rules the structure. 33. Order of Classification. 34. Botanical names.

28. The Perfect Flower is monoclinous (27). In the lower phanerogams the pistil, stamen, and torus make the entire flower, as in the Black Pepper and the Ash (Fig. 8, A); here the torus is a mere point of union with the stem.

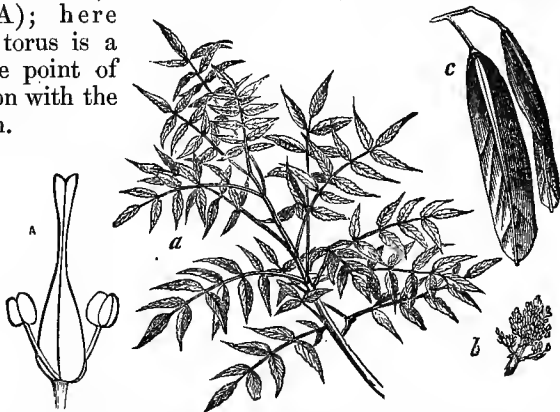


FIG. 8.—A, flower of Common Ash (*Fraxinus excelsior*), with two united pistils, which separate at maturity into two winged fruits, c; a, branch of same; b, cluster of flowers. A, magnified.

29. The Complete Flower is also monoclinous; but it is furnished with outer parts called *Floral Envelopes*, as in the Rose, Hollyhock, Buttercup (Fig. 9, 1, 6), and the Cotton (Fig. 10).

30. The Arrangement of floral parts is always in the following order :

A. The Pistil (with its ovule), in the centre of the torus, whether there be one ovary, as in the Primrose (Fig. 5, 1), or many ovaries, as in the Buttercup (Fig. 9, 6).

B. The Stamens (with their anthers), in a whorl or whorls next outside the pistils or ovaries.

C. The Corolla (L. little crown), next outside the stamens.

Its parts are called *Petals*; they are usually brightly

colored and delicate in texture. When the petals are united into a tube, as in the Morning-glory and Primrose (Fig. 5, 1), the flower is *Monopetalous* (one-petalled); when the petals are separate throughout, as in the Rose, Cotton, and Buttercup (Figs. 9, 10), the flower is *Poly-petalous* (many-petalled); when wanting, the flower is *Apetalous* (without petals).

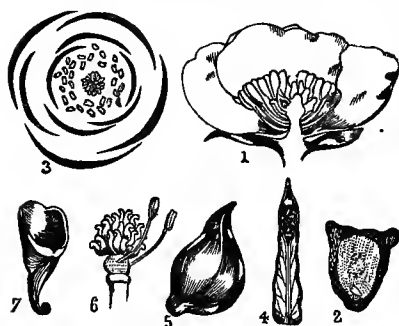


FIG. 9.—1, vert. sec. of fl. of Buttercup (*Ranunculus acris*); prolonged cone-shaped torus in the centre, with many pistils on its top; stamens (with long filaments) in whorls below the pistils; petals next outside the stamens (only three petals shown, others cut off); sepals next outside the petals; only two seen. 2, seed of Aconite, cut vertically, showing the very small embryo, the large perisperm, and the thickened testa. 3, diagram of Buttercup fl. 4, ripe follicle (pod) of Columbine (*Aquilegia*), open at top. 5, ripe akaine (one of the little pistils) of Buttercup. 6, pistils and part of stamens of Buttercup. 7, spurred petal of Columbine.

D. The Calyx (Gr. chalice, cup), its parts called *Sepals*, next outside the corolla. Often, when the petals of a flower are separate, its sepals are united into a cup at base, as in the Rose, the Cherry (Fig. 5, 5), and the Apple. The calyx-cup of the Rose becomes the red hip when ripe; the calyx-cup of the Apple becomes the fleshy part we call the fruit, though strictly the fruit is the seed alone. The corolla and calyx are called *Floral Envelopes*. They are always on the torus. When there is but one floral envelope, as in the Lily-of-the-Valley, or the Wood-rush, it is called a *Perianth*.

E. The Peduncle is a stalk on which the flower is often raised, as in the Buttercup, Cherry, Rose, Cotton (Fig. 10).

F. The Bract (L. scale) is a transformed leaf, on the peduncle or at its base. It is conspicuous in the Rose and Carrot. In the Hollyhock and Cotton (Fig. 10) the large bracts just below the flower exactly resemble a calyx; but the true calyx is within; and we can always tell the difference between bracts and sepals, because bracts are never on the torus.

31. Basis of Classification.—The ruling principle in all classification is the *Relative Value of Characters*, the most constant (enduring) characters taking the highest rank. In Botany these are found in the flower, but especially in the embryo; therefore *The condition of the embryo is the basis of classification*. The rules of value are as follows:

I. THE EMBRYO: A. The absence (Cryptogamia) or presence (Phanerogamia) of differentiated organs such as cotyledons, radicle, and plumule;

B. The absence (Gymnospermæ) or presence (Angiospermæ) of an ovary;

C. The number of cotyledons (Monocotyledonæ, Dicotyledonæ).

II. THE PETALS: A. Their absence (Apetalæ) or presence (Petalæ). B. Their cohesion (Monopetalæ) or separation (Polypetalæ).

III. THE STAMENS: Their manner of insertion, giving rise to the distinctions *Ovary Free*, *Ovary Adherent*, etc.

IV. THE PERISPERM: Its presence or absence; Its nature.

V. THE RADICLE: Its direction.



FIG. 10.—Indian Cotton (*Gossypium trilobatum*), fls. on peduncles; bracts just below the calyx, simulating a calyx; smaller bracts lower down on the peduncle, and at its base.

VI. *ÆSTIVATION*, or the arrangement of floral envelopes in the bud.

VII. *SYMMETRY* in the position, number, and form of the floral whorls.

32. *The Embryo rules the structure of the leaf and stem.*

I. Cryptogamia: **A. Class I. Naked Spores** (*Thallogens*) produce cellular growth without true leaves or stems (Seaweeds, Liverworts); and

B. Class II. Covered Spores (*Acrogens*) produce fork-veined leaves (Ferns), or awl-shaped leaves (Club-Mosses), and simple cellular stems with but little wood.

II. Phanerogamia. **A. Class I. Naked Seeds** (*Gymnospermæ*) produce parallel-veined leaves (Cycas), or fork-veined leaves (Gingko), or awl-shaped leaves (Pines), with imperfectly exogenous stems;

B. Class II. Covered Seeds (*Angiospermæ*), which have two divisions:

a. Monocotyledons, producing parallel-veined leaves (rarely net-veined, Yam) and endogenous stems (Wheat, Indian Corn, Banana, Palm).

b. Dicotyledons, producing net-veined leaves and fully exogenous stems (Oak, Almond, Rose, Magnolia).

33. Order of Classification.—Each Series—*Cryptogamia* and *Phanerogamia*—has its Classes, Orders, Genera, and Species.

For example, the Dog-Rose (*Rosa canina*) and the Sweet-Brier (*Rosa rubiginosa*) differ in a few specific points, such as rustiness and fragrance in the leaves of the Sweet-Brier; they are therefore different in SPECIES (*canina*, *rubiginosa*). They are alike, however, in fruit, flower, leaf, and stem; they are accordingly placed in the same GENUS (*Rosa*). The Peach and Almond resemble the Apple in flower; but the Apple-blossom has five pistils, whilst the Peach- and Almond-blossoms have but one. Their fruit also differs from that of the Apple; they are therefore placed in a different genus (*Prunus*) from that of the Apple (*Pyrus*). Yet the Peach, Almond, and Apple, in their flowers, their seeds without perisperm and with a straight embryo, resemble the Rose; they are therefore placed in the ORDER of the Rose (*Rosacæ*). The Oak differs from all of these in flower, fruit, and leaf; it is therefore placed in a different Order (*Cupuliferæ*). But its seed is covered,—that is, it has a pericarp; the Oak is accordingly placed in the same CLASS with the Rose (*Angiospermæ*, *Covered Seeds*); its embryo has two cotyledons, like the embryo in the Rose Order; it is therefore in the same SUB-CLASS (*Dicotyledonæ*). All these plants have visible flowers producing seeds; we know, therefore, that they

belong to the SERIES *Phanerogamia*. *Species*, then, make a Genus; *Genera* make an Order; *Orders* make a Class; *Classes* make a Series; and *Two Series*—*Cryptogamia* and *Phanerogamia*—make the Vegetal Kingdom.

34. The Botanical Name of a Plant is always double, and written after the rule of the Latin Grammar, though the etymon, or root, may come from any other language. The first name belongs to the Genus, and is called *Generic*. The second name belongs to the Species, and is called *Specific*. *Rosa* is the generic name of any rose; *Rosa canina* specifies (gives the species of) the rose we call in English Dog-Rose (*canina*, from L. *canis*, dog). *Rosa rubiginosa* (L. *rubiginosa*, rusty) specifies the rusty-leaved rose we call Sweet-Brier. (See Rules of Pronunciation, Lesson XXXV.)

LESSON V.

MORPHOLOGY OF THE PLANT AS A WHOLE—PLANT DEVELOPMENT.

Series I.—Cryptogamia. 2 Classes { 1. *Thallogens*, Naked Spores.
2. *Acrogens*, Covered Spores.

CLASS I.—THALLOGENS. Naked Spores.

35, 36. Protophytes. 37. One-celled Plants; THE CELL DEFINED. 38. Digestion and Growth. 39. Single Reproduction. 40. Parthenogenesis. 41. Reproduction and Multiplication. 42. Volvox. 43. Diatoms. 44. Dual Reproduction; Conjugation. 45. Green Sea-weeds. 46. Parentage; Summary.

35. Protophytes (Gr. *protos*, first, *phyton*, plant) are called *First Plants* because they were the first plants created. They are considered the first formed of living creatures, and therefore the foundations upon which all organic life is based, for the plant must have preceded the animal (5). They teemed in the seas ages before land appeared, and perhaps long before any animal was created; living their brief day, and then, in their fossil remains, laying up food for the coming generations of higher plants.

36. In the lowest geological formations (see Lesson XIII.) the rocks are without organic remains; above these, fossil *Seaweeds* appear; a little higher, *Ferns* and *Pines*; then *Cycads* and *Palms*; then the *Oak*, *Maple*, *Magnolia*; then the thousands of grasses, herbs, shrubs, and trees. It is of the profoundest interest to the student to see how, through slow periods of time, plants of the higher types were brought forth; and how, as the earth became better fitted for man, the ancient growths were supplanted by these higher types, leaving only here and there some microscopic descendant, like the Red Snow and the Diatom, or some solitary patriarch, like the Dead-Man's-Rope, the Tree Fern, Pine, and Palm, to tell the story of that strange elder time, which did its work and passed away ages before man appeared on the scene.

On a stone exposed to moist air and shaded from the sun, or on one over which water flows continually, we find delicate blotches, usually green, sometimes olive, brown, or red. These are composed of myriads of tiny plants, *Seaweeds*, *Moulds*, *Fungi*, *Lichens*, etc. They live their little life of a day, an hour, a week, a year. They die, and their remains form a *nidus*, or nest, for the mosses. Minute phanerogams (grasses, etc.) succeed the mosses; the stone is not only covered, but gradually pulverized; soil is formed. This soil is suited to the growth of shrubs and trees, and the once bare granite thus becomes fertile earth, ready for the abode and sustenance of man. We see this miracle daily, the same now as in the beginning. It shows us that creation is a continued energy, not an accomplished work. Nature has a forward as well as a backward look; the stones and plants, her eloquent prophets, not only unveil the past, but predict the future. Each stone holds the imperishable history of its own organisms; each organism foreshadows the type that is to succeed it.

37. **One-celled plants. The Cell defined.**—Among the *Algæ*—usually called *Seaweeds*, though many of them are fresh-water plants and some of them land plants—we find the simplest expression of organic life. We see the green blotches on the stone; the crimson patches on the north side of a damp cliff; the Blood-rain that falls in different parts of the world; the delicate stuff called Red Snow (Fig. 11, D) which appears so often on the true snow in the Alps, the Pyrenees, and in British America, where it covers the rocks on Baffin's Bay to a depth of ten feet. These consist of myriads of individual plants, each plant being a single cell. Their color is due to

A. *Chlorophyl*, or leaf-green (Gr. *chloros*, green, *phyllon*, leaf), the substance which gives verdure to leaves. We examine one of these little plants under the microscope (Fig. 11, D). It is a simple cell or globe, with a closed outer wall of soft elastic material called

B. Cellulose, or cell-fabric. This consists chiefly of carbon and water; it makes the fabric of all plants. This wall surrounds an inelastic jelly-like substance (from which it is separable) called

C. Protoplasm, or First mould (Gr. *protos*, first, *plasma*, mould). Protoplasm consists chiefly of carbon, water, and nitrogen, the elements that form animal fabric. It has the inherent power to move in every direction toward inorganic substances; to convert them into organic matter; and to transmit to this organic matter its own powers of digestion, growth, and reproduction. It is a homogeneous mass, usually globular; its periphery, or limiting surface,—called the *film*,—is slightly firmer than the rest of the mass of protoplasm; but it is exactly identical with it, and inseparable from it, and may be compared to the surface of a drop of water, or of a mass of fresh jelly. This protoplasm—of course including its film—is sometimes called

D. Primordial utricle, or First-bladder,—a name given it by Mohl,—because it is the first-formed part of every organism, whether vegetal or animal. We have already seen it in the embryonic vesicle of the higher plants (Fig. 3, A). A denser portion near the centre of the mass is called the *nucleus*; it is the seat of vital activity. Within the nucleus there is often to be seen a well-defined spot with the vitality almost of an eye; this is called the *nucleolus*, or little nucleus.

Protoplasm is the first beginning of every cell. It builds itself, out of itself; it next constructs, out of its own materials, the cellulose, which is the wall of its house; which is separable from it; and which completes the vegetal cell.

We find all the elements of protoplasm in inorganic nature. We combine them in the exact proportions in which they exist in the living cell; but we cannot make protoplasm. Nor is it ever free in nature. It is always pre-existent in a mother-cell, or in a wandering mass called *Plasmodium*, as in the slime-moulds (53). Farther than this we cannot go. The most daring explorer is arrested here, at the threshold of life, by this silent door-keeper. We can no more tell whence came this first living mother than we can tell whence came the first inorganic atom.

38. Digestion and Growth.—We watch one of these little plants (which are usually associated in masses). It

has no roots, stems, nor leaves; but it has parts equivalent to them (8). Its cellulose (Fig. 11, A), moved by the protoplasm within, absorbs materials from the water, the air, and the earthy matter they contain, just as shrubs and trees absorb them through the root, stem, and



FIG. 11.—A, single plant of *Chroococcus rufescens*, \times . B, same, two cells forming inside. C, same, four cells, ready to burst. D, Red Snow—*Protococcus nivalis*, \times , forming many cells. E, young plant of *Pediastrum granulatum* before the formation of cellulose; two cilia, which are mere projections of the surface (film) of protoplasm.

leaf. These materials are called *Pabulum* (L. food). The protoplasm receives the pabulum transmitted to it by the cellulose; with unerring exactitude it selects, combines, digests the various substances;

it endows them with its own powers; it grows.

39. Single Reproduction. Cell-division, Fission.—This little cell has no flowers, but it has parts equivalent to them (8). The mother-cell divides interiorly into several daughter-cells (Fig. 11, B, C, D). Each daughter-cell invests herself with a primordial utricle; the mother-cell bursts and dies; the daughter-cells escape as spores. Each spore at first has no cellulose; in some species the primordial utricle is protruded in the form of ciliae (Fig. 11, E) making zoöspores, as in *Vaucheria*. These frisk and frolic, like those of *Vaucheria*, for a while; then they withdraw their ciliae, form a wall of cellulose (as in Fig. 1, E); each repeating the simple family history, performing within itself all the functions of seed, plant, and flower. This earliest form of parentage (birth through a mother-cell alone) is called *Cell-division*. It is called *Fission* when the mother-cell divides into two parts, creating two daughter-cells.

40. Single Reproduction is sometimes called *Asexual* or *neuter* by botanists; but this is an ill-chosen and contradictory term, and should be avoided, even in the flower-world. In the *Protococcus*, and in one form of the *Vaucheria* and *Ædogonium* (Fig. 1, D, E, F), the whole of reproduction is begun and developed in a mother-cell without foreign aid. We see the same thing very often in some of the Orders of *Phanerogamia*,—*Hemp*, *Cœlebogyne*, and *Bryony* (Fig. 184), which are diœcious; the female flowers frequently produce perfect seeds (developing into perfect plants) without the aid of pollen. In *Phanerogamia* this mode is dignified

by the name *Parthenogenesis* (Gr. *parthenos*, virgin, *genesis*, parentage), or Virgin Parentage. There is no reason why the little Protococcus mother should be denied the distinction of womanhood merely because she remains forever in the embryonic condition. This mode is also called *Gemmiparous* (Gr. *gemma*, bud or bulb, *pario*, I bring forth); the daughter-cells being compared to the gems (stem-bulbs) of the Lily and Onion. This is not an accurate term, however; it is best to avoid loose definitions, and to learn

41. *The Difference between Reproduction (Generation) and Multiplication.*—The Lily and Onion multiply by bulbs (subterranean) and gems (stem-bulbs); the Rose multiplies by stolons (shoots from the root). We say, therefore, of the Lily that it is *bulbiferous* and *gemmaferous*—bulb-bearing and gem-bearing; of the Rose, that it is *stoloniferous*. These bulbs, gems, and stolons are a part of the old plant (old generation), like a leaf or twig; we plant them, and each grows up into a perfect individual; the race is thus increased by *Multiplication*. The new generation, however, is always produced by the floral organs, and in a mother-cell. These organs are a part of the old plant (old generation), like the leaf, twig, bulb, etc.; but their offspring is the new generation, the embryo, which becomes a perfect individual; the race is thus increased by *Reproduction or Generation*.

42. One of the most beautiful protophytes is the *Volvox globator*, or Revolving Globe (Fig. 12). It consists of a colony of one-celled plants, in a transparent envelope or common cell-wall; each individual is a ciliated active zoospore, flask-shaped, with two cilia at its pointed end; the plants so arranged that their cilia protrude through the common envelope, giving the globe a hairy appearance. The *Volvox* has a constant rolling motion. It is common in ponds, and is about $\frac{1}{50}$ of an inch in diameter. Among these simplest types are the *Microbes* (Gr. *mikros*, small, *bios*, life), called *Bacteria* by scientists (Latinized *bacterium* from Gr. *bakterion*, rod). They are rod-like, rigid; reproducing by transverse fission,—cutting the cell into two equal parts, each part becoming a perfect individual. They are the smallest, the most beautiful, yet most formidable of living creatures: being the cause of putrefaction and of all loathsome and deadly diseases. They are omnipresent, active, nearly indestructible; in air, earth, water, hot or cold; in filth; in old straw, shucks, wool, feathers, etc., in bedding; in wall-paper, carpets, rags, soiled clothing; in privy-vaults, sewers, swamps. Cleanliness is the only safeguard against them.

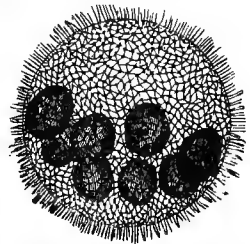


FIG. 12.—*Volvox globator*; a colony of ciliated zoospores; greatly magnified. The eight large bodies are mother-cells enlarging into oögonia.

43. Next come the *Diatoms* and *Desmids*, the most interesting children of the microscopic world. They exist in rust-colored, jelly-like masses, or in slender, rigid filaments, or otherwise variously arranged. Sometimes they are soli-

tary, as in *Navicula* (Fig. 13, A). Each cell here also is an individual. In different genera the cells are of different shapes,—now like a rod (whence the name *Bacillaria*, Little Stick), now like a buckler (Fig. 14), now like a boat; this last getting its botanical name—*Navicula* (Little Boat)—from its shape. The cell is called *Frustule* (fragment), because at maturity the cells

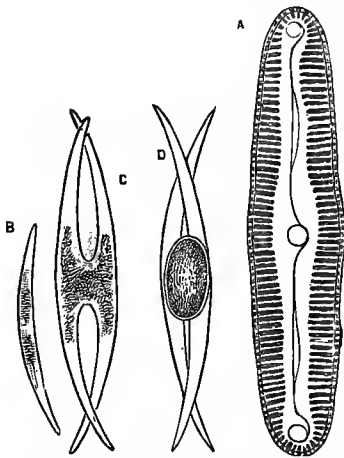


FIG. 13.—A, Diatom (*Navicula viridis*). B, Desmid (*Closterium acutum*), single individual. C, same, two individuals conjugating. D, same, spore formed; greatly magnified.

separate from one another as if broken at the joints or points of union. Each frustule is two-valved; it imbibes silex, or silica (flint, quartz), so that the protoplasm is invested with a shell. A drop of water contains millions of these tiny things; when magnified twenty diameters they are still invisible. Yet the silica protects them, so that they are nearly indestructible. They live, dried, a hundred years; then, when borne to the water, or to a moist place, they begin active life again.

Their motions are wonderful. The Little Boats (Fig. 13, A) move regularly back and forth as if propelled by an unseen oarsman with invisible oars. And so they are; the protoplasm sends them to and fro in search of food; and so powerful is its attraction that the fine grains of sand which furnish the silica of the outer wall of the boat flock to it and run hither and thither along its sides as if they too were alive. Under the cities of Richmond and Petersburg, Virginia, there is a deposit of their fossil remains twenty feet thick. A cubic inch contains forty trillions; yet each tiny shell is carved with exquisite tracery. The Rotten-stone, or Tripoli, of our household economy owes its polishing qualities to the shells of myriads of fossil diatoms (Fig. 14). The Mountain-meal (Bergmehl) of Norway, which the peasants mix with their flour in times of dearth

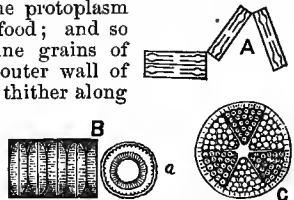


Fig. 14.—A, *Grammatophora marina*; Stonington, Conn.; salt-water. B, *Melosira sulcata*; a, frustule; Richmond, Va. C, *Actinocyclus senarius*, Richmond, Va. B and C are fossils.

to make the loaf last longer, is also composed of these fossils ; for whilst the shell is flinty, the cell itself is rich in starch, which has been preserved through countless ages.

44. Dual Reproduction. Conjugation.—We here see *Dual Reproduction*, or Paired reproduction (birth from two individuals). At maturity the mother-cell divides into two equal parts, called valves. Each valve is an individual (Fig. 13, B), but it is incapable of reproduction by itself alone. Presently two valves approach each other (Fig. 13, C); their walls in the central part unite and then rupture, so that their contents mingle in one mass; this mass develops a wall of cellulose (Fig. 13, D), and becomes a spore called a *Zygospor*e, or Jointspore (Gr. *Zygoö*, I join). Then the valves die, and the *Zygospor*e becomes a complete individual, rupturing into two valves like the parent. The two valves thus produced are not apt to rejoin; each seeks a stranger; thus showing that Nature, even in her lowest types, teaches the advantage of cross-fertilization. This mode is the first hint or prophecy of two sexes; but here, though the cells are separate, they are exactly alike, and both are active. This mode is therefore called *Conjugation*, or Joining.

45. Green Seaweeds.
—We next find a plant which takes the form of a branch, and fastens itself to the earth or stone by projections which serve the purpose of hold-fasts, and simulate roots; but they are not true roots, for they have no power of absorption. This branching plant consists of a single cell, like a glove with many fingers. The *Vaucheria* (Fig. 1) is an example; the lovely little *Bryopsis* (Fig. 15) is another.



FIG. 15.—*Bryopsis plumosa*, nat. size.

Here the reproduction is of two kinds. Sometimes a mother-cell is formed at the end of one of the branches by the concentration of the chlorophyl or protoplasm, and the development of a partition (torus), which separates it from the main plant. A spore is formed by this mother-cell, unaided; at maturity the mother-cell bursts, and the spore escapes as a zoöspore (Fig. 1, D). Sometimes two cells of different forms appear, near to each other, on the same branch; these have already been described (15); and the union of their contents, as we know, is called *Fertilization*.

46. Parentage.—There are, then, two modes of parentage or reproduction, each exhibiting two forms.

A. SINGLE REPRODUCTION :

I. *Cell-Division, or Fission*—

Cryptogamia, spore.

II. *Parthenogenesis*—Phanerogamia, seed.

} Produced and developed in a mother-cell without foreign aid.

B. DUAL REPRODUCTION :

I. *Conjugation*—Cryptogamia, spore.

II. *Fertilization*—Cryptogamia, spore.

Phanerogamia, seed.

} Produced by the union of two similar cells.

} Produced by the union of two dissimilar cells.

LESSON VI.

THALLOGENS FINISHED.

47. Many-celled plants; Thallus. 48. Olive Seaweeds. 49. Wracks. 50. Red Seaweeds. 51. Fungi. 52. Mildews. 53. Moulds. 54. Mushrooms. 55. Fungi described. 56. Lichens. 57. Thallogenous Growth.

47. Many-celled plants. Thallus.—We next find plants forming cells as usual, by division; but the cells remain united, forming *cellular tissue*, which spreads into leaf-like shapes, often branching and simulating stems, boughs, leaves, and fruit. This tissue is called a *Thallus*, as we have already learnt in Lesson II. (15 a); it is also called a

*Fron*d (L. *frons*, *frondis*, leaf). The terms thallus and frond are usually restricted to those cellular parts which are spreading and leafy in appearance; they are always distinguishable from the true leaf, however; for they bear the floral organs, whereas the true leaf very rarely bears them. And they are always without *stomata*, or breathing pores (Gr. *stoma*, mouth, pl. *stomata*).

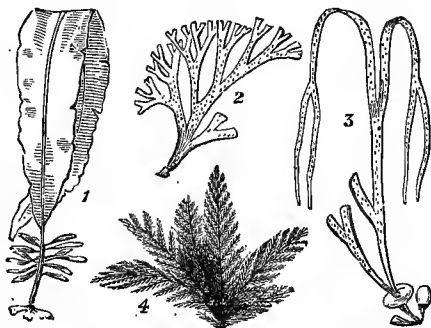


FIG. 16.—1, Badderlocks, *Alaria esculenta*. 2, *Dictyota dichotoma*. 3, Sea-thong, *Himantothalia lorea*. 4, *Rytidophlea thujoides*.

Each cell of the thallus is not reproductive, however; floral organs are produced only in special cells (sporangia). These sporangia are either in superficial groups called *Sori* (L. *sorus*, a heap), or in *Conceptacles*. The conceptacles may be sunk in the frond; or they may be in the form of tubercles, as in *Fucus* (Fig. 17, a). But the spores themselves are still naked. The flowers are always unisexual; they may be dioecious or monœcious.

48. Olive Seaweeds.—We are now fully entered upon the domain of the Seaweeds, which are always lovers of light, though various in texture and habit. Among the olive-spored Seaweeds are the Peacock Laver (full-page illustration, Lesson I.) of tropical seas, including our own Southern coasts; the edible *Badderlocks* of the Scotch coast (Fig. 16, 1), the name being a corruption of *Balderlocks*, in honor of the long-haired god Balder; the *Dictyota* (Fig. 16, 2), with its variable forms; the great Sea-thong (Fig. 16, 3), with its small cup-shaped frond and long branching conceptacles. Here is the Dead-Man's-Rope (book cover, front), so called because its slender fronds, rope-like, tough, and sometimes fifty feet long, and tangled into great submarine tracts, are the terror of swimmers. It is a lineal descendant of the Old Chorda (Fig. 81,

A), which flourished ages before man appeared in the world.

49. *The Wracks—Varecks*—are here (Fig. 17). Among them is the Gulf-weed, the most ancient and renowned of sea-rovers. No one has ever yet found it rooted. Its birthplace seems to be the Gulf of Mexico, whence its common name; but it is always floating, buoyed up by the berry-like air-bladders which give it its botanical names—*Sargassum bacciferum*; *Sargassum* from the Sp. *sargazo*, sea-lentils; *bacciferum* from the Latin *bacca*, berry, *ferre*, to bear. It makes great tracts, like meadows, through which boats cannot be steered. One of these is in the Atlantic Ocean, lat. 20° to 30° N., long. 20° to 60° W. of Greenwich; the other is in the Pacific Ocean, lat. 30° to 40° N., long. 140° to 180° W. of Greenwich. Each of these tracts is called a Sargasso Sea. The one in the Atlantic was encountered, as we know, by Columbus. The thickly-matted tufts which form it have existed there from immemorial time; a line in Aristotle has led critics to infer that the Phœnicians had found this sea before his time—384 B.C. Crabs and other marine animals of species found nowhere else abound in it, making it a world of its own. The Olive Seaweeds serve a thousand purposes, as food, thatch, manure, etc.

FIG. 17.—*Fucus vesiculosus*: a, conceptacle (tubercle) full of sporangia; b, air-vesicles.

Olive Seaweeds. Among them is the little mossy *Rytiphloea* of the British coast (Fig. 16, 4), here represented of the natural size. The Dulse and Carrageen Moss belong here. In the Red Seaweeds the Oögonium is furnished with a fine, hair-like tube which imitates a pistil; this hair is called *Trichogyne*, or Hair-pistil (Gr. *trich*, hair).

51. *The Fungi* include Moulds, Mildews, and Mushrooms. They have no stomata, frond, chlorophyl, nor starch. They are usually *parasites*; that is, they grow and feed upon some other plant, or upon animal substance; this plant or substance is called the *Host*. They are often *hypogæal* (growing under the earth); *hypophitæous* (growing under the bark); or *endophyllous* (under the skin of the leaf); often micro-

50. *The Red Seaweeds—Rose Tangles*—stand at the head of the Order. They are more beautiful, though less useful, than the

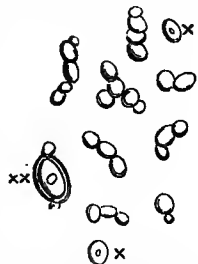


FIG. 18.—Yeast plant (*Torula cerevisiæ*), magnified 200 diameters: X, cell-division; XX, gemination.

scopic, especially in the moulds, one species of which (Fig. 18) forms Beer-Yeast; another (Fig. 19) is the Potato-rot; another (Fig. 20) lives on fruit, paste, etc., which is beginning to spoil.

52. Among the Mildews are the Wheat-blight (*Puccinia*), Smut (*Ustilago*), and Ergot (*Cordiceps*, *Sphæria*). Close to these is the Truffle (Fig. 21). It is hypogæal, loving chestnut woods. It is common in Southern England and the southern

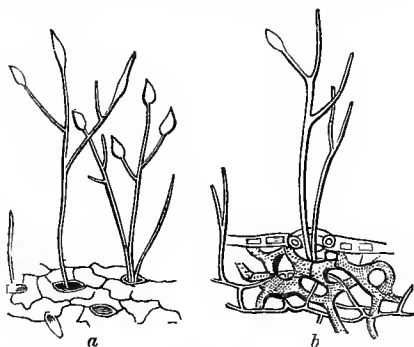


FIG. 19.—Potato-rot (*Peronospora infestans*): stipe proceeding from stomata of the potato-leaf; mycelium creeping through the leaf-tissue. Much magnified.

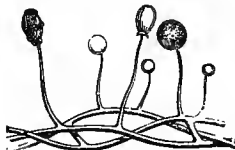


FIG. 20.—Common Mould (*Mucor mucedo*), showing mycelium, stipe, and receptacle.

parts of Europe. Here is the edible Morel (*Morchella*). Many of the plants of this division are of a brilliant scarlet or orange.

53. The Slime-Moulds (*Myxomycetes*) are included in the Fungi. They show us the simplest form of vegetative life,—a wandering mass of *Plasmodium** (shapeless protoplasm) without cell-walls. This mass moves slowly, growing sometimes to the thickness of an inch, and covering considerable surface. After a certain period the plasmodium passes into a state of rest, and forms itself into masses; each mass develops into sporangia, of various forms according to the genus; many of these contain a *Capillitium*, which is a net-work of threads, often very beautiful. Their spores are elegantly grouped, like those of the Mushrooms, on oblong or conical cells; each of these cells (called a *Basidium*—*basis*, or pedestal) has two or four slender points (*sterigmata*, sing. *sterigma*), each point bearing a spore. This floral development places them, therefore, notwithstanding their simple vegetative structure, close to the Mushrooms.



FIG. 21.—Black Truffle (*Tuber melanosporum*).

* Closely resembling *Protozoa* (first animals). Plasmodium resembles the wandering *sarcode* (flesh protoplasm) of *Amœba*, and other *Protozoa* (5).

54. *The Mushrooms* include many genera: *Clavaria* (Fig. 22, 7), *Hydnum*, *Boletus*, *Polyporus*, and others, besides the true Mushrooms, *Agaricus* (Fig. 22, 4, 5, 6), and *Amanita*.

The fairy-rings, so venerated by the superstitious and so long a puzzle to scientists, are the work of mushrooms. Several species—*Agaricus oreades* (Fig. 22, 6), *A. coquectineus*, and others—have a tendency to grow centrifugally in excess. The spot on which they grow soon becomes unfit for their support, and they spread outward with almost mathematical precision, leaving bare rings.



FIG. 22.—4, St. George's Agaric (*Agaricus Georgii*); d, young. 5, Common Mushroom (*A. campestris*); e, young. 6, Fairy-ring Mushroom (*A. oreades*); f, young. 7, *Clavaria phalloides*; g, young.

These rings at first produce nothing, but they eventually become fertile from the decayed remains of the mushrooms. Abundant grasses then spring up, which form the fairy-rings. These rings grow larger continually as the mushrooms spread, until some obstacle breaks the circle.

55. The vegetative part of the Fungi is called *Mycelium* (pl. *mycelia*), from the Gr. *mykos*, *mukos*, mushroom (Figs. 19, 20). This consists of elongated cells called *hyphæ*, which are isolated or collected in threads, or united into a web or membrane (*hymen*). The mycelium is sometimes barely visible, but often it is conspicuous, sometimes root-like. The flower-cluster (called *Receptacle*) grows out of this mycelium; in the Mushroom it is called *Pileus*, or cap. When there is a flower-stalk it is called a *Stipe*, as in the Moulds (Figs. 19, 20) and the Mushrooms (Fig. 22). The surface on which the flowers grow in mushrooms is the *Hymenium*, or membrane. It covers the Gills (*lamellæ*) on

the under side of the mushroom cap (Fig. 22); the *Tubes*, or pipes, in *Boletus*; the *Processes*, or teeth, in *Hydnum*. The spores are sometimes in a closed cavity called a *Conceptacle*; the Hymenium is then called a *Clinode* (*clinodium*), or couch. The flower-cluster is sometimes enclosed in a volva (pouch), as in *Agaricus campestris* (Fig. 22); this bursts as the cap grows. The slime-moulds and the puff-balls (*Lycoperdon*, *Boletus*, etc.) have an outer cover around the receptacle. This cover is called *Peridium*; it is sometimes double, its outer coat separating into regular parts from the top to the base of the stipe, as in the Earth-star (*Geaster*), making a star-shaped, flower-like figure with a puff-ball in its centre. The flowers are monœcious. The antheridium grows near the oögonium; it never develops antherozoids, but blends its protoplasm with the contents of the oögonium without previous change. Gemmation (budding) occurs, as in the Yeast Plant (Fig. 18, XX). Virgin reproduction takes place by means of *Conidia*, which are simple cells producing zoöspores (these are elegantly seen in Fig. 19); and by *Stylospores* (stalked spores) included in a conceptacle called *Pycnide*. Simple cells called *Spermatia* (enclosed in a conceptacle called *Spermogonium*) are secondary male flowers. The ripe spores of Fungi are so minute they resemble smoke in escaping. Slender threads (called *Paraphyses*) often accompany the spore-cases here, as well as in Lichens and Mosses.

56. The Lichens are closely related to Fungi, but they have a thallus. This has four layers: 1. *Cortical* (barky) layer, called *Epithallus*; 2. *Gonidial layer*, consisting of bright green cells containing chlorophyl, and called *Gonidia*; these gonidia are protophytes (like *Protococcus*, etc.), on which all lichens are parasitic, whether the lichen be fixed or aerial. 3. *Medullary layer*, composed of interlacing filaments (hyphæ). 4. *Hypothallus*, covered with root-like hairs (Fig. 25). The conceptacles holding the female flowers are called *Apothecia* (Figs. 23, 25). The males are in conceptacles called *Spermogonia*. They produce *Spermatia*, equivalent to Antherozoids, but motionless. Some lichens are air-plants; and many are edible. They prefer cold climates, though many inhabit the tropics. They are

dry and leathery, but some are gelatinous, like the Lichina.

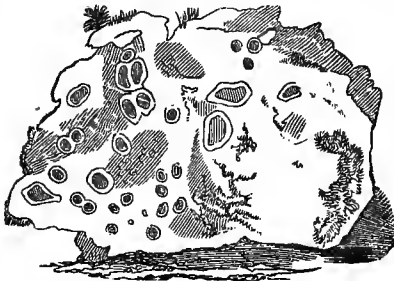


FIG. 23.—Cudbear (*Lecanora tartarea*), on a stone; showing the apothecia.

They are *polymorphous* (of many forms), often imitating stems, as in the Bearded Lichen (*Usnea barbata*).

A lichen (*Lecanora esculenta*) is believed to be the manna which fed the Israelites in the desert. It grows among flints, from which its small, filbert-shaped thallus can scarcely be distinguished; and it appears suddenly in such abundance that it is blown into heaps by the winds. It is common in Algeria, Armenia, and Persia, but especially in the mountains of Tartary. One species furnishes the dye called Cuthbert, or Cudbear (Fig. 23).

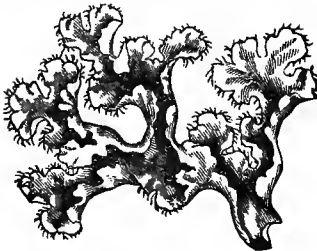


FIG. 24.—Iceland Moss (*Cetraria islandica*). Single plant.

57. Thallogens.—The plants thus far examined, from Proto-phytes to Lichens inclusive, consist either of a single cell like the Protococcus, Diatom, and Bryopsis, or of many cells united into a mass called cellular tissue, like the higher Seaweeds and the Lichens (Fig. 25). The growth is *peripheral* (increasing at the circumference chiefly), and usually broadening horizontally (Fig. 26). Observe these characteristics:

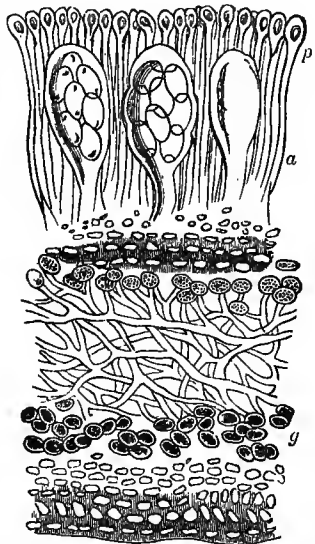


FIG. 25.—Vert. sec. of thallus of Wall Lichen (*Parmelia parietina*): a, apothecia; g, gonidia; p, paraphyses, or threads, surrounding the spore-cases.

I. *Spores naked.* *Embryo* a simple cell without differentiation into parts;

II. *Flowers* (Oögonium and Antheridium) microscopic and rudimentary;

III. *Foliage* a *thallus*, or frond, without *stomata* (breathing-places);

IV. *Growth* peripheral; tissue cellular; no true roots, stems, nor leaves.

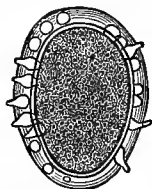


FIG. 26.—Germinating spore of Lichen (*Megalospora affinis*), showing peripheral growth. \times .

We have enough edible Fungi in the United States to keep the poorest families in delicious food if they will take the trouble to gather the plants in the country, or grow them—as they may without cost—in the cities. See *Fungi* in *Manual*.

LESSON VII.

CLASS II.—ACROGENS—COVERED SPORES.

58–60. Liverworts. 61. Mosses. 62. Charas. 63, 64. Ferns. 65. Tree-Ferns. 66. Alternate Generation. 67. Scythian Lamb.

58. Acrogens. Covered Spores. The Liverworts introduce us to the second and higher class of Cryptogams. The female flower is now called an *Archegonium* (14). It is no longer naked in its receptacle, like the spore of the Lichen (Fig. 27, *p*); but its vesicle, or nucleus, is covered by a cellular sac which simulates a pistil (Fig. 27, *a*). This soon ruptures at top, to admit the antherozoids.

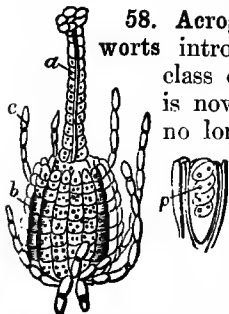


FIG. 27.—*a*, Archegonium of Liverwort (*Marchantia polymorpha*): *a*, style-like process; *b*, body of it containing the nucleus; *c*, separate filaments; *p*, oögonium of *Lecanora tartarea* (Lichen).

The archegonia are usually enclosed in a wide-mouthed cup. Each archegonium, after fertilization, develops into a spore-case (*sporangium*, plural *sporangia*) containing many spores; the spores are intermixed

with spiral threads; these, in uncoiling, lift and disperse the spores; they are therefore called *Elaters* (Fig. 28).

59. The *Antheridia* are flask-shaped, oblong, or spherical. The antherozoids are ciliate and active. The antheridia, like the archegonia, are contained in special receptacles (Fig. 29, *a*).

60. The spore now (except in *Chara*) develops a *Prothallus*, or thalloid growth; this produces the plant, with root, stem, leaf, and stomata. The appearance of the Liverworts is often thalloid, like that of Lichens; but the Liverworts are always provided with chlorophyl and stomata (Fig. 29, *s, s*). In the higher genera we see stems with cedar-like foliage (*Jungermannia*). Here are true roots also; but these are small, consisting of simple fibres. The Liverworts love damp, shady places; they are usually very delicate; and are green, violet, or brown. The stem-growth is terminal; giving to the second class of Cryptogamia the name *Acrogens*, or Top-growers (Gr. *akron*, top, summit).

61. The Mosses (Fig. 30) have true roots, stems, and leaves. They are cosmopolitan. Their chief use is to make and enrich the soil. Their colors are green and brown, rarely white; leaves simple, 1-nerved. Stems at first simple, then giving off branches called *innovations*. The prothallus is confervoid.

FIG. 28.
—*Marchantia*: *a*, elaters; *b*, spores.

and enrich the soil. Their colors are green and brown, rarely white; leaves simple, 1-nerved. Stems at first simple, then giving off branches called *innovations*. The prothallus is confervoid.

Here the nucleus, after fertilization, grows so rapidly that the archegonium is ruptured transversely, its upper part being carried up by the nucleus; this upper part is the *Calyptra*, or *Cap* (Fig. 30, *c*). The lower part of the archegonium remains as a little sheath (*Vaginula*) around the base of the nucleus, this base being a slender *Seta* (L. bristle). The seta elongates (still capped by the calyptra) till it attains its full height; then its upper

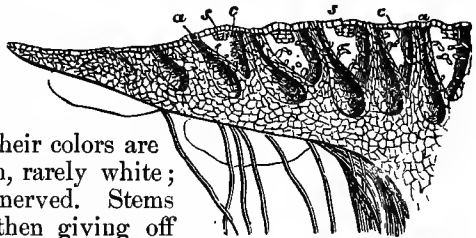


FIG. 29.—Vert. sec. of a receptacle of Liverwort (*Marchantia*): *a, a*, cavities left by antheridia; *c, c*, air-chambers; *s, s*, stomata.

part, within the calyptra, develops into a spore-case called *Capsule*, or *Urn* (Fig. 30, *c*); its slender seta becomes a pedicel, which is often thickened into an *Apophysis* (against the body), just beneath the capsule. The capsule in many of the higher mosses has a separable lid (*L. operculum*); this covers the mouth of the capsule. The mouth is often surrounded with a ring (*L. annulus*), or with a *Peristome* consisting of one or two elegant borders of teeth or hairs.

62. The *Charas* (Figs. 31, 32) are small submerged water-plants of purely cellular tissue, and resembling *Algæ*. But their manner of growth is *axiferous*—axis-bearing, with true root and stem. They are leafless; the stems are jointed, with branches whorled on

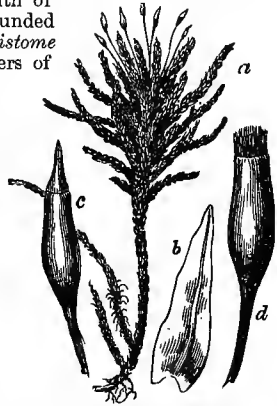


FIG. 30.—*Hypnum dendroides*: *b*, separate leaf magnified; *c*, capsule with its pointed calyptra; *d*, calyptra and operculum removed, showing peristome.



FIG. 31.—*Chara fragilis*.

a level with the joints. They are nearly worthless to man, except as a study. Some of them are used for polishing plate, the stems being calcareous; these are the Water-lustres (*Lustre d'eau*). Their flowers show a higher development than many even of the higher Acrogens (Fig. 32).* The spore germinates without developing a prothallus.

Here the archegonium is contained in a spore-case called a *Nucule* (Fig. 32); it has one large starchy spore.

The antheridium is called a *Globule* (Fig. 32, *a*).

* "The Order might perhaps have been introduced between Equisetaceæ and Marsileaceæ; but its true place is hard to determine."—A. GRAY.

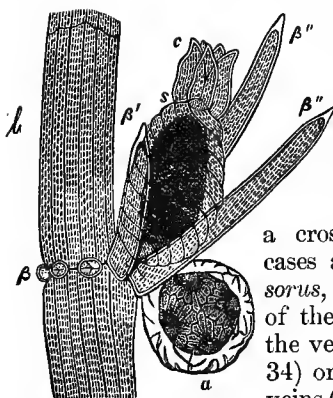


FIG. 32.—*Chara fragilis*: *a*, globule; nucule above it cut vertically; *a*, spiral cells around the spore of the nucules; *b*, stem; *B*, joint; *B'*, *B''*, branchlets.

63. The Ferns have leaf-like fronds which bear the spores, though the spore-bearing fronds are often transformed, as in the *Osmunda* (Fig. 33). The fronds are *fork-veined* (Fig. 33, *a*) and *circinate* in bud,—rolled like a crosier (Fig. 34). The spore-cases are in groups called *Sori* (L. *sorus*, a heap), on the under surface of the frond; either at the end of the veins and near the margin (Fig. 34) or variously arranged along the veins (Figs. 33, 35). The fronds vary greatly in shape and texture.

64. The student will observe the distinctions in the spore-cases as we proceed. These are the characters which separate the Tribes in classification.

The Ferns are the most beloved of Cryptogams. The Venus Maidenhair (Fig. 34) is perhaps the most beautiful of the low ferns. At Cumberland Falls, Ky., where it has all the requisite conditions,—warmth, reflected light, and moisture,—it has a delicacy in both color and texture which no art can portray. On this, and the Hart's-tongue (Fig. 35), which is another favorite, the spore-bearing fronds differ but little from the others.

65. The Tree-Ferns (see full-page illustration, Lesson I.) are found in the higher sections of this Order. They are tropical, inhabiting both hemispheres; occurring on the mainland (Peru, etc.), but especially loving islands, where they get the needed warmth and moisture. The ferns are most interesting to



FIG. 33.—Royal Fern (*Osmunda regalis*), with sterile and spore-bearing fronds: *a*, leaflet of sterile frond; *b*, lft. of spore-bearing frond; *c*, spore-case; *d*, same opening by 2 valves

the student of nature; they have more

fossil representatives than any other Order, not excepting the Pines; upwards of two hundred species are found in the coal-measures of Europe and North America.

66. Alternate Generation, or *Di-genesis* (two creations), is a character of the Ferns and the allied Orders (which follow). The spores are produced on the fronds by Parthenogenesis (virgin parentage). But the spore thus produced is in a sort



FIG. 34.—Venus Maidenhair (*Adiantum Capillus-Veneris*). Spores under edge of fronds, at ends of veins.



FIG. 35.—Hart's-tongue (*Scolopendrium vulgare*). Spores on veins, on under surface of fronds: *a*, spore-case; *b*, same open, showing its elastic ring.

of preparative state; when planted, it sprouts into a monocious prothallus, which is foliaceous and emarginate at tip. This prothallus (Fig. 36) develops the bisexual organs, archegonium (*ac*) and antheridium (*an*). These behave like those of *Vaucheria* and other genera in the Orders already described; they produce an embryo capable of growing up into a fern; but even this embryo is still a simple spore without differentiation into special parts or organs. At maturity it sprouts into the true fern, which continues during its life of from one to sixty

years to produce spores each year by pure parthenogenesis alone.

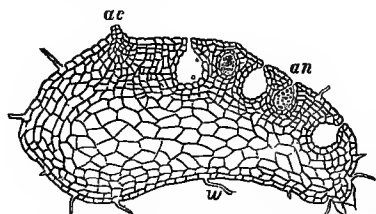


FIG. 36.—Vert. sec. of prothallus of *Botrychium Lunaria*: *ac*, archegonium; *an*, antheridium; *w*, root-hairs.

67. A fern (*Cibotium Barometz*) found in abundance west of the Volga is believed to be the Scythian Lamb (*Agnus Scythicus*) of antiquity, which was, and still is, held in great reverence by the people, being regarded as half plant, half animal. Its root-stock, which is thick and fleshy, resembles a lamb not only in fleece and form, but in the color of its flesh and its blood-like

juice. The fleece (*villus*) consists of fine long, velvety, gold-colored hairs, thought to be the *Byssus* of the ancients, out of which they manufactured famed stuffs sold at fabulous prices. *C. glaucum*, *C. Chamissoi*, *C. Menziesii*, of the Sandwich Islands, furnish from their root-stocks the fleece called *Pulu*, used for stuffing mattresses.

LESSON VIII.

ACROGENS FINISHED.

68. Horsetails. 69. Marsileas. 70. Club-Mosses. 71. Resurrection-Rose. 72. Acrogenous Growth.

68. The **Horsetails** (Fig. 37) are low plants (in the tropics sometimes tall) with straight stems and whorled branches, the branches resembling Pine leaves. The spore-cases are borne on scales, collected into cone-like shapes, still further increasing the resemblance to Pines. They love temperate regions.

They have little economic value; their stems, which contain silica, are used for polishing wood and metals; they are thence called *Scouring Rushes*.

69. The Marsileas (Fig. 38) have true leaves, resembling those of a four-leaved clover, but fork-veined like the fern, and circinate in bud. The spore-cases of these elegant little water-plants look so like the pods of some phanerogams that they are called *Sporocarps*. The sporocarps contain two kinds of spores (Fig. 39): *Macrospores* (Gr. *makros*, large), which are female, and *Microspores* (Gr. *mikros*, small), which are male. These sporocarps spring from the creeping root-stock, or from the base of the leaf-stalk.

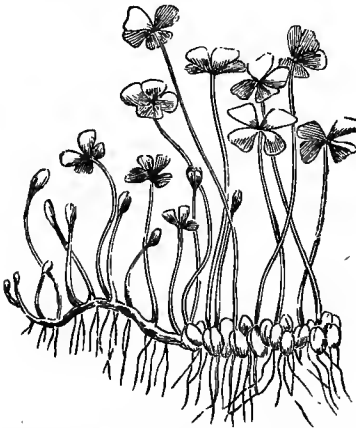


FIG. 38.—*Marsilea macropus*, or *Salvatriz*; showing sporocarps on the creeping root, near the bases of the long leaf-stalks. Plant entire.

edible. Those of the Nardoo (*M. macropus*), which abounds in Australia, are made into bread by the natives. The Marsileas love temperate and hot climates.

70. The Club-Mosses (Fig. 40) stand at the head of the Cryptogamia. They have branching prostrate stems and true leaves, which are *subulate* (awl-shaped), like those of

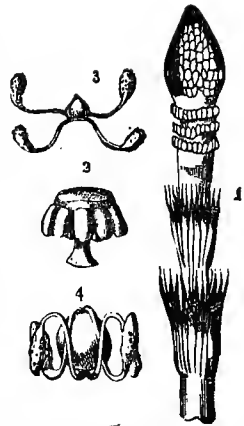


FIG. 37.—Horsetail (*Equisetum Telmateia*): 1, top of fertile stem, with cone of spores; 2, a scale from the cone, with its spore-cases and stalk; 3, a spore with its four filaments uncoiled; 4, spore with coiled filaments.

The leaves sleep at night. The little starchy fruits, about the size of peppercorns, are

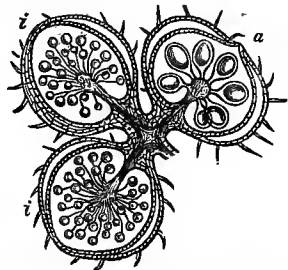


FIG. 39.—Vert. sec. of sporocarps of a Marsilea (*Salvinia natans*): *i, i*, microspores; *a*, macrospores. $\times 10$.

the *Arbor Vitæ*, Cedar, and Pine; they are therefore called *Ground Pines*. Their spores are of two kinds, like those of the Marsilea; they are contained in spore-cases which grow in the axils of leaves which form special cones. The prothallus here is a mere vegetative cell (Fig. 41, A); it is seen in the macrospore before germination (A, above the line *d*); in germination the root-hairs spring from this prothallus; below the line *d* is the *perisperm*, foreshadowing the phanerogam; the archegonia are developed in this prothallus, projecting also into the perisperm which nourishes their embryos, *e, e*. Antheridia are developed in the germinating microspore, and the process of fertilization is the same as described in the ferns. The embryo, however, is still without differentiation into parts (Fig. 41, B); it develops its organs only after leaving the spore. This formation of the prothallus in the spore before germination (it is formed, we remember, only after germination in the ferns, etc.) shows the higher development of the Club-Mosses, and is one of the characters which place them highest in their class. They grow in all climates; but the finest are found in a moist, warm, even temperature.

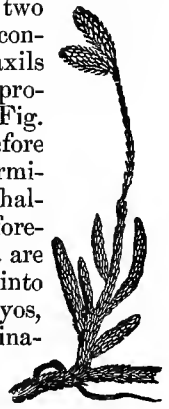


FIG. 40.—Club Moss (*Lycopodium clavatum*). Stems, with fertile spikes.

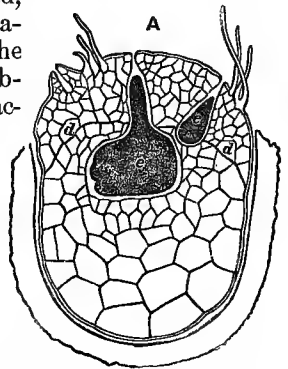
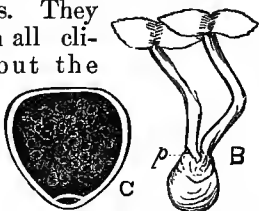


FIG. 41.—A, Vert. sec. of germinating macrospore of *Selaginella Martensii*. Prothallus with root-hairs, above the line *d*; below this, the perisperm which fills the spore; *e, e*, embryos in the archegonia. B, same, further advanced; two plants with their first leaves, springing from the prothallus *p*. C, microspore, showing the antheridium with its small prothallus.

71.—

Among the Club-

Mosses is the *Selaginella*, of which so many fine species are ornaments of our green-houses; often climbing; with lace-like

foliage-spray, which is broad, flat, and very delicate. Some of them are rosulate, and never rooted; these are the Bird's-Nest Mosses of florists (*S. cuspidata*, called also *Lycopodium circinata*). They are never fairly rooted; they curl up into a ball when dry, keeping their vitality, however, though driven by the winds for miles over sandy wastes in the dry seasons of the tropical countries in which they abound. In moist weather they cling with their small rootlets to the light sand or soil, unfold their leaves, and continue their life of vegetation and reproduction. One of these is the curious Resurrection Rose (*Selaginella lepidophylla*) of the South-western United States and Mexico.

72. Though the growth in *Acrogens* is still cellular, wood-bundles occur. These are not definite in form, however; they appear near the circumference, as in the Tree-Fern (Fig. 42). There is no true bark; the thick rind is composed of the persistent bases of fallen leaves. Observe four characteristics:



FIG. 42.—Horizontal section of stem of *Cyathea arborea*, Tree-Fern. Wood-bundles (white) near the circumference.

I. Spores covered; Embryo still a simple cell without differentiation into parts;

II. Flowers (Archegonium and Antheridium) still rudimentary and microscopic;

III. Fronds and Leaves fork-veined (Fern, Marsilea), or subulate (Moss, Club-Moss), and furnished with stomata;

IV. Growth terminal (at the apex only) with cellular and woody tissue, true roots and simple stems, or stems with simple branches (Club-Mosses, etc.).

LESSON IX.

PLANT DEVELOPMENT CONTINUED.

Series II.—Phanerogamia. 2 Classes { 1. *Gymnosperms*, Naked Seeds.
2. *Angiosperms*, Covered Seeds.

CLASS I. GYMNOSPERMÆ. *Naked Seeds.*

73. Central Link; Cycas. 74. Cone-bearers; Yews. 75. Cypresses.
76. Pines. 77. Fertilization. 78. Joint-Firs. 79, 80. Welwitschia.
81. Gymnospermous Growth.

73. *The Gymnosperms (Gymnogens)* are the central link in the chain of Natural Succession or development (see full-page illustration, Lesson I.). They constitute what are termed *Comprehensive Types*; including (comprehending) among themselves characters which belong to classes widely separated from one another. The *Cycas* leaves are circinate in bud,



FIG. 43.—Ovule-bearing leaf of *Cycas revoluta*, reduced two-thirds: *f*, unchanged leaflets; *sk*, *sk'*, ovules occupying the place of lower leaflets.

allying it to the Ferns; the stem is almost wholly cellular, another Cryptogamous trait; it yields large quantities of starch which make the Sago of commerce. The stem is simple, with the habit of both Tree-Fern and Palm; the leaves are so palm-like that the *Cycas* is miscalled Sago-Palm (sago being furnished from its pith). The embryo has two cotyledons; but these are unequal and united for the greater part of their length, with only a slit near the plumule through which it may es-

cape at germination, thus imitating a monocotyledon; here, then, are two endogenous characters. The two cotyledons show its kinship with the Exogens; the stem is imperfectly differentiated into pith, wood, and bark, increasing the exogenous traits. But the pith (cellular tissue) greatly predominates. The flowers are dioecious. The males are mere anthers on club-shaped scales, which are arranged in cone-like catkins. The females are naked ovules (Fig. 43), with but one integument or seed-coat (the testa); they grow singly, each in the place of a suppressed leaflet, on the lower parts of the compound leaves.

These leaves form a large cone-like growth at the apex of the stem in the midst of the foliage leaves; and after ripening the fruit, the stem continues to grow upward through this fruit cone, developing leaves and flowers as before. Growth like this, producing a stem from the midst of the flower, is called *Proliferous*, or race-bearing (*L. proles*, race). The Cycads are of slow growth, and long-lived. The fruits of some species are large and edible. They belong to tropical countries.

74. The Cone-bearers (Coniferæ) include Yews, Cypressess, and Pines; trees with branches; but the trunks *ex-current* (running through to the top). *The Yews* have dioecious flowers. Among them is the handsome Ginkgo-tree of Japan (Fig. 44). Here the male flowers are in long clusters called Catkins; but they are still mere anthers (*f*) without floral envelopes. The female flowers (*d*) are still mere naked ovules without floral envelopes. Each ovule has a disk



FIG. 44.—Ginkgo (*Salisburia adiantifolia*): *a*, female br.; *b*, male br.; *c*, male fls.; *d*, female fls.; *e*, ripe fr.; *f*, anthers. Reduced; nat. lf. 4 inches in diam.; trees 60 to 70 ft. high.

at its base (*d*, *e*); this is a thickening of the torus, or the end of the flower-stalk, the ovules growing singly, or sometimes in pairs, at the end of the flower-stalks. There is but one seed-coat (*testa*). This becomes fleshy, as in the *Cycas*, and is edible. The embryo has two cotyledons, separate throughout. The leaves are fork-veined, and so like those of the Maidenhair Fern (compare with Fig. 34) that the specific name *adiantifolia* is given to the tree.

The Berried Yew (*Taxus baccata*) has leaves like the Pine; the ovule has small scales at base, prefiguring the Pine cone; it develops a fleshy aril (321), which turns red at maturity, simulating a berry, but not entirely enclosing the seed.

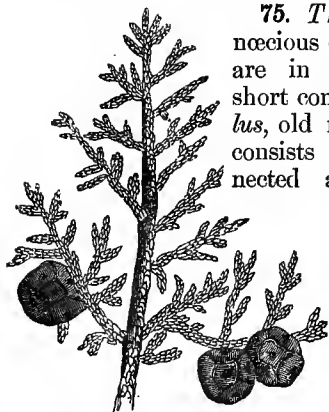


FIG. 45. — Cypress (*Cupressus sempervirens*); br. with ripe galbulus.

75. *The Cypresses* (Fig. 45) are monœcious or diœcious. The male flowers are in catkins; the females in a short cone called a *Galbulus* (*L. galbulus*, old name of the same fruit); this consists of several scales closely connected and sometimes fleshy, each bearing a number of erect naked ovules at the base of its inner (upper) face. Here we see that the floral leaf, instead of being suppressed entirely, as in the *Cycas* and *Ginkgo*, is transformed into a scale. The leaves resemble those of the Mosses (Fig. 30). The embryo has

two separate cotyledons; these are often deeply parted, resembling many cotyledons. Among the cypresses are the *Big Trees* of California (Fig. 95), 300 feet high and 30 feet in diameter. They are the oldest living monarchs of our world. They sprouted before King Solomon was born, and have outlived all the empires known in history.

76. *The Pines* stand at the head of the Cone-bearers. They are monœcious. The male flowers are in catkins; the females on the inner bases of scales which form the true

cone (Fig. 46). Here the ovules, instead of being numerous and erect on each scale (as in the Cypresses), are single or in pairs, and inverted on the scale (Fig. 46, *b*, *c*), the micropyle pointing downward. The cotyledons are often divided.

The Scotch Pine has five, six, or seven cotyledons (Fig. 47, *E*, *F*); the Cedar of Lebanon (Fig. 47, *D*) has six. The Italian Stone Pine (so called from its large edible stone or seed) has cotyledons with 9 to 11 divisions; when the ripe kernel is split, they separate in the form of a hand; this the peasants of the South of France call "*La main de Dieu*," the Hand of God; they use it as a remedy for intermittent fevers.

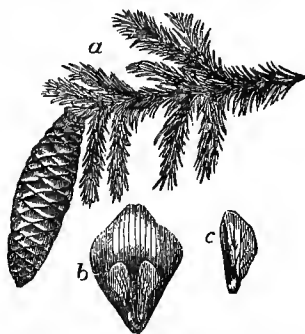


FIG. 46.—Norway Spruce Fir (*Abies excelsa*): *a*, branch with cone; *b*, scale with 2 inverted winged ovules; *c*, single ovule, separated from scale.

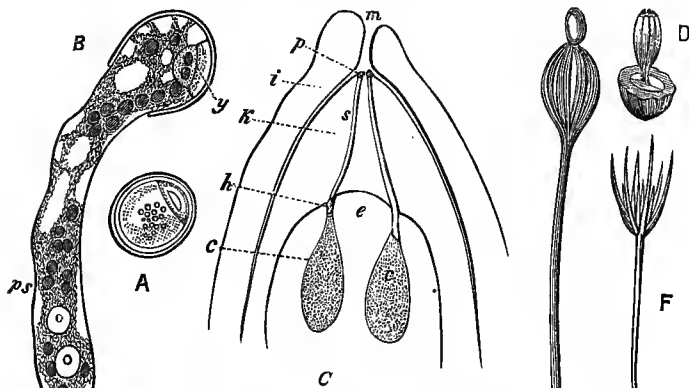


FIG. 47.—*A*, pollen-grain of Cypress (*Cupressus sempervirens*), showing the extine and intine, and the rudimentary prothallus as a small cell cut off at one end from the main cell. *B*, pollen-grain of *Ceratozamia longifolia* emitting its intine in the form of a pollen-tube, *ps*, which escapes through the ruptured extine *e*; *y*, rudimentary prothallus. *C*, diagram of vert section of ovule of *Pinus sylvestris*: *i*, integument, or testa; *m*, micropyle; *k*, nucleus; *e*, embryo-sac; *c*, *c*, embryonic vesicles; *h*, neck of one of them; *p*, extine of pollen-grains; *s*, pollen-tubes. *D*, embryo of ripe sd. of Cedar of Lebanon (*C. Libani*), half of sd. cut away, showing perisperm and testa. *E*, emb. of Scotch Pine (*P. sylvestris*), sd. attached. *F*, same, with plumule. *E* and *F* sprouting.

77. Fertilization of Gymnosperms is very simple. There

is no ovary, style, nor stigma. The open micropyle (Fig. 47, C, *m*) secretes a fluid on which the pollen-grain is held when the wind bears it to the ovule. Here it germinates; then it sends out a tube (Fig. 47, B, *ps*), which, as we know, is a prolongation of the intine, and which contains the fovilla, or nourishment (19). The extine, as we have already learnt (20), has no special openings provided for the emission of the pollen-tube; it bursts irregularly. We see in the Pine pollen-grain a trace of the prothallus of the Cryptogams (Fig. 47, B, *y*); here it is a small cell cut off from the true or pollen-cell. We know also (20) that the process of both fertilization and fruit-ripening is very slow.

78. The Joint-Firs, or Sea-Grapes, are low seaside plants with slender, jointed, green-barked branches destitute of foliage, except the minute leaves at the joints. The flowers now have bracts which sometimes simulate

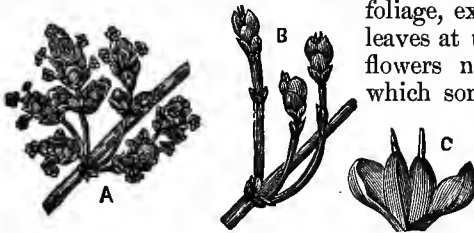


FIG. 48.—Joint-Fir, or Sea-Grape (*Ephedra distachya*). A, male fls. B, female fls., which grow in pairs. C, a pair of female fls., showing the 2 naked ovules, each with an erect style-like process, which is a prolongation of the tegmen.

a perianth; but each flower is still nothing more than a naked ovule. This has two coats, the inner (tegmen) prolonged into a slender process resembling a pistil; but the process is open at the apex, so that the ovule is still naked (Fig. 48, A, B, C).

79. The Welwitschia belongs with the Joint-Firs. It is a curious dwarf tree of Southwestern Africa. The trunk or stock (Fig. 49) rises but a few inches above the ground. It has two long, ribbon-like leaves, evergreen and parallel-veined, like the leaves of Endogens (Monocotyledons). These leaves are the cotyledons, put forth when the seed germinates, and persistent through the lifetime of the plant, which is estimated at one hundred years. The leaves are 3 feet wide and 6 to 8 feet long; they lie along the ground, and year by year, though torn into shreds, they keep their vitality. The portion of the stem above these two leaves "has the appearance of a 2-lobed depressed mass; it is sometimes 14 feet in circumference, and looks like a round table." The flowers spring from the rim of this table. They are

monœcious, and in cones on branching stems nearly a foot in length; the cones ripen into a fine crimson color. The male cones are half an inch long; the female two to three inches.

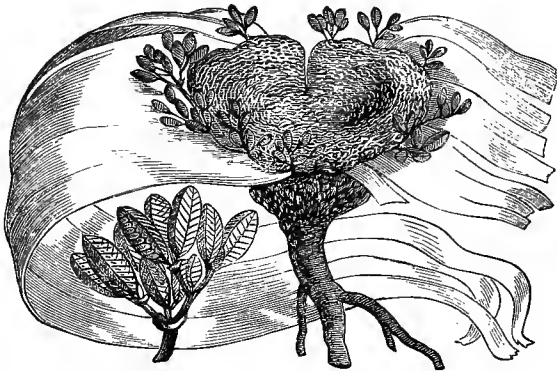


FIG. 49.—*Welwitschia mirabilis*. Plant entire, with a branch of fertile cones removed from the rim.

80. Thus far, throughout both Cryptogamia and Gymnosperms, the male and female flowers are diclinous, and dioecious or monœcious. The *Welwitschia* flowers are monœcious; but the male flower shows a curious prophecy—or is it a degradation?—of the monoclinous flower which is found only among Angiosperms. The male flower (Fig. 50, A, B) has an involucre of four bracts, in two whorls, two bracts in each whorl; six stamens with filaments united below into a tube. This tube surrounds an ovule, of which the testa is pro-

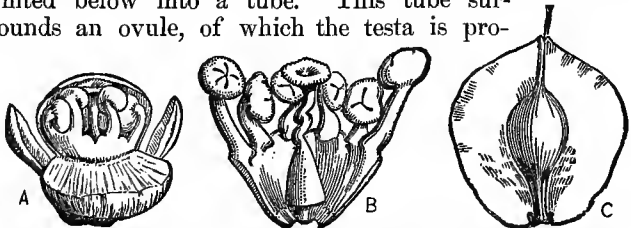


FIG. 50.—A, Male fl. of *Welwitschia*, showing involucre of 4 bracts; 6 stamens with filaments united into a tube; around an abortive ovule, which has its tegmen prolonged, resembling a true pistil. B, same, involucre removed, and etaminal tube divided. C, fertile ovule, with its winged sheath.

longed, resembling an ovary with style and stigma; but

the broad, flat stigma is closed, it has no stigmatic surface, and the ovule is of course abortive—it produces no embryo. The female flower (Fig. 50, C) is without stamens; its tegmen is prolonged to resemble a style, but is open at top so that the ovule is still naked. The calyx-like bract or sheath is broadly winged (Fig. 50, C).

81. *Gymnospermous Growth* is partially exogenous,—differentiated into pith, wood, and bark; but in the Cycads the pith predominates, the growth is chiefly terminal (at the apcx, as in ferns); in nearly all the gymnospermous Orders there is slight difference between wood and bark, and the terminal growth is strongest, making the trunk or main stem *excurrent* (L. *ex*, through, out, *curro*, I run); that is, the trunk runs through to the top, giving off branches, but keeping its integrity (Fig. 95). Observe four characteristics:

I. Naked ovules; embryo many-celled, with radicle, plumule, and two cotyledons, which in some genera are many-parted;

II. Flowers without perianth; females usually on scales which form cones; always wind-fertilized;

III. Leaves parallel-veined (*Cycas*, *Welwitschia*), fork-veined (*Ginkgo*), subulate (*Juniper*), or needle-shaped (*Pine*); never net-veined.

IV. Growth partially exogenous, but not fully so; little difference between wood and bark; wood marked by circular disks (Fig. 215); *stem* simple (*Cycas*) or *excurrent* (*Pine*, Fig. 95).

LESSON X.

Class II.—Angiospermæ. 2 Sub-Classes { 1. *Endogens*, Monocotyledons.
2. *Exogens*, Dicotyledons.

SUB-CLASS I. ENDOGENS. *Monocotyledons*.

82, 83. Ovary Free: Grasses. 84, 85. Sedges.
86. Wood-Rush to Lily. 87. Spadix-bearers.
88. Water-Plantains. 89. Ovary Adherent:
Eel-Grass to Orchis and Banana. 90. En-
dogenous Growth. 91. Specialization.

82. *Division I. Ovary Free (Superior)*.—The Grasses stand first (lowest) in the Monocotyledons. They have fibrous roots; simple stems, which are usually jointed and often hollow; sheathing *parallel-veined*, and simple leaves (Fig. 51). The ovule here is covered by an ovary; the embryo has one cotyledon. The flowers are often monoclinal, sometimes diclinal, as in Indian Corn, and sometimes *polygamous* (diclinal and monoclinal on the same plant), as in Fig. 51. The male flowers have perfect stamens, with filaments and anthers; the female flowers have perfect pistils, with ovary, style, and stigma. The flowers grow in small clusters called *Spikelets* (Fig. 52, A). These spikelets are in larger clusters called *Spikes*, or *Ears*, and the spikes are often arranged in a loose plume called a *Panicle* (Fig. 51, a). Each spikelet has an *Involucre*, or cover, of two bracts called *Glumes*, or Husks (Fig. 52, A, g); each flower has two bracts called *Paleæ*, or Chaff (Fig. 52, A, pe, pi); the outer palea is often furnished with a bristle called an *Awn* (A, a). The flower itself (Fig. 52 B) has an imperfect perianth (which is rarely wanting); it con-

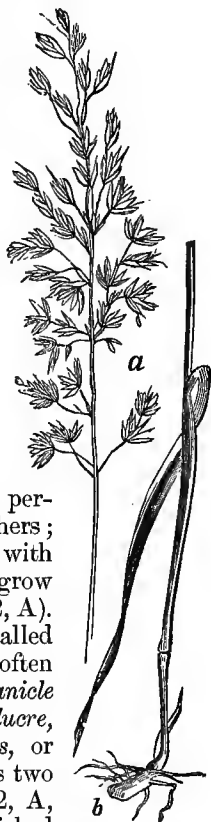


FIG. 51.—a, panicle of Wild Oats (*Arrhenatherum avenaceum*), a grass allied to Oats; b, stem, roots, leaf.

sists of two small scales called *Squamulæ*, which represent a calyx. The flower usually has three stamens; sometimes six, as in Rice (*Oryza*). The ovary is *Free* (not adherent to the perianth); it is one-celled, one-ovuled; but it has two long styles (sometimes three, as in Bamboo). The styles have long, feathered stigmas, with simple or branched hairs ready to catch the fine pollen blown to them by the wind. The ovary has one cell and one ovule. As it develops and ripens, the ovary grows fast to the ovule, so that it is inseparable except by force (Fig. 6, A, C, D). This sort of grain is called a *Caryopsis* (Gr. *karyon*, nut, *opsis*, appearance). The pollen-grains now have special openings for the emission of the pollen-tube (Fig. 52, C).

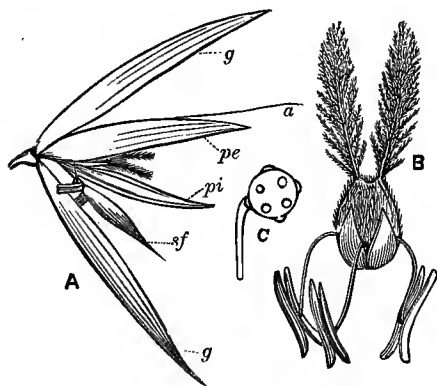


FIG. 52.—A, spikelet of Oats (*Avena sativa*): *g, g*, glumes; *pe, pi*, exterior and interior paleæ; *a*, awn; *sf*, sterile flower. B, separate flower of Wheat (*Triticum vulgare*), showing the 3 stamens; 2 styles with feathered stigmas; large ovary; and the two squamulæ which form the perianth. C, pollen-grain of Orchard Grass (*Dactylis glomerata*).

83. The Grasses include not only the small grains, but the Indian Corn, Sugar-Cane, and the giant Bamboo of India, sixty to one hundred feet high; its hollow, jointed stem is a foot in diameter, and used for a thousand purposes.

84. The Sedges are coarse, grass-like plants; the stems usually solid, and often *trigonus* (3-angled). They are of little use to man. Several species

in India and Egypt serve to make ropes and mats.

Among them is the famed *Papyrus* (Fig. 53), a native of Egypt and the neighboring countries. From the inner part of the stem the ancients cut very thin slices, which they hammered and smoothed into long rectangular sheets, making a beautiful and durable paper. The Greek name *Papyrus* is still retained both in Botany and in the English language. It is called *Babeer* in Syria; our English word *paper* comes from the Greek. *Papyrus* was also made into ropes; the bridge of boats

on which Xerxes and his army crossed the Hellespont was fastened with papyrus cables.

85. The *Sedge flowers* are in spikes, the spikes often in heads, or in umbels, as in the Papyrus. They are monoclinous or diclinous. Each flower is usually single in its glume or glumes. There is no perianth except a few bristles called *Setæ*, and these are often found wanting. Sometimes a glume is transformed into a sort of cup (Fig. 54, A), which envelops the ovary and style; it is called *Perigynium* (Gr. around the woman). The pericarp (ovary) is 1-celled, 1-seeded; it is separable from the seed; but it does not open at maturity; it is therefore called an *Akaine*



FIG. 53.—*Papyrus antiquorum*. Plants entire.

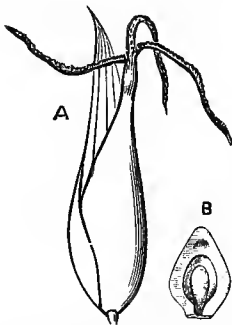


FIG. 54.—A, female flower of Sedge (*Carex riparia*), showing perigynium. B, akaine of *Cladium mariscoides*, cut vertically.

(Gr. *a*, not, *kaino*, I open); sometimes written *Akene*, *Achene*, *Achenium* (Fig. 54, B). The Grasses and Sedges are styled *Glumiferae*, or Husk-bearers. They are wind-fertilized.

86. The *Wood-Rushes* are still grass-like in appearance; but here the perianth is flower-like (Fig. 55, *a*); the floral parts are three, or a multiple of three; the pericarp is *dehiscent* (L. opening); it is three-celled, each cell with one or more seeds. The venerable Grass-trees of Australia follow (Fig. 96). Other Orders lead on to the

beautiful and extensive kingdom of the Lily (Fig. 5, 4), in which we find the Asphodel (Fig. 56) and the Smilax (Fig. 241). We have now fully entered the domain of insect-fertilized flowers.

87. Farther on comes the Cuckoo-Pint (Fig. 57). Here the flowers are dichinous, small, and arranged on a flower-stalk called a *Spadix* (Gr. fruiting palm-branch), which arises from a large, flower-like bract called a *Spatha* (L. sheath).

Other spadix-bearing Orders lead to the Palms (full-page illustration, Lesson I.); here the spadices are branching, and the spa-



FIG. 55.—Wood-Rush (*Luzula sylvatica*):
a, separate fl.

ths are large, tough, and woody. In one species (*Maximiliana*) the spadices are used as kettles and cradles by the Indians of South America. From Cuckoo-Pint to Palm inclusive the Orders are sometimes called *Spadiciferae* (Spadix-bearers).

88. The Flowering-Rushes (Fig. 58) show us the highest development in Endogens. Each floral whorl is not only free from the other whorls, but the parts of each whorl are *distinct* (that is, separate from one another). They bear a striking



FIG. 56.—White Asphodel (*Asphodelus albus*), flowering plant, with separate fl.

resemblance to the Butter-

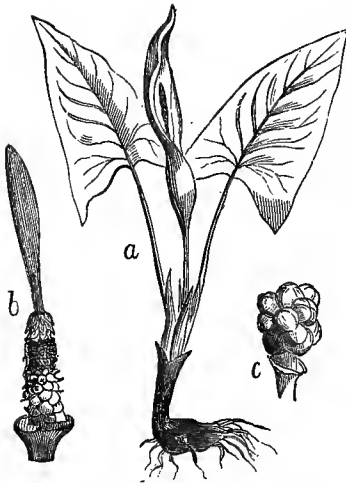


FIG. 57.—a, Cuckoo-Pint (*Arum maculatum*); b, spadix; c, fruit.

89. *Division II. Ovary Adherent* (or Inferior). Here the perianth segments have their lower parts united into a tube which adheres to the ovary; the ovary is therefore called *adherent*. This condition of the ovary—whether free or adherent—is a comparatively trivial character; for we know (31) that the values lessen in importance as they recede from the embryo.

cups (*Ranunculus*, Fig. 9, 1), which show the highest development in Exogens. Yet the condition of the embryo (monocotyledonous) retains the Flowering-Rushes in Endogens.

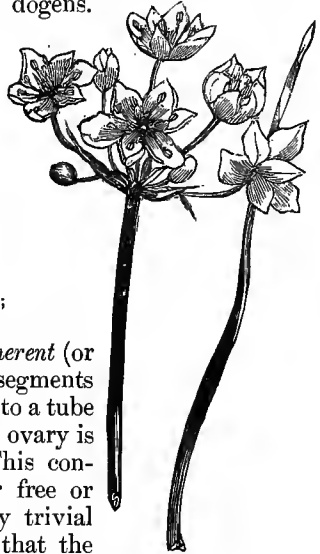


FIG. 58.—Flowering-Rush (*Butomus umbellatus*); umbel, lf.

The Eel-Grass (Fig. 244) opens this division. It is closely allied to the Flowering-Rush and Water-Plantain, making a continued series from the most simple to the most complex types; but the adherent ovary separates it. The Yam comes next (Fig. 89); it has net-veined leaves like the Smilax (Fig. 241), but its ovary is adherent.

In this division is the **Amaryllis Family**, which gives us the Blood-Flower (Fig. 59). Here too are the Orchids (Figs. 152, 153). Here is the Pineapple Family (Fig. 212). The Banana (Fig. 60) closes the list of Endogens; in her Order we find the Ginger (Fig.

151) and the Canna (Fig. 63, C).

90. Endogenous Growth.

—The embryo governs the leaf and stem (32). In Endogens the embryo has one cotyledon, which sheathes the plumule. The plants therefore have alternate, sheathing, parallel-veined leaves; the veins run from base to tip, as in the Grasses (Fig. 51), or from midrib to margin, as in the Banana (Fig. 60). Sometimes the leaves are net-veined, as in the Yam (Fig. 89) and Smilax (Fig. 241); but the net-veins are small, the parallel veins being always strong and strongly marked. The stems consist of cellular

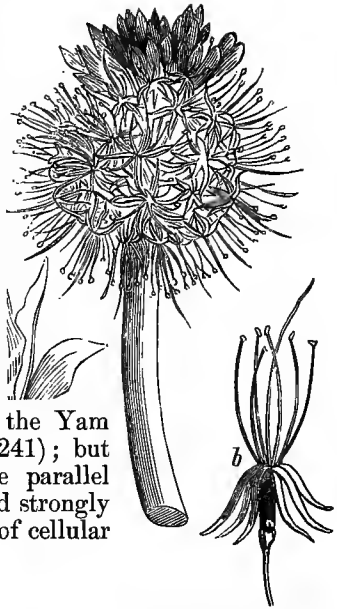


FIG. 59.—Blood-Flower (*Hæmanthus multiflorus*); bd. of fls.; lf. cluster; separate fl.



FIG. 60.—Banana (*Musa paradisiaca*); plant, fl., fr.

tissue interspersed with wood-bundles; there is no differentiation into pith, wood, and bark; the hardened outer part, called the *Rind*, is equivalent to bark; but it has not the structure of true bark (as we shall see in another Lesson), and it is inseparable from the stem. The stems of the Indian Corn, Palm, and Banana are solid (Fig. 61); those of the Grasses—including Bamboo, Cane, etc.—are hollow from the destruc-

tion of the central cells. The new growth springs always from the centre of the stem; it is therefore styled *Endogenous*, or *Inside-growing*. Observe these characteristics:

I. Covered Seeds. Embryo with radicle, plumule, and *One cotyledon, which sheathes the plumule*;

II. Flowers with perfect pistils and stamens; perianth usually present, and often conspicuous;

III. Floral parts ternary,—in threes or a multiple of three (Figs. 62, 63, 64); rarely in twos or a multiple of two (Roxburghia, Smilacina);

IV. Leaves parallel-veined (Figs. 51, 60); rarely net-veined, and even then with strong parallel ribs (Dioscorea, Fig. 89; Smilax, Fig. 241);

V. Growth endogenous (Fig. 61); stem usually simple (Palm).

91. Specialization.

—Plants growing in still, fresh water best preserve the features of ancient types, because they have fewer dangers than land plants, in the way of intrusion from animals, winds, etc. The Flowering-Rushes and Water-Plantains (Figs. 58,

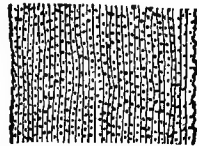
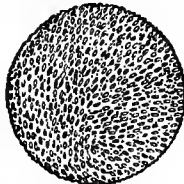


FIG. 61.—Transverse and vertical sections of a solid endogenous stem.

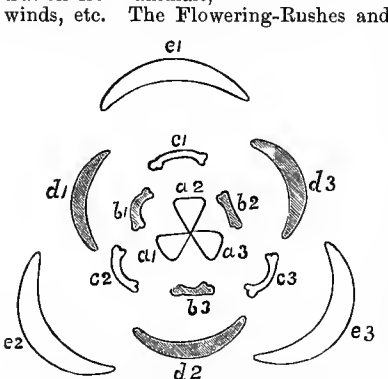


FIG. 62.—Diagram of Alisma family: e, sepals; d, petals; c, outer whorl of stamens; b, inner whorl; a, ovaries.

62) are therefore regarded as the most highly-developed types in Endogens. All their floral parts are in threes or a multiple of three; and all are *distinct* (like parts separate) and *free* (unlike parts separate). Being fertilized by insects, they have large bright petals to attract such visitors. Looking down the line of development, we see the Lilies (Figs. 56, 63 A). They are insect-fertilized; but, being land plants, they *specialty* adapt themselves to their dangers. The 3 ovaries cohere into a 3-celled capsule (Fig. 5, 4), each cell with many seeds; the 3 styles cohere into one, with a 3-lobed stigma (Fig. 56). Still lower are the Grasses (Figs. 51, 52, 64). They are wind-fertilized; their stems and

flowers are therefore specially adapted not only to catch the wind, but to hold out against its fury. The perianth is *degraded* (reduced in size, number of parts, and quality), and consists of 2 small squamulæ (Fig. 64, A, B, *b* 1, *b* 2); the stamens are 3 (there are 6 in Rice); the ovary is 1-celled, 1-seeded, and closely applied to the seed (Fig. 6); but there are 2 stigmas (Fig. 64, A); we can see where the third stigma belongs (Fig. 64, *d* 3); and in the Bamboo it still exists. The number three is still apparent also in the paleæ; the inner palea evidently consists of two paleæ united (Fig. 64, *a* 2, *a* 3).

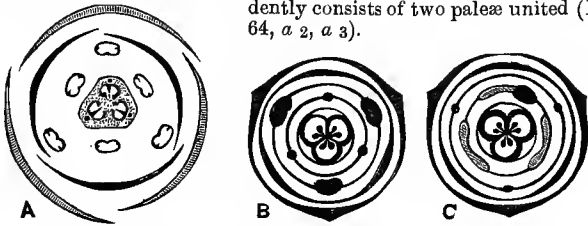


FIG. 63.—A, diagram of fl. of Crown Imperial (*Fritillaria imperialis*). B, do. of fl. of *Iris germanica*. C, do. of fl. of *Canna indica*.

On the other hand, the *Adherent Ovaries* exhibit an opposite form of specialization, particularly in the insect-fertilized flowers.

The *Amaryllis* Family has the sepals and petals (perianth

parts) coherent into a tube to which the ovary is adherent (Fig. 59); the stamens are seated on the upper part of this perianth tube, instead of being below the ovary, as in the Water-Plantains, Lilies, and Grasses. In the Iris (Fig. 63, B) there is the same character, but the stamens are reduced to three. In the Banana Family, which includes the Canna (Fig. 63, C), the stamens are all transformed to petals except one, and this is petaloid (petal-like), with only

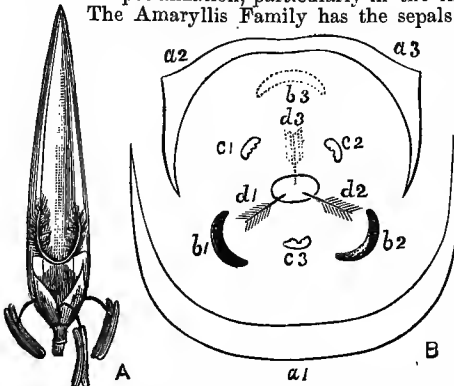


FIG. 64.—A, flower of Oats (*Avena sativa*), with the outer palea removed; the inner palea with 2 dark lateral lines, each representing a midrib or vein. B, diagram of same: *a* 1, outer palea; *a* 2, *a* 3, inner palea, which consists of 2 coherent paleæ, the outer points, *a* 2, *a* 3, representing the midribs; *b* 1, *b* 2, the two squamulæ or perianth parts; *b* 3, the place which the third squamula should occupy; *c*, the three stamens; *d* 1, *d* 2, the two stigmas; *d* 3, the place which the third stigma should occupy.

one anther-lobe. Finally, in the cultivated Banana (Fig. 60), the so-called fruit is no fruit at all, but an adherent 3-celled pericarp, which has become fleshy throughout, producing no seeds.

LESSON XI.

SUB-CLASS II. EXOGENS. *Dicotyledons*.

- 3 Divisions { 1. *Apetalæ*, no petals.
2. *Monopetalæ*, one-petalled.
3. *Polypetalæ*, many-petalled.

92, 93. *Apetalæ*, Ovary Adherent: Mistletoe. 94. Oaks. 95. Walnuts. 96. *Rafflesia*. 97. Ovary Free: Catkin-bearers. 98. Nettle to Amaranth. 99-103. *Monopetalæ*, Ovary Free: Mint to Heath. 104, 105. Ovary Adherent: Harebell to Honeysuckle. 106. Number Five.

92. Division I. *Apetalæ*.—*Two Subdivisions*:

(1) Ovary Adherent; (2) Ovary Free.

Subdivision I. Ovary Adherent.—Among the lowest Orders here we see the Mistletoe (Fig. 65). The flowers are always diclinous, and often diœcious. They have no petals, but a flower-like calyx. The ovule is without tegmen, or testa; it consists of the nucleus alone, and is often reduced to the embryo-sac, its only protection being the ovary, which is adherent. And since the condition of the embryo is the basis of classification (31), this Order ranks lowest in *Dicotyledons*. The female flower has 1 style, a 1-celled ovary, and a 1-seeded fruit.

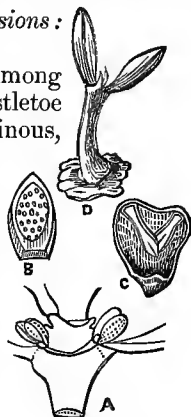


FIG. 65.—A, fls. of Mistletoe (*Viscum album*). B, anther of ♂ fl., showing the many pores. C, section of sd., showing the two embryos. D, young plant.

93. We know that the Mistletoe is a parasite. Botanists suppose that long ago—it may have been hundreds of thousands of years—it was a climbing shrub, with roots in the ground, and ascending trees by means of secondary roots like the Ivy. But the underground root and the lower part of the stem perished in the race for life; and this strange creature of a prehistoric time lives on as a true parasite. It sends its roots into the wood of its host, and incorporates them so completely that they cannot be distinguished from the fibre of the tree. It also adapts its seeds to its condition: each seed usually has two embryos (Fig. 65, C); these protrude from a nucleus without seed-coats; and the ripe berry (pericarp) is so viscid that the seeds cannot fail of a foothold on the host on which they grow, or to which they may be borne by birds. And in order to insure fertilization, the anther (B) is many-celled and honey-

combed with pores, to insure the escape of the pollen.

The Mistletoe was held in great reverence by the Druids; they saw a mysterious emblem of immortality in this evergreen shrub living and producing its kind without touching the earth. It was especially prized when found on the Oak, their sacred tree. We know how beloved it is and has always been in festival, song, and story by Europeans and their descendants throughout the world.

There are several genera. Among them is the noted Flame-tree or Fire-tree of Australia, with conspicuous racemes of handsome yellow flowers which give it its name. It grows to the height of 30 feet, and is the only genus that is not a parasite.

94. *The Oaks* are here. They are apetalous; diclinous and monœcious; the male flowers in catkins, the females solitary, or from 2 to 5, sessile in a common involucre composed of many small bracts, and which is called a *Cupule*, or cup (Fig. 66). The calyx of the male flower is conspicuous. In the female it shows as a rim just below the styles and above the cup. The female flower has 3 styles; an adherent ovary, at first 3-celled, each

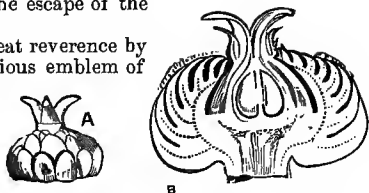


FIG. 66.—Female fls. of Oak (*Quercus robur*): A, entire fl.; B, vertical section.



FIG. 67.—European Walnut (*Juglans regia*); branches with ♂ and ♀ fls. Nut with its fleshy epicarp removed. Half of a kernel (one of the two fleshy cotyledons).

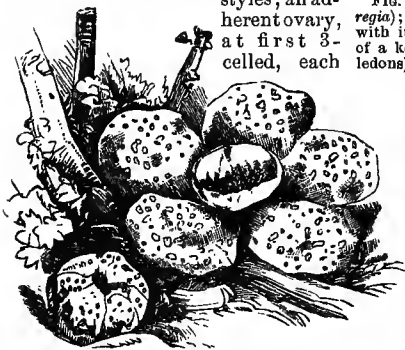


FIG. 68.—*Rafflesia Arnoldi*; 2 plants, ♂ and ♀.

subdivision. This plant consists of the flower alone (which is 3 feet

cell with 2 ovules; but one ovule outgrows the others, obliterates them, and completely fills the acorn shell (which is the pericarp), making it 1-celled and 1-seeded.

95. *The Walnuts* (Fig. 67) follow the Oaks; the male flowers in catkins, the females single or in pairs.

96. *The Rafflesia* (Fig. 68), of Sumatra, is in this

in diameter), and the rootlets it sends down into the host on which it lives; for the *Rafflesia* is a parasite. It is usually found on the surface-roots of a species of *Cissus*. The flower has a 5-parted perianth with numerous bracts below it; in the centre is a deep cup, or corona, which will hold 12 pints of water. The flowers are diœcious; their smell, like that of tainted beef, attracts flies, which aid in the work of fertilization. The *Aristolochia* (Fig. 186) ends this subdivision.

97. Subdivision II. Ovary Free. Perianth usually distinct; sometimes 0.—The Pitcher-plant (Fig. 113) opens this subdivision. The Orders crowd upon us; we shall name only such as are illustrated in these Lessons: the *Euphorbia* (Fig. 146); the *Willow* (Fig. 69, A), the *Sweetgale* (Fig. 111); the *Plane-tree* (Fig. 98); the *Birch* (Fig.

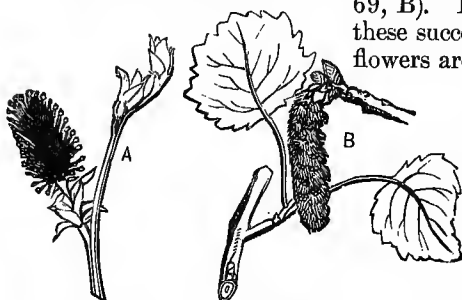


FIG. 69.—A, Willow (*Salix rosmarinifolia*); B, Birch (*Betula pumila*); ♂ catkins.

69, B). In the Willow and these succeeding Orders the flowers are diclinous and in catkins; they are sometimes grouped with the Oaks and Walnuts, and called *Amentales* (L. *amentum*, catkin), or Catkin-bearers.

98. The Nettle is also in this Subdivision; her Order includes the *Banyan* (Fig. 91), the *Fig* (Fig. 140), *Dorstenia* (Fig. 141), *Bread-fruit* (Fig. 213), and the *Cow-tree* (Fig. 238). The *Protea* Order is represented by the *Banksia* (Fig. 165); the *Mezereon* Order by the *Lace-bark Tree* (Fig. 230); the *Laurel* Order by the *Cinnamon* (Fig. 170); the *Goose-foot* Order by the *Strawberry Blite* (Fig. 120). The *Amaranth* is here (Fig. 121).

99. Division II. Monopetalæ. Two Subdivisions: 1. Ovary Free. 2. Ovary Adherent.

Subdivision I. Ovary Free.—The *Mint* Order opens this Subdivision; it includes the *Wood-sage* (Fig. 160). The *Verbena* Order includes the *Chaste-tree* (Fig. 126). The *Acanthus* is here (Fig. 123); the *Bignonia* (Fig. 70), in whose Order is the *Calabash* (Fig. 209).

100. Here are the *Broom-rapes* (Fig. 159); the *Butterworts* (Fig. 88);



FIG. 70.—*Bignonia picta*; br. with lvs., fls., tendrils.

the Foxgloves, which include the Snapdragon (Fig. 161); the Nightshades, which include the Egg-plant (Fig. 158) and Irish Potato (Fig. 239, A); the Morning-Glories, which include the Jalap (Fig. 87) and Dodder (Fig. 93). Here is the Gentian (Fig. 116); the Nux Vomica (Fig. 240); the Milkweed (Fig. 172).

101. The Doghanes are here; they include the Wrightia (Fig. 145), a climbing tree of East India, which twines its trunk around large trees, ascending them to a great height, and finally strangling them to death in its embrace.



FIG. 71.—Edible Olive (*Olea europaea*); br., lvs., fls.: a, fruit; b, fl.; c, pistil and ovary; all reduced.



FIG. 72.—1, Macdonald Heath (*Erica tetralix*). 2, McAlister Heath (*E. cinerea*). 3, Common Scotch Heather, or Ling (*Calluna vulgaris*).

102. The *Olive* (Fig. 71) is here also. Its Order includes the Ash (Fig. 8, B). The Ebony-trees are here (Fig. 228); the Sapodilla Order, which includes the Gutta-Percha (Fig. 149). The Primrose (Fig. 5, 1) is here; and the Plantain (Fig. 136).

103. The *Heaths* (Fig. 72) are here also, with their various and beautiful sub-orders and tribes.

104. *Subdivision II. Ovary Adherent.*

The Harebell (Fig. 144) is in this small Subdivision,—small, however, only in the number of its Orders. For it includes the Sunflower Order; and this comprises one-tenth of the whole Phanerogamia, and contains more than 10,000 species. In this great family we find the Dandelion (Fig. 142), the Artichoke (Fig. 214), the Marigold (Fig. 143), the Jerusalem Artichoke (Fig. 95). The Teasel is here also (Fig. 105).

105. *The Valerian* (Fig. 73) represents the adherent ovary of this Subdivision; we see in its fruit the resemblances to the fruit of both the Teasel and the Sunflower.

The Madder Order is in this Subdivision; it includes the Sweet Woodruff (Fig. 110), Ipecac (Fig. 90), and Coffee (Fig. 147). The Honeysuckle Order (Fig. 107) closes this Subdivision.

106. *Number Five.*—Observe that the number *Five* prevails now in the floral whorls (Bignonia, Egg-plant, etc.). Rarely is the number Two or a multiple of two (*Olive*); rarely Three or a multiple of three (pistils of flower of the *Oak*). Observe that the stem is now fully *exogenous*,—differentiated into true pith, wood, and bark (Fig. 81); and that it is *solvent*,—divided into large branches at a certain height (Fig. 98); observe also that the *leaves* are *net-veined*,—with small fibres interlacing between the larger fibres, and thus forming a net (Fig. 74).



FIG. 73.—Valerian (*Valeriana officinalis*): separate fl.; ripe fr. showing the adherent ovary and persistent calyx, which is *pappose*.

LESSON XII.

SUB-CLASS II.—DICOTYLEDONS FINISHED.

Division III.—Polypetalæ. 3 Subdivisions

1.	<i>Calycifloræ</i> , Calyx-flowers.
2.	<i>Discifloræ</i> , Disk-flowers.
3.	<i>Thalamifloræ</i> , Bridal-chamber-flowers.

107, 108, Calyx-flowers: Ivy to Mimosa. 109, 110, Disk-flowers: Cashew; Lotos of the Lotophagi; Christ's-thorn; Incense-trees. 111. Characters of Stamens. 112. Bridal-chamber-flowers; Lime to Baobab; 113. "Good-day, Sweet lady;" 114, 115. Camellia to Sarracenia; 116. Number Five; 117. Sacred Lotus; 118. Barberry to Calycanthus; Number Three; 119. Buttercups; 120. Exogenous Growth. 121. Specialization. 122. Motherhood; the Master-builder.

107. Subdivision I. Calyx-flowers.—*Calyx usually conspicuous; sepals usually connate into a tube, as in the*



FIG. 74.—Squirting Cucumber (*Ecbalium agreste*): st., lvs., fls., fr.

sepal usually connate into a tube, as in the Cherry (Fig. 5, 5); their upper parts only separate. The Orders belonging to this Subdivision which are illustrated in the Lessons are: The Aralia, which includes the Ivy (Fig. 92) and the Rice-paper Shrub (Fig. 225); the Parsley (Fig. 159); the Cactus (Fig. 102); the Melon, which includes the *Squirting Cucumber* (Fig. 74) and the Bryony (Fig. 184); the Passion-flower (Fig. 155), which includes

the Papaya (Fig. 237); the Evening Primrose, which includes the *Willow-herb* (Fig. 75). In the Melon and Papaya the flowers are monopetalous at base, but their habits and affinities place them here.

108. In this Subdivision are the Loosestrifes, which include the Pomegranate (Fig. 208); the Myrtles, which include the *Monkey-pot* (Fig. 156), *Brazil-nut* (Fig. 201), and *Eucalyptus* (Fig. 157); the

Rose (Figs. 175, 211), which includes the Cherry (Fig. 5, 1), the Peach (Fig. 206), the Strawberry (Fig. 175), the Dewberry (Fig. 131), the Agrimony (Fig. 129), the Quince (Fig. 210). The Pea is here (Fig. 5, 6): her family includes the Tonka Bean (Fig. 198), Sweet Pea (Fig. 167, A), Hedysarum (Fig. 197), Lotus trefoil (Fig. 163), Clover (Fig. 132), Broom (Fig. 166), and Mimosa (Fig. 130).

109. Subdivision II. Disk-flowers.—*Torus usually conspicuous, and called a Disk; often forming a ring or cushion at the base of the ovary or around it.* The Cashew opens this Subdivision (Fig. 76); here the disk is so large that it forms the edible part,—the small pericarp, or true fruit, being at its apex. In the Cashew Order is the Sumach (Fig. 138). The

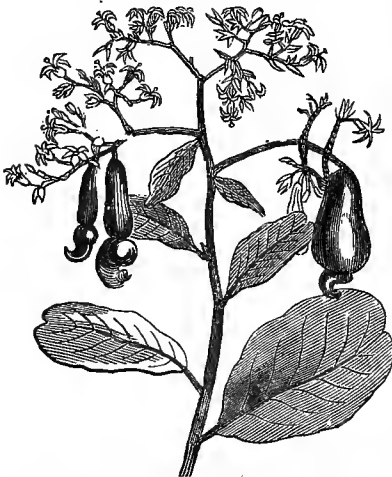


FIG. 76.—Cashew Nut (*Anacardium occidentale*): hr., lvs., fls., fr.



FIG. 75.—Br., with lvs., fls., fr., of Willow-herb (*Epilobium angustifolium*): 1, separate fl.; 2, fl. divided vertically, showing the long calyx-tube with the adherent ovary; 3, sd., with tuft of silky hairs on the chalaza.

Horse-chestnuts (Fig. 192) are in this Subdivision. Here, too, is the Vine (Fig. 101).

The Buckthorns are here; they include the *Christ's-thorn* (Fig. 77), said to be the tree of whose thorny stems Our Saviour's crown of thorns was made. The disk of the *Christ's-thorn* (*a*) widens around the half-embedded ovary, so that the ripe fruit resembles a head covered by a low-crowned, broad-brimmed hat. The French call it *Porte-chapeau*,—Hat-bearer. In the same Order are the Jujube-trees, one

of which is the famed Lotus shrub of the Lotophagi, or Lotus-eaters, an innocent, luxurious people who lived on the north coast of



FIG. 77.—Br., with lvs., fls., fr., of Christ's-thorn (*Paliurus aculeatus*): a, ripe fruit.

Africa (and the adjacent islands), between Tunis and Barca. The Lotus-jube is very sweet, and about the size of a plum. Homer tells us, in the 9th Book of the Odyssey, that the tired shipwrecked companions of Ulysses found the Lotus fruit so sweet, the Lotus-eaters and Lotus-land so charming, they were unwilling to return to their own country.

110. The Crowberry (Fig. 99) is in this Subdivision. Here too are the Incense-trees, which include Myrrh (Fig. 104) and Frankincense (Fig. 125). Here is the Order of the Rue (Fig. 188), which includes the Orange and Lemon (Fig.

127). The Geranium (Fig. 150), which includes the Balsam (Fig. 164). The Bean-capers, which include the Guaiacum-trees (Fig. 128).

111. Observe that in many Orders of these two Subdivisions the filaments are united into 1, 2, or many sets, as in the Pea family (Figs. 130, 132, 163, 166) and Lemon (Fig. 127); and that the stamens are often *Indefinite*; that is, more than 20, and therefore indefinitely numerous, as in the Cherry (Fig. 5, 5), Mimosa (Fig. 130), Lemon (Fig. 127).

112. Subdivision III. Bridal-chamber-flowers (*Gr. thalamus*, bridal-chamber).—*Calyx*, *Corolla*, *Andrœcium*, and *Gynœcium* each separate from the others; all, however, borne on the same torus, as if in a common bridal-chamber.

The Lime-trees (Fig. 117) open this grand Subdivision; they are called *Lime* in Great Britain, *Linden* in Germany, *Linn* in the Southern U. S., *Bass-wood* in the Northern U. S. The Chocolate-trees are here (Fig. 135). The Mallows (Figs. 134, 182), which include the Cotton (Fig. 10), the Hand-flower (so called because its five stamens simulate

a hand), which is sacred among the Mexican Indians, and the venerable Baobab-tree of Africa, 60 feet in diameter, 100 feet high, and which lives to the age of 2000 years.

113. The native negroes hold this tree in great reverence, and build their huts beneath it. Like the rest of its family (Cotton, Hollyhock, Okra, etc.), it blooms for many weeks; the flowers opening at sunrise, blooming for one day, and withering at night,—each day's blooming, however, being profuse. In the early morning the negroes stand in silent groups around the tree, which is sleeping, as they think; as the large, beautiful, white, pendulous flowers unfold, swinging like chalices, on their long peduncles, these simple creatures greet the tree with the salutation, "Good-day, sweet lady."

114. A little higher in this Sub-division are the great Borneo Camphor-trees (401). The Camellias are here also; they include the *Tea* (Fig. 78).

115. The Mangosteens, also; they include the Gamboge-tree (Fig. 169). The Tamarisk (Fig. 119) is here; the Pink (Fig. 174, A); the Polygala (Fig. 185); the Arnotta (Fig. 199); the Violet (Fig. 204, D, E); the Sundew (Fig. 112); the Mignonette (Fig. 122); the Caper (Fig. 177); the Mustards (Fig. 162), including the Wall-flower and Shepherd's Purse (Fig. 200); the Bleeding-heart (Fig. 124); the Poppies (Figs. 181, C, 197, E); the Sarracenas (Fig. 114).



FIG. 78.—*Tea (Thea Sinensis)*: branch with lvs. and fls.

116. Observe that the floral number *Five*, or some multiple of it, still prevails, and that the floral parts incline to be more and more distinct and free. The floral number is rarely two, or a multiple of two, as in the Evening Primroses (Fig. 75), Mustards (Fig. 162), Bleeding-hearts (Fig. 124), Poppies.

117. Next come the Water-Lilies; they include the sacred *Indian Lotus* (Fig. 79), which is figured in the painting and architecture of both India and Egypt. It is the most highly differentiated flower yet discovered.

All its floral parts are distinct and free, including the ovaries (Fig. 79, A), and these are 1-celled and 1-seeded (B); the seed (C) is without perisperm, consisting of 2 fleshy cotyledons and a plumule of 2

large green leaves, with a leaf-bud between them, thus being almost *viviparous* (126). The fruity torus (A), which is supplied with nourishing juices, detaches itself from its peduncle at maturity and floats away to found a new colony. Meanwhile the nuts sprout, still feeding on this nourishing mother; so that by the time she reaches a barrier of the mud in which the plant delights, her young ones are ready to separate from her and begin an independent existence. The nature-loving Hindoo no doubt had discerned this high character, preserved perhaps through millions of years; for fresh-water plants keep their habits and features almost unchanged. And this is probably the reason why the Lotus Lily became the Eastern emblem of Creation and Maternity.

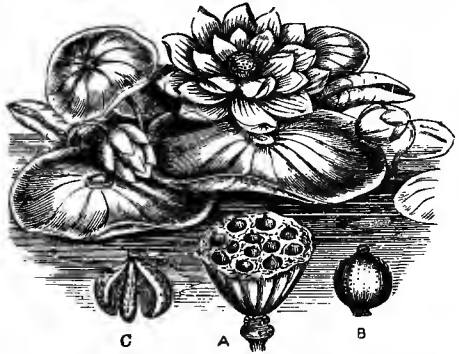


FIG. 79.—Plants, with lva. and fls., of Indian Lotus (*Nelumbium speciosum*): A, ripe fruit, consisting of the top-shaped torus with many separate 1-seeded fruits (nuts) embedded in its top. B, separate nut. C, same opened, showing the 2 large cup-shaped cotyledons and the green leafy plumule between them. All reduced.



FIG. 80.—Br., with lva. and fr., of Sour Sop (*Anona muricata*); fruit, vert. sec.

The floral number is in these Orders *Three*, or some multiple of three; whilst the parts incline still more to be distinct and free.

The Yonquapène (*Nelumbium luteum*) of our Southern States, introduced also into some Northern localities, is twin-sister to the Eastern Lotus. The great Victoria Lily of South America also belongs in this Order.

118. The Barberry (Fig. 5, 3) is in this Subdivision. Here is the *Custard Apple* (Fig. 80); the *Nutmeg* (Fig. 196); the *Magnolia* (Fig. 133); the *Calycanthus* (Fig. 176). The

119. *The Buttercups* (Fig. 9, 1, 3) stand at the head of this Subdivision, and of course at the head of the flower-kingdom; they include the Columbine (Fig. 154) and Clematis (Book-cover, side).

In this Order (with the exception of the ovaries in *Nigella*) all the floral parts are distinct and free (Fig. 9, 3). Many of the plants are marshy or aquatic in habit; and these (Water Crowfoot, etc.) singularly resemble the Water-Plantains in Endogens; except that they are exogenous, and their floral number is Five. The May-apple (in the Barberry family) and the Magnolia have their floral parts in threes; and they resemble the Lilies in the appearance of their petals. These Orders, therefore, seem to be a sort of link between the two Sub-classes Endogens and Exogens. But we must remember that "classification is a net-work, not a chain," as the botanist Robert Brown has said.

120. **Exogenous Growth.**—*The embryo* here has two cotyledons, which are opposite. The *leaves* are either opposite, alternate, or whorled; they are *net-veined* (Fig. 74). The *stem* is differentiated into *pith, wood, and bark* (Fig. 81); its increase is by concentric layers of wood-bundles around a central pith. The *pith* is purely cellular. The newest *wood* is always outside the last layer of wood-bundles, and for this reason the growth is called *exogenous* (outside growth). The *bark* is distinctly differentiated from the wood; its newest growth is outside the wood but inside the other layers of bark. (The stem and its action are treated in the Lessons in Part Second, Phytotomy.) Observe these characteristics:

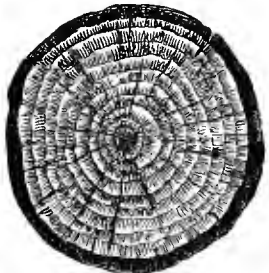


FIG. 81.—Transverse section of an exogenous tree 9 years old; with central pith, 9 wood-circles, 1 for each year, and bark-circles outside the wood.

I. Covered Seeds.—Embryo with radicle, plumule, and 2 opposite cotyledons, with the plumule between them.

II. Flowers with perfect pistils and stamens; perianth sometimes wanting, but usually conspicuous and differentiated into calyx and corolla.

III. Floral parts quinary—Five, or some multiple of five (Fig. 82, b); rarely two, or some multiple of two (Fig. 82,

a); rarely three, or some multiple of three (May-apple, Magnolia, Fig. 133).

IV. *Leaves* net-veined (Fig. 74); rarely parallel-veined or ribbed (Gentian, Fig. 116; Plantain, Fig. 136).

V. *Growth* exogenous. Stem solvent (Fig. 98).

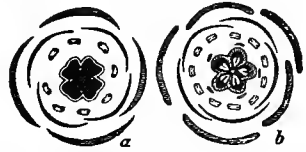


FIG. 82.—a, diagram of fl. of Heath (*Erica tetralix*); b, ditto of Stonecrop (*Sedum pulchellum*).

121. *Specialization*.—Looking from the Lotus Lily and the Buttercup as types of highest floral development in Exogens, it is both interesting and instructive to see here, as in Endogens, how the various types have developed on the one hand and specialized their parts on the other; until from the great Creamnut-tree of South America, in which a single flower develops 4800 stamens, we see the Sunflowers (Fig. 142) so specialized that their little flowers (called *florets*) are in close heads, with each fruit (Fig. 142, b) an akaine; the Oaks (Fig. 66) with apetalous flowers; the Mistletoe (Fig. 65) with its seed reduced to the nucleus.

122. *Motherhood. The master-builder*.—The process of life, through all its gradations, from the simplest to the most complex forms, whether of plant or animal, is the same as in the Red Snow,—birth and development from a mother-cell. And just as in the animal activities, so it is with the plant; every part—root, stem, leaf, and flower—is concerned in the growth of this expectant mother and subservient to her. The protoplasm creates cell after cell, which it sends out to gather materials for the bridal-chamber of the pistil. These skilful artisans frame the torus like a royal couch; they deck it with petals and sepals which no Eastern loom can imitate. They attend in state on the embryo-daughter; they bring the food she needs, they take away the refuse that might harm her. Day by day they shape the cotyledons into a cradle, and canopy it with the curtains of the seed-coats; they make wood-fibre for the pericarp, and build its strong walls to shield her from danger. When the seed is planted and the warm earth quickens the embryo into active life, the protoplasm stirs again in all the cells; the radicle with its delicate point pierces the seed-coats, and by an unerring instinct descends into the ground; the plumule ascends and unfurls its leafy banner in the air. The Dragon-tree, which sprouted before Babylon was built; the Californian Pine, contemporary with the Psalmist David; the Baobab, which swung the censers of its great white flowers in the days of the Cæsars,—all these are the work of this busy little atom. Unresting, unerring, it builds cell after cell, chamber after chamber, adorned with sculpture and garniture; it poises them so delicately that the lightest breeze can stir them, yet fixes them so firmly that man is made ashamed even of his Pyramids.

GEOLOGICAL TABLE,
 Showing the successive periods of Inorganic and Organic Development.
Breadth in the perpendicular lines indicates predominance.

BOTANY.

GEOLOGY.

ZOOLOGY.

CENOZOIC.	Quaternary. Tertiary.	Man. Placental Mammals.	CENOZOIC. Placental Mammals.
MESOZOIC. <i>Exogens: Poplar, Oak.</i>	Cretaceous.		MESOZOIC. Pouched Mammals.
<i>Endogens: Yucca.</i>	Oolitic or Jurassic.		Birds.
	Triassic.		
	Permian.		PALÆOZOIC.
	Carboniferous.		
<i>Gymnogens: Pines.</i>	Old Red Sand- Stone, or Devonian.		Reptiles.
<i>Acrogens: Fern, Club-moss.</i>	Silurian.		Vertebrates: Fishes.
		 Invertebrates: Radiates, Mollusks, Articulates.
AZOIC. A. C. K.	Azoic, or Archæan.	No life.	. AZOIC.

LESSON XIII.

FOSSILS AND THEIR TEACHINGS.

123-125. Earth development. 126. Animal Kingdom. 127. LIFELESS Time. 128. ANCIENT TIME. 129. *Silurian*: Thallogens, Invertebrates; Acrogens, Fishes. 130. *Devonian*: Gymnosperms, Fishes, Insects. 131. *Carboniferous*: Tree-Ferns, Horsetails, Club-Mosses. 132. MIDDLE TIME. 133. *Triassic and Jurassic*: Cycads, Endogens, Reptiles, Reptilian Birds, Pouched Mammals. 134. *Cretaceous*: Exogens, Wader-Birds. 135. MODERN TIME. 136. *Tertiary*: Modern Plants and Animals. 137-140. *Quaternary*: Man. 141. Natural Selection.

123. "In the beginning the earth was without form and void,"—a chaotic nebulous mass (supposed to have been 800,000 times its present size), which was slowly condensed into a liquid ball of molten minerals. As its surface cooled, a rocky crust was formed; this, on account of commotions within the mass, was thrust up and folded in various ways. The vapors became seas; these seas wore away the surface of the first rocks and formed layers; upheavals and depressions made lakes and rivers; finer deposits made soil. The crust of the earth, the best geologists presume, has an average thickness of 25 miles,—less than $\frac{1}{300}$ of its diameter, and thinner in comparison than an egg-shell.

124. *Earth-development* has four divisions of Time (see Table facing Lesson XIII.):

I. Lifeless Time, or Azoic (Gr. *a*, wanting, *zoe*, life). Without plants or animals.

II. Ancient Time, or Palæozoic (Gr. *palaïos*, ancient). Plants and animals prefiguring modern types but different from them.

III. Middle Time, or Mesozoic (Gr. *mesos*, middle). Plants and animals more like modern types.

IV. Modern Time, or Cenozoic (Gr. *kainos*, modern). Plants and animals as they are to-day.

125. Giving to each period its relative age as counted from the time required to make modern deposits of stone, mud, etc., the proportion is 4, 12, 3, 1. The age of the earth is reckoned to be 60 millions of years. We have, then, for Lifeless Time 12 millions; Ancient Time, 36 millions; Middle Time, 9 millions; Modern Time, 3 millions.

126. *The Animal Kingdom (Zoology)*, like Botany, has two Series:

Series I.—Invertebrates, without spinal column. *Reproduction* single, dual, alternate. *Multiplication* by gemmation (producing gems or offshoots). Four classes:

1. *Protozoa* (Nummulites, Sea-Jelly); as simple as protophytes.
2. *Radiates* (Sea-Fir, Star-fish, Coral); plant-like.
3. *Mollusks* (Oyster, Clam, Snail, Cuttle-fish); soft-bodied.
4. *Articulates* (Worm, Crab, Insect); jointed.

Series II.—Vertebrates, with spinal column; producing eggs. Reproduction by fertilization. Five classes:

- | | | |
|---|---|--|
| <ol style="list-style-type: none"> 1. <i>Fishes</i> (Herring, Salmon, Cod, Shark). 2. <i>Amphibians</i> (Salamander, Mud-Eel, Frog). 3. <i>Reptiles</i> (Turtle, Snake, Lizard, Alligator). 4. <i>Birds</i> (Goose, Ostrich, Parrot). | } | <p>Oviparous; young developed in the egg after it separates from the mother.</p> |
| <ol style="list-style-type: none"> 5. <i>Mammals</i> (Opossum, Sloth, Whale, Cat, Rat, Bat, Mole, Monkey, <i>Man</i>). | } | <p>Viviparous; young developed in the egg in the mother's body, and suckled by the mother after birth.</p> |

127. Lifeless Time. Though the layers of later periods are placed in regular succession, the Lifeless, or Azoic rocks (sometimes called *Archæan*), have been thrust up at various times by internal commotions, and are seen at the surface in Norway, Sweden, Bohemia, and Scotland. They are remarkably exhibited in North America, especially in Canada (called the Laurentian rocks, from the river St. Lawrence), and extending along the Allegheny and Blue Ridge ranges to Alabama; also in the Rocky Mountains. America is indeed the Old World rather than the New. Some of her living quadrupeds (Opossum, Sloth) and one of her races of men (Esquimaux) are found elsewhere only in fossils.

128. Ancient Time has four periods:

1. *Silurian* (L. *Silures*, the Welsh), because these rocks abound in Wales.
2. *Devonian*, from Devon, England; sometimes called Old Red Sandstone.
3. *Carboniferous*, from the abundance of its coal-measures.
4. *Permian*, from Perm, in Russia.

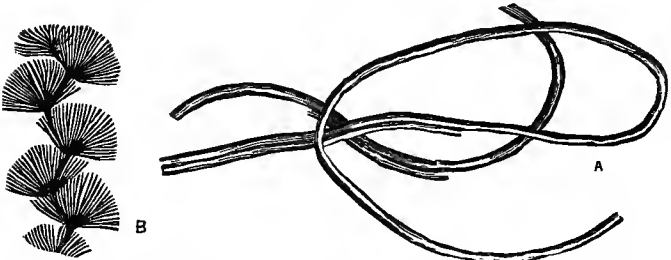


FIG. 83.—A, *Pulvohorda minor*, seaweed, fossil, Scotland. B, *Oldhamia antiqua*, sea animal, fossil, Ireland.

129. In the Lower Silurian (see Table) are the first authentic fossils. The plants are THALLOGENS; one of them is a *Seaweed* (Fig. 83, A), resembling the Dead-Man's-Rope of our own time (Book-cover, front). Another is an *Invertebrate* animal, also marine, like our Sea-Fir (Fig. 83, B). *In the Upper Silurian* land plants appear; ACROGENS,—*Ferns*

and *Club-Mosses*. Vertebrates, too, are here,—*Fishes* resembling the Shark and Sturgeon.

130. In the *Devonian* Desmids abound; Ferns and *Club-Mosses* increase. *GYMNOSPERMS* appear,—trees resembling the Pines. *Fishes* so abundant that this is called the *Age of Fishes*. Insects appear. At the close of the *Devonian* period New York State arose above the seas.

131. The *Carboniferous* period exhibits the most magnificent vegetation the earth has ever known. During this time Nature produced and stored up her supply of coal for man, although he was not to appear for millions of years. More than half the plants that make our coal-measures are fossil ferns. The *Tree-Ferns*, *Horsetails*, and *Club-Mosses* were giants. One of the *Club-Mosses*, the *Lepidodendron* (Fig. 84), was more



FIG. 84.—Fragment of fossil *Lepidodendron*: leaf-scars spirally arranged.

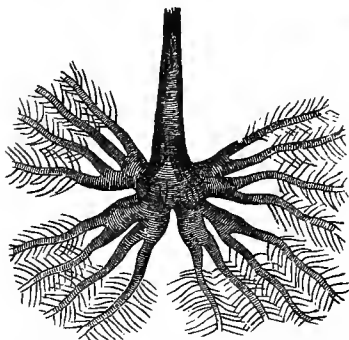


FIG. 85.—Roots and part of stem of fossil *Sigillaria*: stem fluted, and marked with seal-like scales.

than 60 feet high and 4 feet in diameter. The *Sigillaria* (Fig. 85), allied to the *Club-Moss*, prophesied the *Cycas*.

Ancient Time, through all its periods, shows slow growth, great quiet, and mild, uniform temperature. At its close tremendous geologic convulsions took place, and the extermination of life was complete. The Appalachian Mountain chain rose above the seas from New York to Alabama; the Ural chain in Europe.

132. **Middle Time** has three periods:

1. *Triassic* (*L. trias*, three), rocks sometimes in three layers.
2. *Jurassic*, from the Jura Alps.
3. *Cretaceous* (*L. creta*, chalk), from the chalk-beds of Europe.

133. In the *Triassic* and *Jurassic* periods *Club-Mosses* and Ferns diminish to their present size and number. The *Cycads* reach their greatest size, and exceed all other plants in number. Pines increase. *ENDOGENS* appear,—Lilies, Grasses, Pond-weeds, and Screw-Pines. Reptiles abound; flying dragons, more hideous than the fabled one slain by St. George. Insects come in. Birds appear, but with jointed, long tails, like the tail of a lizard (though richly feathered), and claws on their wings, like those on the Bat's. Mammals, bearing

their young in a pouch (like the Opossum), come in. At the close of the Jurassic period the Sierra Nevada, Wahsatch, and Humboldt Mountains were thrust up in North America. Europe was still an archipelago; eastern and southeastern England was still submerged.

134. *In the Cretaceous* period Diatoms and Desmids abound. Palms increase. EXOGENS appear,—fossil leaves of the Oak, Poplar, Beech, Willow, Dogwood, Sassafras, and Tulip-tree. Huge reptiles continue; Middle Time is called the *Age of Reptiles*. The birds resemble Cormorants and Waders; but their teeth are pointed, like a reptile's.

The climate of the world was still mild. At the close of this period disturbances occurred, and life was again exterminated. The Rocky Mountain region arose above the seas and became a level plateau. But the Gulf of Mexico still extended to the mouth of the Ohio River, and covered the whole area east of the Rocky Mountain plateau as far as the Arctic Circle.

135. *Modern Time* has two periods:

1. *Tertiary, or Third*, so called because Lifeless Time was once called Primary, Ancient and Middle Time Secondary;

2. *Quaternary, or Fourth*, sometimes called Recent.

136. *In the Tertiary* Diatoms still abound. Ferns and Pines sink to their present proportions. Exogens appear very nearly as they are to-day.

The Butterfly and Bee come in with the flowers; we see them embalmed in *Amber* (Fig. 86), which is the fossil resin of some coniferous tree. The strange animals disappear; the higher Mammals come in,—the Whale, Horse, Hog, Elephant, Ox; the Tertiary is the *Age of Mammals*. The Pheasant and Woodpecker, the Wildcat and Deer, appear in the woods. The Monkey is their comrade, and grins at us with an ancestral familiarity that cuts down

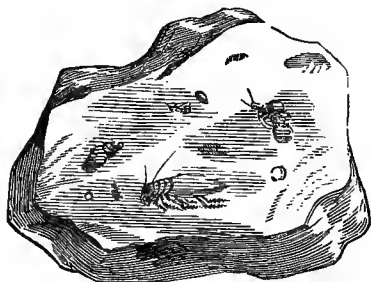


FIG. 86.—Amber, with remains of fossil insects.

our self-conceit. The earth still preserved a mean temperature of 48° Fahrenheit. At the close of this period there was another upheaval. The Pyrenees, Alps, and Carpathian Mountains were made in Europe; the Himalayas in Asia; the Rocky Mountain plateau was thrust up into its present line of mountains. But the Gulf of Mexico still extended to the mouth of the Ohio River; Florida and the Atlantic States were submerged as far as New York.

137. *The Quaternary* is the *Age of Man*. It has three periods:

1. *Glacial*, in which moving glaciers in high latitudes modified the surfaces of continents;

2. *Champlain*, in which the ice passed away and coast deposits were formed;

3. *Recent, or Terrace*, in which the land was raised approximately to its present level.

138. *In the Glacial and Champlain* periods Man is first seen as a

fossil skeleton in Belgium; a cave-dweller, with rude stone implements beside him; low-browed, short in stature, a hunter and fisher, as the bones attest which are associated with him; this, therefore, is his *Palæolithic* (Old-Stone) *Age*. The Esquimaux are considered his lineal descendants. At the close of the Champlain period a higher type appears in the south of France; still a cave-dweller, but of larger stature and brain; he has better stone implements, and others of horn, bone, and ivory, elegantly carved with the figures of animals. The bones of the Reindeer are associated with him; this is his *Reindeer Age*. After a second glacial period, which occurred in Europe, the *Recent Period* comes in, and a still higher type appears in the Denmark skeletons,—a farmer and herdsman, with handsome stone implements and vessels of pottery. He understood spinning and weaving; was to some extent an engineer, for in Great Britain he excavated galleries in the chalk-beds to extract flints, which he converted into weapons and tools. He believed in a future state; the pottery, arrow-heads, etc., found in his graves were evidently placed there for the use of the dead. This is his *Neolithic Age* (New Stone). The Lapps in Northern Europe, the handsome Basques in the south of France, the small, dark Welshman and Irishman of West Ireland, are considered his descendants. To the latter part of this period the Lake-dwellers of Switzerland belong; they used bronze instruments as well as stone; theirs is therefore the *Bronze Age*.

139. *Of man's antiquity*, as compared with historical annals, the geologic records afford every proof; the best scientific authorities agree that he appeared first at least sixty thousand years ago. Yet geology teaches us that he is the latest born of living creatures. We see, therefore, that the fossil Bible under our feet and the written Bible which is our rule of life tell the same story of Creation.

140. Both plant and animal types are still dying out, as in former ages. The Horsetails and Cycads are few and diminishing. The Auk, a bird of Northern seas, has become extinct within forty years. The Esquimaux and Lapps are decreasing.

141. **Natural Selection.**—In the midst of all the geologic, glacial, and climatic changes, certain types of both plants and animals have adapted themselves by specialization to the needs of their “environments” or surroundings. We have examples in the Grasses and Lilies in Endogens; in the Mistletoe, Oak, and Sunflower family in Exogens. These seem to have been *selected by nature as the fittest to survive*. Hence we have the two famous phrases of Mr. Darwin,—*Natural Selection and Survival of the Fittest*.

PART SECOND.—PHYSIOLOGY.

LESSON XIV.

ROOT AND SUBTERRANEAN STEM.

142. The Root: 143. Axial; 144. Inaxial; 145. Tuberous. 146. Air-plants. 147. Adventitious Roots. 148. Parasites. 149, 150. The Stem: 151. Bulb; 152. Corm; 153. Rhizome; 154. Tuber.

142. The Root is the organ of absorption. It imbibes food materials, which it sends up to the stem and leaves;

there they are digested into food and sent back to be stored both as food and structure in the stem and root. Roots are of two kinds, *Axial* and *Inaxial*.

143. The Axial root has a strong central root, called *Tap-root*; it characterizes *Exogens*. It has four forms, — *Conical*, *Carrot*; *Fusiform*, or spindle-shaped, *Radish*; *Napiform*, or turnip-shaped, *Jalap*



FIG. 87.—St., with lvs. and fls., of Mexican Jalap (*Ecogonium purga*); a, root.

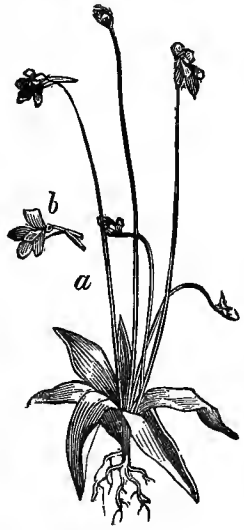


FIG. 88.—a, Butterwort (*Pinguicula vulgaris*); b, separate fl.

(Fig. 87); *Ramose*, or branching, *Butterwort* (Fig. 88).

144. Inaxial roots have no tap-root, on account of the early decay of the radicle. They characterize *Endogens*,

but are found also in some Exogens,—the Sweet Potato, Dahlia, Peony, etc. They are *Fibrous* (thread-like) in the Grasses (Figs. 6, 57); *Tuberous*, or tuber-like, in the Yam (Fig. 89) and Sweet Potato.



FIG. 89.—Rt., st., with lvs. and fls., of Yam (*Dioscorea sativa*) of West Indies and Southern States. Lvs. do not show the ribs plainly enough.

145. **Tuberous roots** are distinguishable from the true tuber in being without buds, or *Eyes*; they develop leaves and stems only from the extremity. (Compare Figs. 89 and 95.) They are

Coralline, like coral, in the Coral-root Orchid;

Fasciculate, bundled, in the Asphodel (Fig. 56);

Filipendulous, hanging separately at the end of a long fibre, in the Dropwort;

Moniliform, necklace-like, like a string of beads, in the

Pelargonium and *Ipecac* (Fig. 90).

146. **Air-Plants, or Epiphytes** (Gr. *epi*, upon, *phyton*, plant), do not grow in the ground, but rest upon other plants, and draw their food from the air. They are chiefly of the Orchis and Pine-Apple Orders, growing in warm, moist climates. The Magnolia Orchis (*Epidendron*) and Spanish, or Florida, Moss (*Tillandsia*) are examples. In these the roots serve the same purpose as in other plants,—support and absorption.

147. **Adventitious, or Secondary Roots** will spring from any part of the stem if it be favorably placed. We see this in cuttings and slips. The Indian Corn and Sugar-Cane send out secondary roots from several joints near the ground; the Mangrove of our Southern States sends them out in such size and abundance that it gets its generic name—*Rhizophora*, Root-bearer—from them. The Banyan (Fig. 91) sends them down from its wide branches, making a miniature forest; one



FIG. 90.—Rt., st., and lvs. of Ipecac (*Cephaelis Ipecacuanha*) of Brazil.

tree often has 300 of these root-props, which enable its branches to extend until they cover a space 2000 feet in diameter,—large enough to shelter 7000 men. Other adventitious roots are seen in the *Ivy* (Fig. 92), Trumpet Flower, and Poison Sumach. These serve as supports to the plant in climbing.

148. Parasites, as we know (51), not only rest, but feed upon other plants. The roots of the *Rafflesia* (Fig. 68) and the Mistletoe (Fig. 65) penetrate into the wood of the host, and become so incorporated as to seem a part of it. Usually, however, parasitic roots strike through the bark only far enough to reach the sap between the bark and wood of the host. The *Dodder* (Fig. 93) is one of our common parasites. The plant springs from a seed in the ground; then, climbing to some other plant,—Flax, Clover, Alder, etc.,—it sends out adventitious roots, which penetrate the bark of the host. The first root perishes soon; and the *Dodder* lives entirely upon its host, twining its pale, leafless, amber threads so tightly that it has the name Love-Vine, or Love-Cord, in the South. The Banyan, like the *Dodder*, is parasitic from choice. It rarely vegetates in the ground, but chooses the crown of the palm-tree, where its seeds are left by birds. Here it sprouts, and sends roots to the ground, which at the same time embrace the nursing palm and literally suck its life away.

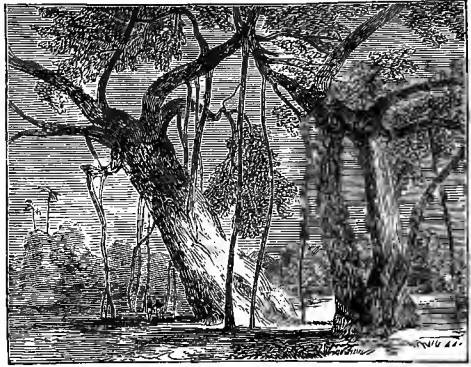


FIG. 91.—Banyan-trees (*Ficus indica*) of East India.



FIG. 92. Ivy (*Hedera Helix*); plants entire.

a caulis, or stem, like the Butterwort, Fig. 88) have a short suppressed stem at the surface of the soil; their leaves are called *Radical*—root leaves—because this stem is so

149. The Stem is the organ of circulation. It bears buds, leaves, branches, flowers. Even *acaulescent* plants (those without

short it seems a part of the root. The points from which the leaves spring are called *Nodes* (L. *nodus*, knot); the spaces between the nodes are *Internodes* (Fig. 93). The buds are usually in the *axil* of the leaf; that is, at the base of the leaf or leaf-stalk, at its upper face. There is a bud also at the apex of the stem; this is the *Terminal* bud; the other buds are *Axillary*, or *Lateral*.

150. *Stems* are *Subterranean* (L. *sub*, under, *terra*, earth) and *Superterranean* (L. *super*, above). Subterranean stems include the *Bulb*, *Corm*, *Rhizome*, *Tuber*.

151. The *Bulb* is a suppressed subterranean stem, with many nodes, bearing fleshy leaves in the form of scales or of coats. The Lily bulb is *Scaly*. The *Onion* (Fig. 94) is *Tunicated*, or *Coated* (L. *tunica*, coat); the central part representing the stem is hemispherical. Each scale of the Lily, or tunic (coat) of the Onion, may produce a bud or a bulb in its axil.

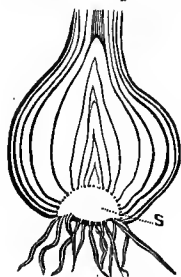


FIG. 94.—Vertical section of Onion (*Allium cepa*): s, suppressed subt. stem.

152. The *Corm* is bulb-like, with many nodes, but few scales, and these quite small, as in the *Cyclamen* (Fig. 245).

153. The *Rhizome*, or *Root-stock*, is usually fleshy, and always developed in length; it may be prostrate, erect, or creeping. It has many nodes and scales, usually smaller than those of the corm. When abrupt at the lower end it is called *Præmorse*, or *Bitten*, as in *Solomon's-Seal* and *Calamus-Flag*. The *Rhizome* of the *Common Ginger* (Fig. 151) furnishes the ginger of commerce.

154. The *Tuber* is solid, fleshy, with many nodes; but the scales are so small that the naked bud looks like and is called an *Eye*. The *Jerusalem Artichoke* (Fig. 95) and *Irish Potato* are examples.



FIG. 93.—Flax Dodder (*Ouscuta Epilinum*) on clover; fls. clustered.



FIG. 95.—Jerusalem Artichoke (*Helianthus tuberosus*).

LESSON XV.

UPPER (SUPER-TERRANEAN) STEM.

155, 156. Stem growth and names. 157. Herbs. 158. Shrubs and Trees. 159. Descriptive terms. 160. Climatic changes. 161. Age. 162. Monocarpic Plants. 163. Tree Forms. 164. Stem Habits. 165. Lianes, Lianas. 166. The term Vine. 167. Triangular and Square Stems. 168. Fleshy Stems. 169. Branches. 170. Transformations. 171. Spines, Thorns, Tendrils. 172. Prickles and Hairs.

155. Stems, as to manner of growth, are, as we know, *Simple* in Acrogens and Endogens,—Tree-Fern, *Grass-tree*

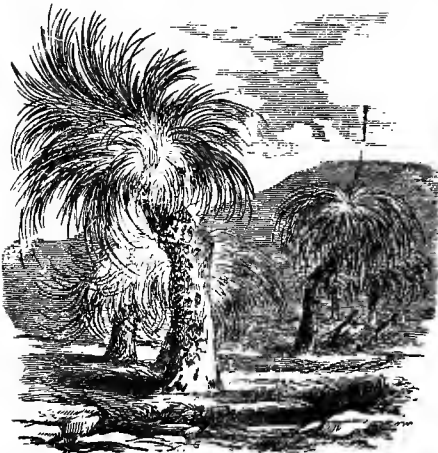


FIG. 96.—Grass-tree, Black Boy (*Xanthorrhoea hastilis*), of Australia; st. 6 to 10 ft. high.

(Fig. 96), Palm; *Excurrent* in Gymnosperms, — *Pines* (Fig. 97); *Solvent* in Exogens, — *Plane-tree* (Fig. 98).

They are named as follows:

Caudex, the stem of Ferns (Acrogens);

Culm, the stem of Grasses (Endogens);

Stipe, the stem of Palms (Endogens);

Stem, the general name of herbaceous and woody climbers, bushes, and shrubs;

Trunk, the body of trees in Gymno-

sperms and Exogens, but applied also to Endogens and Acrogens.

156. Plants as to age, texture, and form are classed as Herbs, Shrubs, Trees.

157. Herbs (except the grasses) have soft stems. They include

Annuals, that sprout, bloom, bear fruit, and die within

the year, sometimes in a few weeks: Indian Corn, Morning-Glory;

Biennials, that sprout and grow the first year; bloom, bear fruit, and die the second year: Radish, Canterbury Bell;

Perennial herbs, with roots that live many years, but stems that die annually: Butterwort, Catchfly.

158. Shrubs and Trees are perennial throughout. Their stems are hard and ligneous (woody).

A Shrub has no stout trunk, and is from 4 inches to many feet in height: Heath (Fig. 72), Strawberry (Fig. 99), Rose, Lilac, Vine (Fig. 101). A Tree has a trunk, and is from 10 to 400 feet high. The Peach, Almond, Crêpe-Myrtle are small trees, 10 to 30 feet high. The Oak, Sycamore, Plane, (Fig. 98), and Magnolia are large, 60 to 120 feet high. The California Pines (Fig. 97) and the Eucalyptus of Australia are gigantic, 150 to 300 feet high; the Eucalyptus sometimes 400 feet.

159. The following descriptive terms are used:

Arboreous, proper trees; *Arborescent*, large shrubs, small trees; *Frutescent*, ordinary shrubs; *Herbaceous*, plants that die entirely or down to the ground each year; *Suffrutescent*, perennials slightly woody at base, herbaceous above. *Suffruticose*, perennials quite woody at base, herbaceous above.

160. Climate often makes changes in these conditions. The Castor-Oil Plant is a perennial tree in the tropics; in Tennessee it is tree-like, but suffruticose; in the Northern States it is an annual.

161. Age is usually proportioned to the size and quality of the stem. Bushes and Shrubs live from 5 to 15 years. The Peach lives 12 to 15 years in perfection; the Apple, 30; the Chestnut, 600; the Oak, 1500; the Olive and Baobab, 2000; the Pines, 3000; the Grass-tree (Fig. 96) and Dragon's Blood (both Endogens) live 4000 years. The

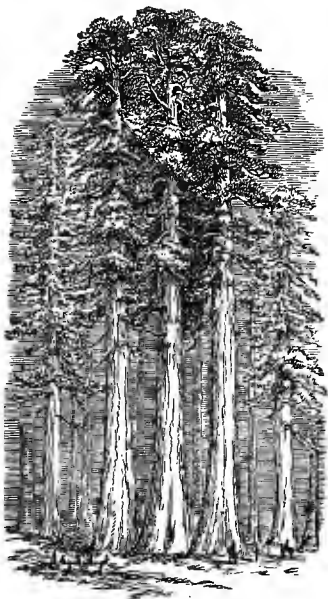


FIG. 97.—Big Trees (*Sequoia gigantea*). "The Three Graces," Cal., 300 feet high.

primitive types—Gymnogens and Endogens—live longest; a character resulting, doubtless, from the needs of their former geological conditions.



FIG. 98.—Plane-tree, or Sycamore (*Platanus orientalis*).

(panicle), which in 6 weeks reaches a height of 40 feet, with corresponding dimensions, and bearing 20,000 lilies. In a few weeks more the fruit ripens, and then the whole plant dies. The Agave (Fig. 115) is also monocarpic. It is called Century Plant for this reason; but the plants bloom at the age of 20, 40, or 50 years.

163. Trees, as to form, are

Drooping, with branches (and sometimes trunks) declined: Weeping Willow, Birch; *Fastigate*, with small, erect branches, parallel to the trunk: Lombardy Poplar; *Round-headed*, with solvent trunks and nearly equal branches: Plane (Fig. 98); *Spire-topped*, with excurrent trunks and tapering branches: Pines (Fig. 97).

164. Stems, as to habit, are

Ascending, *Assurgent*, when they rise obliquely, as in Polygala (Fig. 185); *Cespitose*, when in turfy patches like the Mosses; *Declined*, bent on one side: Judas-Tree; *Decumbent*, at base erect, but the stem prostrate without rooting: Raspberry; *Difuse*, loosely spreading: Raspberry; *Procumbent*, *Prostrate*, *Trailing*, lying flat on the ground without

162. Monocarpic Plants.—Perennials, after a few years' growth, usually bear flowers and fruit annually until they die of old age. Among Endogens, however, and especially in the Amaryllis Order, we find *Monocarpic*, or Once-fruiting plants. The giant *Fourcroya* of South America is an example. The stem is 400 years attaining its full growth, a height of 60 feet. Then it suddenly sends up a branching flower-stalk 40 feet, with correspond-



FIG. 99.—Crowberry (*Empetrum nigrum*); plant entire: b, fr. cut open; c, flower.

rooting: Crowberry; *Repent* (*Creeping*), prostrate and rooting: White Clover, Ivy; *Sarmentaceous*, *Sarmentose*, with long, flexible twigs: *Wistaria*; *Scandent*, climbing other plants or objects. The *Wistaria* climbs by coiling the ends of its sarmentose twigs; the *Vine*, by tendrils; the *Virginia Creeper*, by tendrils, which it converts at will into rootlets or holdfasts, thus becoming a true creeper. The *Clematis* makes tendrils of its leaf-stalks. Some plants climb by twining the stem, like the *Morning-Glory* and *Hop*; these are called *Voluble*.

165. *Liana* (Sp. lee-áh-na) and *liane* (Fr. lee-áhn), words meaning a rope or cord, are the names given to all tropical climbers, but especially to such as are woody (Fig. 100). These names have



FIG. 100.—Tropical Lianas.



FIG. 101.—Wine-bearing Vine (*Vitis vinifera*); branch with tendrils, leaves, and fruit; separate cluster (thyrses) of fis. and 2 separate stamens; sep. fl. with ovary and 5 stamens; sep. corolla with 5 petals coherent at top.

means wine in Greek and Latin, whence the word is derived) is the name of the woody climber that produces grapes. The name is misapplied

long been adopted into the English language, and supply a very great need. The *Wrightia*, already mentioned (101); the *Vanilla Orchid*; the *Rattan Palm*; the *Smilax*; the *Yellow Jessamine*; the *Virginia Creeper*; the *Wistaria*; the *Vine*, are representative lianas (Fig. 101).

166. The term *Vine* should never be used to describe scandent or running stems. *Vine* is a generic name, like *Rose*, *Lily*, etc. We might as well say the *Cucumber Rose*, the *Madeira Rose*, as to say the *Cucumber-Vine*, the *Madeira-Vine*. The *Cucumber* is a running plant; the *Madeira flower* is a twining plant; these are in no sense *vines*. *Vine* (which

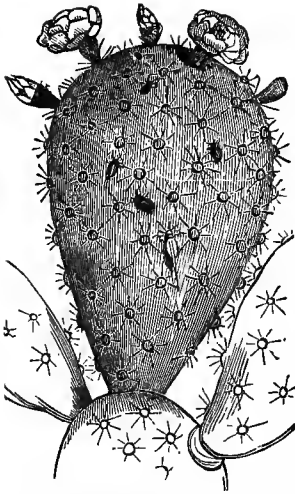


FIG. 102.—Cochineal Cactus (*Opuntia cochinillifera*), with cochineal insects.

buds in the leaf-axils (nodes) of the stem. They are *Runners* when prostrate and rooting only at the end,—*Strawberry*; *Suckers* when arising from subterranean stems,—*Rose*, *Aspen*; *Stolons* when they are decumbent suckers, taking root where they touch the soil,—*Gooseberry*.

170. Transformations.—In the *Butchers' Broom* (Fig. 103), the so-called leaves are branches expanded into leafy shapes, each tiny spiny-tipped "leaf" bearing a little white flower in its centre, which becomes a red berry nearly as large as the leaf. The leaves of the *Asparagus* and of the "*Smilax*" (*Myrsiphyllum*) of the greenhouses are also transformed branches. In all these plants the true leaves are small scales; they are well seen in young *asparagus*-shoots. Some botanists regard these leaves as transformed peduncles, and term this form of inflorescence *Epiphyllous* (Gr. *epi*, upon, *phyllon*, leaf).

171. Spines, Thorns, Tendrils, are transformations. When transformed branches they are part of the wood, and remain so after the

to other plants only in the United States and in some few localities in England. *Climber* is a correct term for all scandent stems; *runner*, for all that trail or run.

167. Stems are usually cylindrical; but in the *Sedges* they are triangular (triquetrous); in the *Mint Order* they are square.

168. Fleshy Stems characterize the *Cactus Order*. They are usually leafless; the green skin—there is no developed bark—serving the purpose of leaves. In the *Prickly Pear* (Fig. 102) the thick, jointed stems simulate leaves; the true leaves are minute scales, with bristles in their axils. In the tree cacti the stems are tall and columnar. Other fleshy stems are seen in the *Stapelia*, the *Tortoise-Plant*, and some *Euphorbias*. Growth like this, no matter in what part of the plant it occurs, is called *Anomalous* (Gr. *irregular*), because it departs from established order.

169. Branches usually spring from



FIG. 103.—*a*, *Butchers' Broom* (*Ruscus aculeatus*); *b*, fruit; *c*, sd.; *d*, fl.

bark is removed; as in the tendrils of the Vine (Fig. 101), and the Spines and Thorns of the Myrrh (Fig. 104), the Hawthorn, etc. When transformed leaves, they come off with the bark, as in the spines of the Locust, the thorns of the Rose, the tendrils of the Clematis and Pea.



FIG. 104.—Myrrh (*Balsamodendron myrrha*); br. with lvs., fls., spines.



FIG. 105.—Fuller's Teasel (*Dipsacus fullonum*).

172. Prickles and Hairs belong to the epidermis, or skin, of the bark and leaf. They are often strong and sharp, as in the Teasel (Fig. 105), the Prickly Pear, and Thistle. Hairs are varied in form and texture (Fig. 106); they are among the most interesting objects of the microscope; and they have given rise to most of the poetical terms which describe leaf-surface, as we shall see in Lesson XVIII.

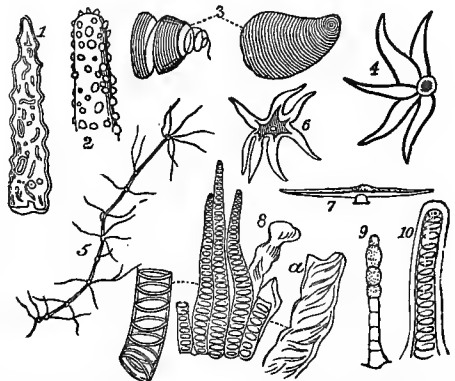


FIG. 106.—Hairs of Plants: 1, *Delphinium pinnatifidum*, $\times 200$ diam.; 2, *Anchusa crispa*, $\times 200$ diam.; 3, scale-like, from sd. of *Cabea scandens*, $\times 50$ diam.; 4, stellate, lf. of *Hedera Helix*, $\times 100$ diam.; 5, branched, *Verbascum Thapsus*, $\times 25$ diam.; 6, stellate, *Alyseum*, $\times 100$ diam.; 7, horizontal, stalked, *Grevillea lithidophylla*, $\times 30$ diam.; 8, annulated, from sd. of *Ruellia formosa*, in water, $\times 50$ diam.; 8a, detached cell-wall of same, $\times 200$ diam.; 9, glandular, *Bryonia alba*, $\times 50$ diam.; 10, from sd. of *Salvia*, $\times 50$ diam.

LESSON XVI.

BUD AND LEAF.

173-175. Buds. 176. Gems. 177. Grafting. 178. Bud-Scales. 179. Vernation, Præfoliation. 180. Vernation of leaves as regards one another. 181. Leaf-arrangement. 182. Spiral arrangement. 183. Leaf; an organ of digestion. 184. Blade. 185. Transformations. 186. Leaf uses. 187. Petiole. 188. Stipule.

173. Buds are of three kinds : Leaf-Bud ; Flower-Bud ; Mixed Bud with both leaves and flowers.

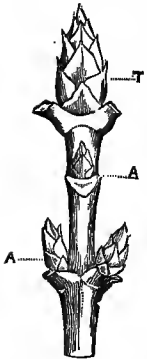


FIG. 107.—Black Honeysuckle (*Lonicera nigra*): A, axillary, and T, terminal buds.

174. The Leaf-Bud is the beginning of a stem or branch. A point in the centre, around which the leaves are grouped, is the Growth-point (L. *Punctum vegetationis*). The part to which the leaves are attached is the *Pulvinus*, another L. word for cushion. In habit, the bud is *Naked* when without scales, as in the Cinnamon (which is tropical, needing no protection from cold); *Scaly* when covered by scales, as in

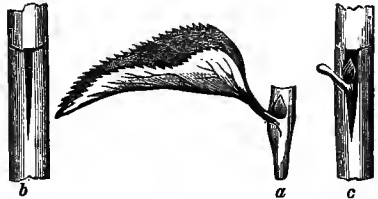


FIG. 108.—a, bud prepared for insertion; b, stem prepared to receive it; c, bud and stem after insertion.

175. Buds are Axillary and Terminal (Fig. 107), as we know; they are *Accessory* when two or more are near the axillary bud; *Adventitious* when they appear at random on the stem; *Latent* when they lie dormant, awaiting an opportunity to put forth.

176. Gems are solid fleshy buds, which appear in the leaf-axils (Lily) or in the flower itself (Onion). They never grow into branches; they ripen and fall, imitating seeds; then take root and form new plants.

177. Grafting.—Each leaf-bud is the germ of a perfect plant. Gardeners take a bud from one plant (Fig. 108) and insert it in the stem of another of the same genus. Scions, or cuttings, are treated in the same way. The first process is *Grafting by Bud*; the second, *by Scion*.

178. **Bud-Scales** are transformed leaves, evidently provided against accident or change of temperature. They usually fall when the leaves unfold; in the Currant and Southern Buckeye they revert to the leaf-form and persist.

179. **Vernation** (*L. vernus*, belonging to spring) is the arrangement of leaves in the bud; it is sometimes called *Præfoliation*. The leaf, in regard to itself and its axis, or stem, is *Open*, *Folded*, *Rolled*.

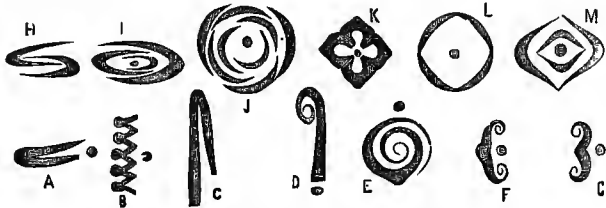


FIG. 109.—Vernation; different modes.

The **Open Leaf** is seen in the Mistletoe (Fig. 65). The **Folded Leaf** (Fig. 109) is *Conduplicate* (A) when its halves fold perpendicularly, as in the Magnolia, Oak, Cherry; *Plicate* (B) when folding like a fan, as in the Currant; *Reclinate* (C) when conduplicate and bending on the leaf-stalk, as in the Tulip-tree. The **Rolled Leaf** is *Circinate* (D), coiled downward from the top, as in the Fern; *Convolute* (E), straight, one edge coiled round the other, as in the Plum; *Involute* (F, both edges rolled inward, as in the Violet and Lotus-Lily; *Revolvute* (G), both edges rolled outward, as in the Dock and Azalea.

180. Leaves, as regards one another in vernation, are: *Equitant* (H) when conduplicate leaves bestride each other, as in the Flags and Sedges; *Half-equantant*, or *Obvolvute* (I), conduplicate bestriding one margin only, as in the Sage; *Imbricate* (*L. imbrex*, tile), open, overlapping one another, like tiles on a roof (J), as in the bud-scales of the Horse-Chestnut; *Induplicate* (K), partly folded, touching, margins turning in; *Valvate* (L, M), convex, barely touching at the neighboring margins.

181. **Leaf Arrangement** (Phyllotaxy).—Leaves, in position on the stem, are **OPPOSITE** when opposed to each other (making a pair) on the same circumferent line, as in



FIG. 110.—Woodruff (*Asperula odorata*).

the Honeysuckle (Fig.

107) and Mint; here the leaves are also *Decussate* (L. *decusso*, I cut across), each pair standing at a right angle to the pair below it. Opposite leaves are *Whorled* (*Verticillate*) when standing in threes, fours, etc., on the same circumference line, as in the Woodruff (Fig. 110) and Oleander. ALTERNATE leaves stand one above another at regular angles on different circumference lines, as in the Sweet Gale (Fig. 111), the Cherry, etc. Alternate leaves are *Fasciculate* when bundled in twos, threes, etc., as in the Pines; *Rosulate*



FIG. 111.—♂ and ♀ branches of Sweet Gale, or Candleberry Myrtle (*Myrica Gale*): a, scale of catkin; b, stamens; c, an anther.

of the circumference or circle, 360° , the second node is half-way round, 180° from the first; the third is exactly above the first, completing the circuit. This is called the $\frac{1}{2}$ cycle: 1, the numerator, names the number of cycles or circuits; 2, the denominator, names the number of nodes passed in completing it. This is also called *Distichous*, or two-ranked (Gr. *dis*, twice, *stikos*, row). In the Sedges 3 nodes are passed; this is the $\frac{1}{3}$ cycle, or *Tristichous*. In the Cherry two circuits are made and five nodes passed before the leaf (6th) stands over the first; this is the $\frac{2}{5}$ cycle, called *Quincuncial* (L. *quinque*, five). Much more intricate cycles are found in the Plantain, House-Leek, and Pine Cone.

(rose-like) when separate but closely arranged, as in the House-Leek and Fly-Trap (Fig. 112).

182. Spiral Arrangement.—All leaves have an established order of arrangement, which is uniform in plants of the same species. In the strictly *Alternate* arrangement, like that of the Lime (in which the leaves stand above one another on opposite sides of the stem), if we fix a thread to the lowest node, or leaf-bud, and wind it around the stem from node to node, we shall form a spiral like the thread of a corkscrew. Taking the first round as the expression



FIG. 112.—Fly-Trap (*Drosera rotundifolia*).

183. The Leaf is the chief organ of digestion. It is an

expansion of the bark; with two surfaces: one facing the sky, called the upper, or inner face; one facing the earth, called the under, or outer face. The line where these faces meet is the *Margin*. The Complete Leaf consists of *Blade* (lamina), *Petiole* (leaf-stalk), and *Stipule*. When the petiole is wanting the leaf is sessile; when the stipule is wanting the leaf is *exstipulate*.

184. The Blade has a frame of fibrous branches called *Ribs* or *Nerves*.

The strongest, in the centre (Fig. 74), is the *Midrib*; those branching from it are *Veins*; the smaller ones branching from the veins are *Venules* (little veins); and the whole make a net, which gives name to *net-veined* leaves. Hold a leaf between you and the light; its *venation* (veining) will be beautifully seen. (Leaf-pulp is treated of in Lessons XXXI., XXXII.)

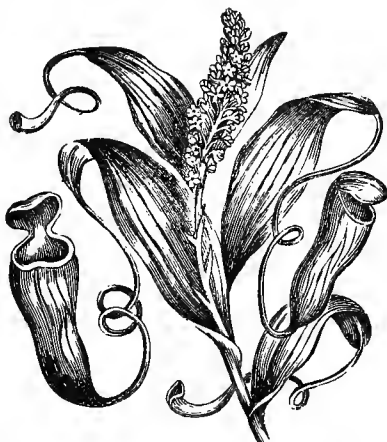


FIG. 113.—Pitcher-Plant (*Nepenthes distillatoria*).



FIG. 114.—*Sarracenia purpurea*: 1, fl., corolla removed, showing the umbrella-like stigma; a, complete fl.; b, ovary; c, section of same. Plant entire.

as soon as the insect alights the hairs

185. Transformations.—Though plants, as a rule, feed on inorganic matter, some of them have a daintier tooth, and make a dessert of insects and animal flesh; using various devices to ensnare their prey. The American Fly-Trap (Fig. 112) allures flies by exuding a sticky substance from the strong gland-bearing hairs on its *leaf-blade*; impale it, the leaf closes over it,

and the little creature is killed and digested at leisure. In the Pitcher-Plant of Asia and Australia (Fig. 113) the *Midrib* is first prolonged into a tendril, then dilated into a pitcher with a lid hinged as no human artificer could hinge it; the pitcher secretes an attractive liquor, refreshing to man as well as other animals. A species of shrimp sometimes takes possession of a low-lying pitcher, and as the plant climbs she is borne higher and higher from the ground, passing her life in this aerial lakelet. The *Nepenthes* also digests the insects which enter its pitcher. The *Sarracenia* (Fig. 114) has pitchers which are a transformation of the petiole (leaf-stalk); the lid is the blade of the leaf. This plant is also insectivorous (insect-eating); its pitchers do not distil a liquid, like the *Nepenthes*; they contain, however, a small quantity of rain or dew; they secrete an alluring substance, and, like the Fly-Trap, they have strong hairs which prevent the escape of the insect which enters them.

186. Leaves have a thousand uses.

From the thick, fleshy leaves of the Century Plant (Fig. 115) the drink called *pulque* is made. Leaves of Palm, Mallow, and other plants were the primitive writing materials as well as articles of clothing of the human race. Virgil speaks of the Sibyl who wrote her oracles on dry leaves which the winds scattered. Hence the same word is used

for the leaf of a tree and that of a book in nearly all languages. The palm-leaf is used for thatch, fans, umbrellas, sails, curtains; its strong fibre serves for the stout rope or the finest woven fabric. New Zealand flax is the leaf-fibre of a lily (*Phormium*); Manilla cordage is made from the leaf-fibre of the Banana. The flat, round leaves of the common Water-Lily (*Nymphaea*) serve as table-cloths in India; the bowl-shaped leaves of its sister, the Lotus-Lily (Fig. 79), serve as dishes; these leaves are used for one meal, and then cast aside by the cleanly Hindoos. We have but to mention salads to show how many leaves serve as food.

187. *The Petiole* is sometimes transformed into a leafy shape, called *Phyllodium* (Gr. *phyllon*, leaf, *eidos*, form), as in the Acacias. It serves as a tendril in the Clematis and other plants.

188. *The Stipule* is a transformed leaf, at the base of the true leaf, or on the petiole. Stipules are usually in pairs, one on each side of the leaf. They are *Adnate* (adherent) to the petiole in the Rose; *Free* in the Apple; *Ligulate* (*L. ligula*, shoe-latchet) in the Grasses; *Ochreate* (*L. ochrea*, hoot, greave, leggin), united, forming a leggin, in the Smartweed. They are changed to stout thorns in the Locust. They are *Caducous*, *Fugacious*, when they fall early; *Persistent* when they remain,—terms applied to all leaves, sepals, petals, etc.

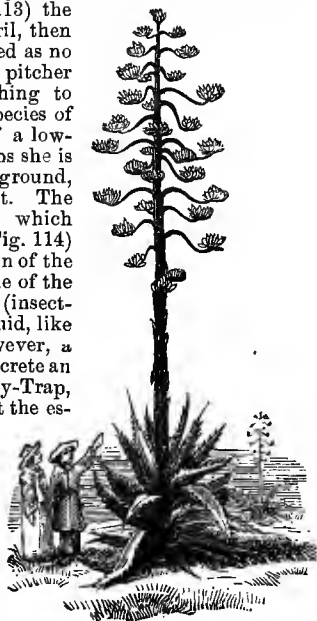


FIG. 115.—Century Plant (*Agave americana*). Monocarpic. Plant entire, in fl.

LESSON XVII.

VENATION—LEAF-FORMS—SIMPLE LEAVES.

189, 190. Venation. 191. Leaf-forms. 192. Leaf-base. 193. Leaf-apex. 194. Leaf-incisions. 195. Leaf-margins. 196. Simple leaves.

189. Venation is of three modes, as we know,—*Forked*, *Parallel*, *Netted*. *Forked* veins branch by forking simply, and do not reunite. *Parallel* veins run parallel to one another, or nearly so; they do not subdivide nor form meshes, except by very short venules. *Netted* veins (*reticulate*) branch and subdivide into veins and venules, which meet again and unite, forming a net-work. In *Aerogens* (Ferns, etc.) the veins are forked; in *Gymnogens* they are forked (Ginkgo) or parallel (Cycas); in *Endogens* they are parallel (Grasses, Banana); in *Exogens* they are netted (Bryony).

190. *Three typical forms of exogenous venation* to be carefully noted are: *Ribbed*, as in the *Gentian* (Fig. 116); *Feather-veined* (*penninerved*), as in the *Lime* (Fig. 117); *Radiate-veined* (*palmi-nerved*), as in the *Sweet-Gum* (Fig. 118). To one or another of these all other types belong, whether suppressed or developed, simple or compound. Compare *Gentian* with *Smilax* (Fig. 241); *Lime* with *Locust*; *Sweet-Gum* with *Horse-Chestnut*.



FIG. 116.—Yellow Gentian (*Gentiana lutea*): a, capsule; b, same, out transversely; c, vert. sec. of sd.

191. *Leaf-forms* result from Venation, and follow a definite law.

They are: *Acerose*, needle-shaped; Pines; *Ascidiata*, pitcher-like, pouch-like; *Nepenthes*, *Sarracenia*; *Cuneate*, wedge-shaped; leaflets of *Marsilea*; *Deltaid*, like Greek letter Δ; leaf of Poplar; *Dolabriform*, axe-shaped; *Thujoopsis*; *Elliptical*, like an ellipse; *Service leaf* and *Ebony leaf*; *Ensiform*, sword-like; *Iris*; *Falcate*, sickle-shaped; *Spotted Euphorbia*; *Fistulose*, cylindrical, hollow, and closed at the end; *Onion*; *Flabelliform*, fan-like; *Palmetto*; *Lanceolate*, lance-like; *Papaw*, *Custard-Apple*; *Linear*, *Grasses*; *Oblong*, *Hypericum*; *Orbicular*, *Nelumbium*;



FIG. 117.—European Lime or Linden (*Tilia europæa*).

Oval, broader than ovate; *Hydrangea*, *Guaianicum*; *Yellow Honeysuckle*; *Panduriform*, fiddle-shaped; *Wild Potato*; *Peltate*, shield-shaped; *Water-shield*, *Nasturtium*; *Rhomboidal*, rhomb-shaped; leaflets of *Silk-Mimosa*; *Rotund*, round in outline; *Cheese-Mallow*; *Scale-like*, *Tam-*



FIG. 118.—Sweet-Gum (*Liquidambar styraciflua*).



FIG. 119.—Tamarisk (*Tamarix gallica*).

arisk (Fig. 119); *Spatulate*, like a druggist's spatula; *Boxthorn*; *Subulate*, awl-shaped; *Juniper*; *Terete*, cylindrical and tapering; *Rush*.

192. The base of the leaf is *Amplexicaul*, stem-clasping; Aster; *Auriculate*, eared; Fraser's Magnolia; *Cordate*, heart-shaped, Morning-Glory; *Cucullate*, rolled like a hood; Common Violet; *Decurrent*, margins running down and adnate to the stem; Mullein; *Hastate*, halberd-shaped, with pointed ears turned outward; *Strawberry Blite* (Fig. 120); *Inequilateral*, one base longer than the other; Lime, Begonia; *Oblanceolate*, lanceolate, tapering at base; *Amaranth* (Fig. 121); *Obovate*, ovate, narrowed at base; Clover; *Perfoliate*, bases of margin united, so that the stem seems to grow through the leaf; Bellwort; *Perfoliate-connate*, bases of two opposite leaves *connate* (united), so that the stem seems to grow through them; Honeysuckle; *Reniform*, kidney-shaped; Wild Ginger; *Sagittate*, arrow-shaped; Weld (Fig. 122).



FIG. 120.—a, Strawberry Blite (*Blitum capitatum*); b, young fl.; c, d, same, accrescent.



FIG. 121.—Love-lies-bleeding (*Amaranthus caudatus*).

193. The Apex of the Leaf is: *Acuminate*, tapering to a point; Black Alder; *Acute*, ending in an acute angle; Choke-Cherry; *Aristate*, with a long bristle (L. *arista*) called *Awn*, as in the glume of Oats (Fig. 52); *Caudate*, tailed; Peepul-tree; *Cuspidate*, with an abrupt stiff point; Dahoon Holly; *Emarginate*, slightly incurved at the midrib; White Clover (Fig. 132) and Wig-tree (Fig. 137); *Mucronate*, ending abruptly in a short, small point; Supple-Jack; *Obcordate*; inversely cordate; Wood-Sorrel; *Obtuse*, blunt-pointed;



FIG. 122.—Dyer's Weld (*Reseda luteola*).

Magnolia glauca; *Retuse*, slightly incurved; Shamrock (Fig.

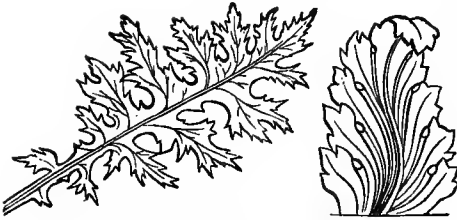


FIG. 123.—*Acanthus spinosus*; leaf natural and conventionalized.

half-way, through the blade. They are *Bifid* (2-cleft), *Trifid*, as in the Passion-flower (Fig. 155), *Quinquefid*, *Multifid*, etc., according to the number of parts into which the leaf is cut. When the partitions are regular, imitating a pinnate leaf (197), the leaf is *Pinnatifid*, as in the *Acanthus* (Fig. 123). The ornament of the Corinthian capital in architecture (second cut in Fig. 123) was suggested to the architect and sculptor Callimachus (400 B.C.) upon seeing a basket covered by a tile and overgrown with *Acanthus* leaves. When the partitions are pinnately regular and slender, the leaf is *Pectinate* (*L. pecten*, comb). The leaf is *Pedate* when its parts diverge from the base, imitating a bird's foot; *Hellebore*; *Runcinate* when the segments turn backward; *Dandelion* (Fig. 142).

Parted leaves are cleft nearly to the base or to the midrib; the terms *Bipartite*, *Tripartite*, *Multipartite*, etc., express the number of parts.

Divided leaves are cleft through to the base or to the midrib, leaving only a slight margin. When finely divided, the leaf is *Multisect*; it may then be *Pinnatisect*, as in the Chamomile, or *Palmisect*, as in the Bleeding-Heart (Fig. 124), or *Laciniate* (slashed into coarse fringes), as in the *Dentaria*.

Lobed leaves have deep, rounded incisions, as in the Black Oak, which is *sinuate-lobed* (*L. sinus*, a bay). The Southern Mossy-cup White Oak is *lyrate*; the terminal lobe larger than the others, imitating a lyre. *Bilobate*, *Trilobate*, etc., are terms expressing the number of lobes.

195. *Leaf-margins* are: *Crenate*, cut into rounded scallops; *Ground Ivy*; *Crispate*, *Crisped*, *Curled*, ruffled like a

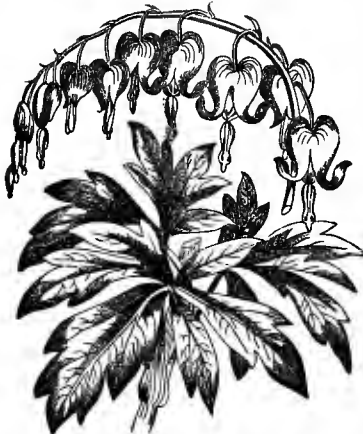


FIG. 124.—Bleeding-Heart (*Dicentra spectabilis*).

flounce; *Curled Mallow*; *Dentate*, with sharp teeth pointing out-

132); *Truncate*, square, as if cut off; *Tulip-tree*.

194. *Leaf incisions.* Leaves are *Cleft*, *Parted*, *Divided*, *Lobed*.

ward; Muscadine; *Entire*, with unbroken margin; Milkweed; *Erose*, as if gnawed by insects; Nightshade; *Incised*, with deep, irregular notches; Red Maple; *Repand*, like the margin of an open umbrella; Oxlip; *Serrate*, with sharp teeth pointing forward; Chestnut; *Sinuate*, with rounded sinuses; Black Oak; *Undulate*, wavy-margined; Garden Sorrel, Dock.

196. A *Simple Leaf* has one blade, and one petiole which is continuous with the ribs and veins; when the petiole is wanting, the leaf is sessile. The leaves described in this Lesson are simple, with the exception of Clover, Marsilea, Medicago, Mimosa, and Trefoil, which are compound, and of which the leaflets only are described here.

LESSON XVIII.

COMPOUND LEAVES—LEAF TEXTURE AND SURFACE.

197. Compound leaf. 198, 199. Pinnate leaves. 200, 201. Palmate leaves. 202. Leaf-texture. 203. Leaf-surface.

197. A *Compound Leaf* has 1, 2, 3, or many blades, each blade jointed to a common petiole. The separate blades are called *leaflets*, or *foliules* (L. *foliolus*, leaflet); the whole, with their common petiole, make a complete leaf. The leaflets, as we saw in Lesson XVII., in venation, form, etc., take the habit of simple leaves. Compound Leaves are *pinnate* and *palmate*. The pinnate leaf (Fig. 125) corresponds to the feather-veined (penni-nerved) simple leaf. The palmate leaf (Fig. 126) corresponds to the radiate-veined (palmi-nerved)

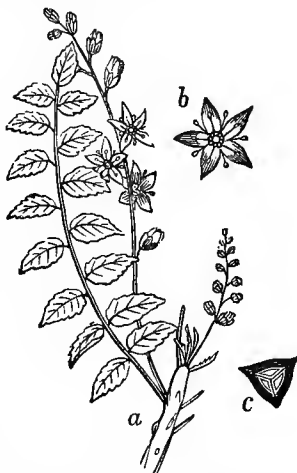


FIG. 125.—a, Frankincense-tree (*Boswellia serrata*); b, sepa. fl.; c, fr., trans. sec.

simple leaf. The part of the common petiole to which the leaflets of a pinnate leaf are attached is called the *rachis* (Gr. spine). Palmate leaves have no rachis; each leaflet is jointed to the common petiole at a common point. Sometimes in the pinnate leaf each leaflet has a petiole; this is called a *petiolule*; if it has a stipule, this is called a *stipel*.



FIG. 126.—Chaste-tree (*Vitex Agnus-Castus*), with sepa. fr.

198. *Pinnate Leaves.* The most reduced pinnate leaf is that of the Lemon (Fig. 127). Though one-leaved, it is jointed to the petiole, a character never found in the simple leaf.

199. Pinnate leaves are: *Unifoliolate*; Lemon (Fig. 127); *Bifoliolate*, *Binate*; Bignonia; *Trifoliolate*, Ternate; Dew-berry (Fig. 131); *Multifoliolate*; Wistaria, Locust; *Even-pinnate* (*pari-pinnate* when the leaflets are in pairs with no end-leaflet), Guaiacum (Fig. 128);

Odd-pinnate (*impari-pinnate*), with a leaflet at the apex; Locust, Boswellia (Fig. 125); *Interrupted-pinnate*, interrupted by small intervening leaflets; Agrimony (Fig. 129); *Bi-pinnate* when the leaves are still further compounded by branching once; Mimosa (Fig. 130); here the branches are called *pinnae* (L. *pinna*, feather); *Tri-pinnate*, when thrice-branched: the last branches called *pinnules* (L. *pinnulæ*); Venus' Maiden-hair Fern. The Mimosas furnish elegant examples of bi-pinnate forms. The Silk-flower-tree so common in Southern gardens has a leaf with 10 to 13 pairs of *pinnae* and 24 to 30



FIG. 127.—Lemon (*Citrus Limonum*).

pairs of leaflets in each pinna; the whole leaf having 1560 leaflets— 26×60 —when fully developed. The leaf of our common wild Sensitive Plants (*Schrankia*, *Aca-*



FIG. 128.—*Guaiacum officinale*.



FIG. 129.—*Agrimonia (Agrimonia Eupatoriæ)*.

cia, etc.), though not larger than a baby's hand, has from 1000 to 1500 leaflets.

200. Palmate Leaves—called also *digitate* (*L. digitus*, finger)—are so different from pinnate leaves that they are readily distinguishable, except in the trifoliolate (ternate) forms. But in these there is a distinction carefully to be noted: The ternate leaf of the pinnate form has the rachis lengthened, extending its end-leaflet beyond the two other leaflets, as in the Dew-berry (Fig. 131); the palmate form has its leaflets stalked alike, or sessile,



FIG. 130.—*Nile Mimosa (Mimosa Nilotica)*.

and jointed alike to the common petiole, as in the White Clover (Fig. 132).

201. Palmate leaves are *Trifoliolate* or *Ternate*; Dewberry, Clover; *Quadrifoliolate*, 4-leaved; *Marsileae*; *Quinate*, 5-leaved; Virginia Creeper, Chaste-tree (Fig. 126); *Septinate*, 7-leaved; Horse-Chestnut; *Biter-nate*, twice-ternate; Columbine; *Triter-nate*, thrice-ternate; Baneberry.

202. *Leaf-Texture*. Leaves in texture are *Coriaceous*, leathery; Mistletoe; *Fleshy*; Century Plant (Fig. 115); *Mem-branous*, thin, clear, showing the veins; Wild Cherry; *Pungent*, hard, with a rigid point; Dropseed Grass; *Rough*, with un-even texture; Hop; *Rugose*, wrinkled; Sage; *Scarious*, dry; Cane; *Striate*, with slender longitudinal grooves; Wild Barley; *Succulent*, juicy, pulpy; Purslane; *Sulcate*, with deep, longitudinal furrows; Worm Seed.

203. *Leaf-Surface*. Leaves in surface are *Aculeate*, prickly; Sodom Apple;



FIG. 131.—Dewberry (*Rubus cæsius*).

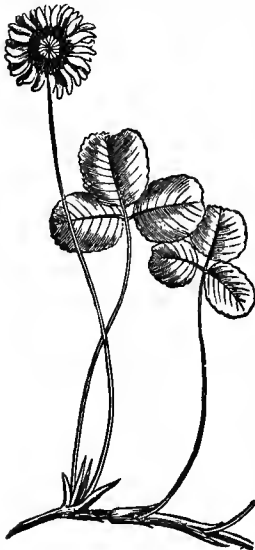


FIG. 132.—White Clover, Sham-rock (*Trifolium repens*).

Arachnoid (Gr. *arachne*, spider, cobweb); *Froelichia*; *Canescent*, grayish white; under-surface of Maple, Aspen, Linden; *Ciliate*, fine hairs on the margin; Hawkweed; *Cinereous*, cineraceous, ashen; *Cineraria*; *Downy*, with fine soft hairs; Chess Grass; *Ferruginous*, dusty; under-surface of *Magnolia grandiflora*; *Floccose*, with fleecy tufts; *Froelichia*; *Glabrous*, without hairs; white *Asclepias*; *Glandulose*, furnished with *glands*, small cells secreting a special substance which is aromatic (Orange, Lemon) or poisonous (Nettle); *Glaucous*, with white bloom; Ground Ivy; *Hairy*, with coarse hair; Horse-wced; *Hirsute*, with scattered hairs; *Arnica*; *Hispid*, covered with long, stiff hairs; Nettle; *Hoary*, frosted; Hoar-hound; *Incanus*, glittering white; Abele Poplar; *Lanuginous*, woolly; Cinnamon Fern; *Lepidote*, scaly; Oil-nut, Oleaster; *Pilose*, with soft, slender hairs; Crab Grass; *Pruinous*, frosted with blue waxy powder; Cabbage; *Puberulent*, down scarcely visible; Spindle-tree; *Pubescent*, with soft hairs, like the down on a boy's chin; Carolina Clematis; *Pulverulent*,

dusted with fine powder; Eucalyptus; *Punctate*, sprinkled with clear dots or glands; Orange, Myrtle; *Ramentaceous*, with chip-like scales; Polypodium; *Scabrous*, with small, hard projections; Fig; *Sericeous*, with silky hairs; Mouse-ear; *Setaceous*, bristly; Dog's Bent; *Setous*, with stiff bristles; Borage; *Shining*, lustrous; *Magnolia glauca*; *Spinous*, with strong spines; Horse-Nettle; *Smooth*, with even surface; Chestnut; *Strigous*, with stiff hairs; *Verbena strigosa*; *Tomentose*, felt-like; Mullein, Edelweiss; *Velutinous*, velvety; Velvet-leaf Mallow; *Vernicose*, varnished; Copal Sumach; *Villose*, with shaggy, soft hairs; Italian Honeysuckle; *Viscous*, viscid, secreting a tenacious, ropy substance; Catchfly.

LESSON XIX.

ÆSTIVATION—INFLORESCENCE.

204–207. Æstivation. 208, 209. Inflorescence. 210. *Indefinite Inflorescence*: 211. Catkin, Ament; 212. Cone; 213. Galbule; 214. Spadix; 215. Spike; 216. Ear; 217. Raceme; 218. Panicle; 219. Thyrsus; 220. Corymb; 221. Umbel.

204. Æstivation (*L. æstivus*, belonging to summer) is the arrangement of flowers in the bud,—sometimes called *Præfloration*.

The flower-bud, like the leaf-bud, represents a stem; the torus is the stem; the bracts, sepals, petals, stamens, and pistils are leaves variously transformed. Each lobe (division, fold) of a monosepalous calyx and monopetalous corolla also represents a leaf. Usually the nodes are so close together that the stem-like character of the torus is lost; but in the *Magnolias* (Fig. 133) it is superbly illustrated.

205. It is not uncommon to see a proliferous rose,—developing a stem from the centre of its torus; often, too, flower-buds in the axils of its petals. Stamens transformed to petals make double flowers,—Roses, Hollyhocks, etc.; the Green Rose has all its parts changed to sepals; in the Alpine Strawberry each part, even including the ovule, reverts to the leaf form.

206. In the flower-bud we have bracts, sepals, petals, stamens, pistils, ovules, each representing a certain sort of leaf in the same bud; and each set of these must be considered not only in respect to itself and the torus, but also to the other sets. Therefore, though the terms

used in æstivation are nearly the same as in venation, there are these exceptions: We say of the parts of each set—sepal, petal, or lobe—that it is

Convolute when it envelops all beneath it; petals of *Magnolia*, *Camellia*;

Contorted (twisted) when one edge overlaps the next beneath it; petals of *Mallow* (Fig. 134), lobes of *Morning-Glory*;

Reduplicate when valvate and doubled back; sepals of *Mallow* (Fig. 134);

Supervolute when plicate lobes overlap in a contorted manner; *Datura*, *James-town-weed*;

Vexillary (L. *vexillum*, banner) when one petal, much larger than the others, is spread over them like a banner, enclosing them; *Pea*, *Wistaria*, etc.

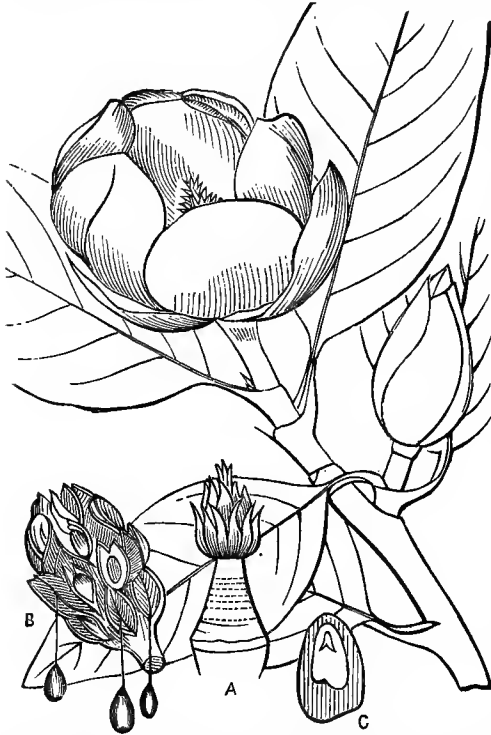


FIG. 133.—*Magnolia glauca*. A, torus, showing spirals of scars left by the fallen stamens; pistils in spirals on its apex. B, ripe cone, with sds. hanging by cobwebby white threads. C, seed cut open, showing small embryo, large perisperm, large red aril enveloping sd.

207. Different æstivation in sepals and petals of the same flower is quite frequent, as in the *Mallow* (Fig. 134).

208. **Inflorescence**, or Flower-arrangement, relates not only to the flowers on the stem of the plant, but also on the flower-stalk. Flower-buds, like leaf-buds in regard to the stem, are Axillary (*Pea*, *Wistaria*); Terminal (*Oleander*); Latent; and Adventitious (Fig. 135). One difference must be noted, however: The terminal and axillary leaf-buds continue to grow year by year, developing into stems and branches; the flower-bud has nothing to do with this vegetative stem-growth; its sole function is to perform the work of reproduction;

when this is accomplished the flower-stalk dies, and the point of the stem which bore it ceases forever to grow. The flower then, in its special work, is independent of the plant, whilst every part of the plant is subservient to the flower. Examine the Pea plant in bloom (axillary), the Oleander, or the Elder (terminal). Adventitious inflorescence—like that of the Chocolate-tree—is rare. Latent buds are common; they usually appear in the bract-axils.

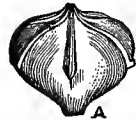
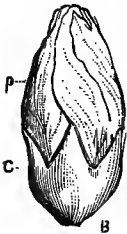


FIG. 134. — A, calyx of Mallow (*Malva Aacea*); B, corolla.

209. *Inflorescence* especially relates to the position and behavior of clustered flowers in regard to the peduncle. When a flower stands alone on its peduncle, like the Butterwort (Fig. 88) and Violet, it is *solitary*; when flowers are clustered on a *common peduncle*, as in the Plantain (Fig. 136), they form what is technically called an *Inflorescence*. The upper part of the common peduncle, on which the flowers grow, is

the *rachis*; when the lower part is wanting, the inflorescence is sessile. In acaulescent plants, like



FIG. 135.—Chocolate-tree (*Theobroma Cacao*).

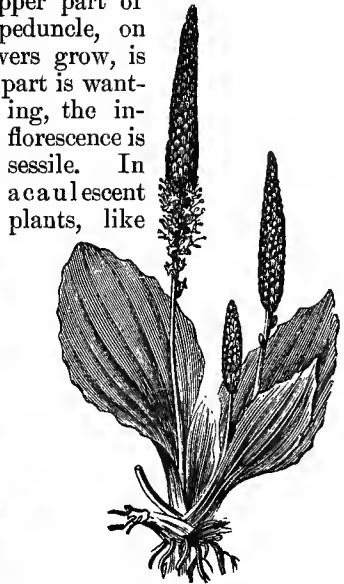


FIG. 136.—Common Plantain (*Plantago major*); entire; in fl.

the Butterwort and Plantain, the common peduncle is

called a *Scape* (L. stalk). In an inflorescence, when each individual flower has a separate peduncle, this separate peduncle is called a *Pedicel*. When a pedicel has a bract, this bract is called a *Bracteole*. Bracts around a solitary flower, or around an inflorescence, form an *Involucre*; when around a single flower in a cluster (Teasel, Fig. 105), or around a secondary cluster (Parsley, Fig. 139), they form an *Involucel*. The calyx-like involucre around the flower in the Mallow, the Cotton (Fig. 10), and Pink is called a *Calyculus*. Bracts and their derivatives (involucre, spatha, etc.) are often showy and flower-like.



FIG. 137.—Wig-tree (*Rhus Cotinus*); anomalous pedicel; fl., fr.

In the Cock's-comb the anomalous peduncle, enlarged, simulates a crest. In the Venetian Sumach, as it is called (its close cousin is in Alabama), the anomalous pedicels (Fig. 137) are the most conspicuous part of the inflorescence, and give the tree its various common names,—Wig-tree, Smoke-tree, Mist-tree. The French call it *Arbre aux perruques*—Powdered-wig-tree. Few of its flowers are perfect; the pedicels lengthen, branch, and become finely feathered, giving the large panicles a light, fleecy look.



FIG. 138.—Lily of the Valley (*Convallaria majalis*); lvs. and fls.

210. Indefinite Inflorescence. Flowers in their growth on the peduncle have the same habits as in their growth on

the stem. When axillary, those farthest from the apex

open first, as in the Plantain (Fig. 136), and the peduncle continues to grow *indefinitely* until its strength is exhausted. Indefinite inflorescence is expressed in the Ament or Catkin; Cone; Corymb; Galbule; Head; Panicle; *Raceme*; Spadix; Spike; Thyrsus (given alphabetically to assist the memory). Indefinite inflorescence is called *racemose*, because the raceme is one of its best illustrations. In development these various types rank as follows:



FIG. 139.—1. Umbel of Fool's Parsley (*Aethusa cynapium*). 2. Lf. and umb. of common Parsley (*Petroselinum sativum*); a, umbellet of Fool's Parsley; b, fr. of common Parsley; c, fl. of same.

211. Ament or Catkin. Rachis slender, lengthened; flowers unisexual; sessile, or on very short pedicels; with or without scales or bracts; deciduous when mature. Oak, Walnut (Fig. 67), Willow, Birch (Fig. 69).

212. Cone (Strobile, Strobilum). A catkin with large, thick scales, which become woody; each scale producing one, two, or more pistillate flowers, which are naked ovules. It characterizes the Pines, Firs, etc., in Gymnospermæ, which are called *Coniferæ*, or Cone-bearers (Fig. 46).

213. Galbule. A short cone with fleshy or woody scales, usually indehiscent. Cypress (Fig. 45).

214. Spadix. Rachis thick, lengthened; flowers unisexual, sessile, or nearly so, apetalous or petalous; spadix usually with a large enveloping bract, called a *Spatha*. Arum, Palm. In the Palm the spadix has many branches; it is called a *Regime* (Fr.).

215. Spike. Rachis usually slender, lengthened; flowers sessile, or nearly so, apetalous or petalous, unisexual or

bisexual. Wheat, Tuberose, Banana (Fig. 60), Plantain (Fig. 136). The Hop has a *strobiloid* (cone-like) spike.

216. In the Grasses the spike is called an *Ear*; the "ears of corn" in Holy Scripture are spikes of Wheat, Rye, etc.; they are still called ears—all the small grains are called corn—by all English-speaking peoples except those of the United States, who restrict these terms to the Indian Corn: When the spikes branch, the branches are called *Spikelets* (Figs. 51, 52).

217. **Raceme.** Rachis slender, lengthened; flowers petalous, bisexual, with pedicels of nearly equal length. Currant, Wistaria, Willow-Herb (Fig. 75). When the flowers are all turned towards one side, the raceme is *secund*, as in the Lily of the Valley (Fig. 138). When the pedicels branch slightly, the raceme is compound, as in Mignonette.

218. *Panicle.* A raceme (or a spike) with many branching pedicels of varying lengths. Oats (Fig. 51), Rice, Agave, Sumach.

219. *Thyrsus.* A compact ovoid (egg-shaped) panicle, with the apex of its rachis slightly reduced. Vine (Fig. 101).

220. *Indefinite or racemose Corymb.* A raceme with the apex of its rachis reduced so that the lowest pedicels are longest, giving the inflorescence a rounded top. St. Lucia's Cherry. When the pedicels branch, the corymb is compound. *Spiræa corymbosa*.

221. *Umbel.* Rachis reduced to a flat or rounded surface at the apex of the common peduncle; all the pedicels—which are nearly of equal length—spring from this surface, like the sticks or ribs of an umbrella, whence the Latin name *umbella*. Flowering Rush (Fig. 58). When the pedicels branch and bear other umbels, these secondary clusters are called *Umbellets* (Fig. 139).

LESSON XX.

INFLORESCENCE FINISHED.

222. Head; Bread-fruit, Fig. 223. Composite heads. 224. Leguminous heads. 225. Reduction, development. 226. *Definite Inflorescence*: 227. Cyme; 228. Euphorbia; 229. Fascicle; 230. Glomerule; 231. Verticillaster; 232. Stone-crop; 233. Mixed inflorescence.



FIG. 140.—Fig (*Ficus Carica*): a, b, ♂ fls.; c, d, ♀ fls.; a and c X.

222. **Indefinite Inflorescence** continued. The reduction of the rachis has led us to the *Head*: here the rachis is suppressed in length, but dilated in breadth, and bears sessile flowers, which may be unisexual, bisexual, polygamous. In the Bread-fruit (Fig. 213) and Bois d'arc the head contains female flowers only; they are seated on a globose *receptacle* (the rachis dilated); and their calyces become *acrescent* (increasing in size) and fleshy, making the Bread-fruit of the one, the Osage Orange of the other. In the Fig (Fig. 140) we see the Bois d'arc Orange reversed; here the receptacle is fleshy, hollow, and lined with *diclinous* (unisexual) flowers,

both sexes in the same head. The *Dorstenia* (Fig. 141) is, as it were, a fig laid open; its receptacle is broad, flat, with both sexes embedded in its surface.

223. **Composite Heads** characterize and give name (*Composite*) to the Sunflower Order. Each head, though simulating a single flower, is composed of many flowers, called *florets*. Each floret has its

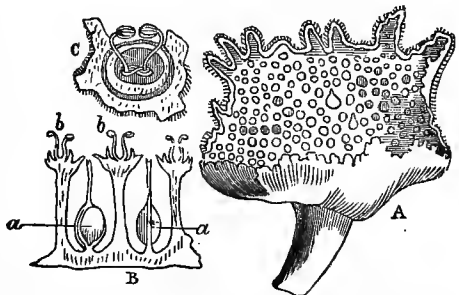


FIG. 141.—A, receptacle of *Dorstenia Contrayerva*. B, section of same X: a, ♀ fls.; b, ♂ fls. C, ♂ fl. still more X.

Each floret has its

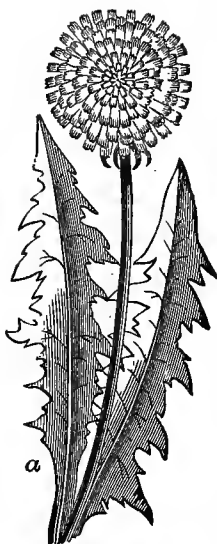


FIG. 142.—*a*, Dandelion (*Taraxacum Dens-leonis*); *b*, fr.

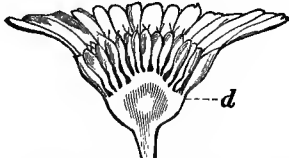


FIG. 143.—Section of Garden Marigold (*Calendula officinalis*); *d*, disk.

head; and developed, on the other hand, into compound raceme, panicle, and thyrsum.

own proper calyx, which is often *pappose* (Gr. *pappa*, grandfather); that is, it has, instead of sepals, long, silky hairs, called *pappus*, and resembling an old man's beard; as in the Dandelion (Fig. 142), in which the calyx, after flowering, lengthens and ripens into a long beak, which is tipped with the persistent pappus. The composite receptacle, sometimes flat, sometimes cone-shaped, is also called a disk (but it must be carefully distinguished from the true disk of single flowers, as seen in the Discifloræ). The bracts of the involuere resemble sepals, but they are quite distinct from sepals. In the Marigold (Fig. 143) the central florets (florets of the disk, as they are called) are tubular; those at the circumference are *ligulate* (strap-shaped); and because they diverge like sun-rays, they are called *ray-florets*. In the Dandelion (Fig. 142) all the florets are ligulate. In the Thistle, Edelweiss, and Artichoke (Fig. 214) all the florets are tubular.

224. In the Pea Order we find the Mimosa (Fig. 130) and the Clover (Fig. 132). In the Clover the rachis often lengthens in growing, so that the head becomes a spike.

225. Taking the raceme as a model, the types are reduced on the one hand through umbel and spike to



FIG. 144.—Harebell (*Campanula rotundifolia*); terminal flower withered.

226. **Definite Inflorescence (Cymose).** Here the flower

at the apex (that is, the centre of the cluster) unfolds first; and thus arresting growth in that direction, it *defines* the further development of the inflorescence. Its simplest expressions are the *Cyme*, *Fascicle*, *Glomerule*, *Verticillaster*.

227. Cyme. Flowers with pedicels on a rachis, the pedicels reaching a nearly level height, as in the racemose corymb. When the plant has alternate leaves, as in the Harebell (Fig. 144), the cyme may develop into a cymose raceme or cymose panicle; when the leaves are opposite, as in the *Wrightia* (Fig. 145), *Euphorbia* (Fig. 146), and *Privet*, or whorled, as in the



FIG. 145.—*Wrightia tinctoria*.

Oleander, the cyme may become a

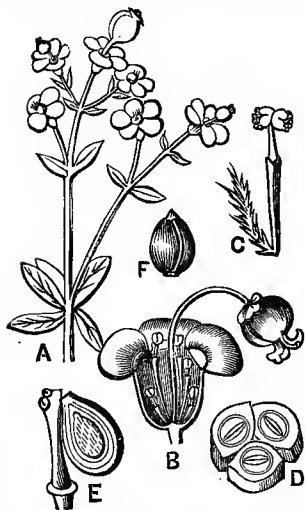


FIG. 146.—A, *Euphorbia corollata*. B, section of involucre; ♀ fl. in the centre, ♂ fls. around it. C, ♂ fl., with bract. D, section of fr. E, ♂ fl., with bract. F, sd.



FIG. 147.—a, Coffee (*Coffea arabica*); b, berry, trans. sec.

Compound Cyme (*Wrightia*, *Oleander*, *Elder*), or a Cymose Panicle

(Privet). In all these cases the terminal or central flower of each secondary axis (branch) opens first. Cymose umbels and true or Cymose corymbs have the same character. When but one side of the rachis is developed, the cyme is *Scorpioid*, or Scorpion-like; Fly-trap (Fig. 112).

228. The Euphorbia inflorescence is very interesting. Each apparently single flower is really a cyme. The white, corolla-like part is an involucrel (Fig. 146, B); the cyme which it encloses consists of a central female flower reduced to a pedicelled ovary; this is surrounded by male flowers, each one of which (C) is reduced to a pedicelled stamen with a bract.

229. Fascicle. Cymes with short, erect, nearly equal pedicels, closely clustered; Sweet-William.

230. Glomerule. More compact than the fascicle; flowers nearly sessile; White Bee-Balm.

231. Verticillaster. Short fascicles in the axils of opposite leaves, forming an apparent verticil or whorl around the stem; Thyme, Coffee (Fig. 147).

232. The reduction is carried still farther; the *Cymose Spike* (or *spicate cyme*) is seen in the Stone-crops; with sessile, or nearly sessile, flowers on spikes branching from a common centre; the inflorescence here (usually with 5 flat spikes or branches) resembles a star; Kentucky Rock-moss (*Sedum pulchellum*, *S. ternatum*).

233. Mixed Inflorescence includes both the Definite and Indefinite Modes. In the Thyme and Coffee (Fig. 147) the general inflorescence (on the stem) is indefinite, whilst the special inflorescence (in the fascicles) is definite. In the Sunflower Order the general inflorescence is definite, the special inflorescence (head) is indefinite.

LESSON XXI.

THE FLOWER.

234. The typical flower. 235. Radical numbers. 236. Deviations. 237. Mimicries: Dancing-Girls. 238. Orchids. 239. Passion-flower. 240. Common Names. 241. Fruit-mimicries. 242. Floral colors.

234. The Typical Flower—exhibiting the highest type of differentiation, development, and symmetry—is ele-

gantly exemplified in the Stone-crop Order (Fig. 82, b), in which are the Red and White Sedums (*S. pulchellum*, *ternatum*) of the Southern States. Here the flower has all the requisite characteristics :

It is *Perfect*, with both stamens and pistils; *Complete*, with pistils, stamens, corolla, calyx; *Regular*, with the parts in each whorl similar to one another; *Symmetrical*, with the same number of parts in each whorl. Its like parts are *Distinct*,—that is, separate from one another; they are *Free*, the parts of each whorl separate from the whorl next to it; *Alternate*, the parts of each whorl alternating with the parts of the whorl next to it.

This Order presents the typical flower in the three ruling numbers. In the



FIG. 148.—Houseleek (*Sempervivum tectorum*).

Houseleek (Fig. 148) the parts are usually 12 (a multiple of 3), sometimes 20 (a multiple of 5); in the Sedums the central flower of the cyme is quinary, the rest of the inflorescence is *quaternary* (4, a multiple of 2).



FIG. 149.—Gutta Percha (*Isonandra Gulla*): 1, fl.; 2, pistil; 4, trans. sec. of ovary; 5, vert. sec.; 6, trans. sec. of fr.; 7, unripe fr.; 8, anther.

235. Radical Numbers. Taking the Greek numerals *Monos* (1), *Dis* (2, twice), *Treis* (3), *Tettares* (4), *Pente* (5), *Hex* (6), *Hepta* (7), *Okto* (8), *Ennea* (9), *Deka* (10), and adding to each another Greek word, *meros* (part), we have the following vocabulary of floral parts: *Monomerous* (1-merous); *Hippuris*; *Dimerous* (2-merous); *Circæa*; *Trimerous* (3-merous); typical number of *Endogens*; *Tetramerous* (4-merous), a multiple of 2; *Heath*, *Fuchsia*; *Pentamerous* (5-merous); typical number of *Exogens*; *Hexamerous* (6-merous), a multiple of 3; *Gutta Percha* (Fig. 149);

Heptamerous (7-merous); *Trientalis*; *Octamerous* (8-merous), a multiple of 2; *Clusia*; *Persimmon*; *Enneamerous* (9-merous), a multiple of 3; *Sassafras*; *Decamerous* (10-merous), a multiple of 5; *Pokeweed*. In most of these, however, some one or other of the floral whorls is deficient in the radical number.

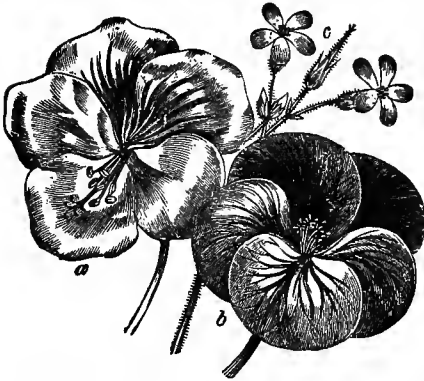


FIG. 150.—a, *Pelargonium cordatum*. b, *Pelargonium tricolor*. c, *Geranium Robertianum*.

236. *Deviations from the perfect type give us:*

a. *Deficiencies, Suppression, parts wanting* (*Apetalæ*);
b. *Cohesion, Con-*

nation, union of like parts (*Monopetalæ*);

c. *Consolidation* (*Adhesion, Adnation*), union of unlike parts (*Ovary adherent to calyx or perianth*);

d. *Irregular development*, like parts different, as the petals of the *Violet* and *Geranium* (Fig. 150);

e. *Unsymmetrical development*, parts of the several whorls different in number, as in the *Mustard Family* (Fig. 162), in which there are four petals and six stamens;

f. *Appendages*, like the *Corona* (crown) of the *Narcissus* and *Passion-flower* (Fig. 155), and the spur of the *Orchis* (Fig. 152).

g. *Transformations*, in which one part is changed to another, as in the *Canna* and *Ginger* (Fig. 151), in

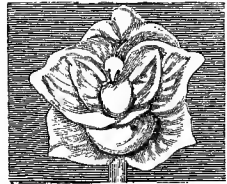


FIG. 151.—Ginger (*Zingiber officinale*): a, fl.; b, anther.

which all the stamens except one are changed to petals, and the pistil even is petaloid.



FIG. 152.—*Orchis Morio*; a, fl. separate.



A



B

FIG. 153.—A, Dove Orchis (*Peristeria elata*). B, Swan Orchis (*Cynoches ventricosum*).

237. Mimicries. In the Banana and Orchis Orders we find all the deviations; giving rise to forms so varied and singular one might suppose Mother Nature has a relish not only for the beautiful, but also for the comic and grotesque. In the Ginger division of the Banana Order we find the *Mantisia*, so called from the resemblance its one dilated anther bears to the insect Mantis (familiarily called Devil's-horse, and Preacher); the specific name *saltatoria* (dancing) comes from the resemblance the petals bear to a ballet-dancer; hence the common English name *Dancing-Girls*. The lovely Butterfly-Lily (*Hedychium*) belongs here also.

238. The Orchids are still further illustrative of the deviations. Here the pistil is reduced to a stigmatic surface; the anthers are mere pollen-masses (Fig. 152); the andrœcium and style are united into a Column, called *Gynostem* (*gynostemium*); the middle one of the three petals is transformed into a Lip, called *Labellum*. The parts thus altered



FIG. 154.—Columbine. (*Aquilegia vulgaris*).

and disposed take myriad forms,—now become a dove, now a swan (Fig. 153), now a butterfly or a spider. Here, too, are real Dancers; the *Bolbophyllum* and *Compartmentia* not only resemble dancers, like the Mantisia, but these comic little imps caper about on their stalks evidently as much to their own delight as to that of the human spectator who chances to stroll into their sylvan ball-room.

239. The *Ranunculus* gets its English names, Buttercup from the flower, Crow-foot from the leaf. The *Columbine* (Fig. 154) is so called because it resembles a flock of five doves with wings partly



* FIG. 155.—A, May-pop, Passion-flower (*Passiflora incarnata*) : *s*, sepals; *p*, petals; *f*, corona; *st*, tube made by 5 united filaments of the stamens; *a*, *a*, *a*, *a*, their upper parts free, tipped each with a hammer-like anther; *o*, ovary; *b*, *b*, *b*, 3 styles. B, branch of same, with leaf, tendril, flower-bud; *i*, involucre of flower-bud. C, fruit; *i*, involucre; *c*, part of calyx. Reduced; nat. fl. 3' in diam.; lf. 4½' in diam.; fr. 2½' long.

folded; its botanical name *Aquilegia* (L. *aquila*, eagle) comes from the same resemblance. The Mexican Hand-flower, sacred with the natives,

* The unpretentious pen-and-ink sketches with the signature A. C. K. throughout this volume are original portraits by the author, who claims for them nothing more than botanical accuracy.

is so called because its andrœcium resembles a hand with long, pointed finger-nails.

240. *The Passion-flowers* get their botanical as well as their common name from the fancied resemblance the various organs bear to the implements of Christ's Passion (Fig. 155). The 3-lobed leaf is a symbol of the Trinity, of which Christ is the Central Person; the tendrils are the cords with which He was bound; the five horned sepals (A, s) are the crown of thorns; the five lavender-colored petals (A, p) are the purple robe; the stipe or stalk on which the ovary (o) is raised, and which passes through the staminal tube (A, st), is the pillar at which He was scourged; the five free upper parts of the stamens, with their large anthers (a), are the hammers which drove the nails that transfixed Him to the cross; the three stigmas (b) are the nails; the ovary (o) is the sponge; the lovely corona of fringe-like threads (f) is the crown of glory with which Christian art encircles His head. The stipe of the ovary persists in the ripe fruit as a short stalk arising from the cup of the calyx (Fig. 155, C, c).

241. Often the fruit takes part in this mimic show. The woody pods of the great *Monkey-pot-trees* of South America resemble iron pots with lids (Fig. 156); the lid is formed by the disk; the star-shaped ornament on its top is the sessile stigma. The greatest skill and patience are necessary to detach this lid. Monkeys particularly like the creamy nuts inside; they remove the lids with admirable dexterity, yet with a sort of patient impatience which is extremely amusing. The *Cannon-ball-trees*, in the same Order (which includes the *Brazil-nut- and Cream-nut-trees*), get this common name not only from the large, heavy pot, but from the noise it makes when it falls,—from a height of 80 to 150 feet,—bursting with an explosion like that of artillery. The *Monkey-pots* serve various purposes as household utensils,—soup-pots, tureens, vases, work-boxes, etc.

Job's-Tears, *Hedgehog*, *Shepherd's-Purse*, are familiar names suggested by other mimics in the fruits. The *Hazel-nut* gets its name

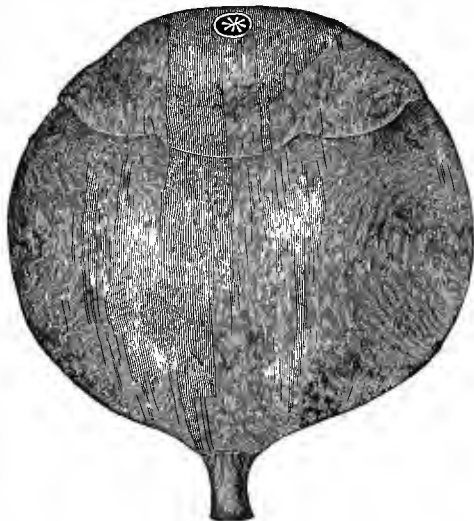


FIG. 156.—Monkey-pot (*Lecythis ollaria*).

from the Anglo-Saxon *Hæsil*, a head-dress, on account of its turban-like cupule.

242. Floral Colors.—Flower-Families almost invariably wear one or the other of the primary colors *yellow* and *blue*; their tints have one or the other of these colors as a base, leading to the third primary color *red*, thence to *white*, which is the absence of color. De Candolle classed the floral colors in two groups: *Xanthic* (Gr. *xanthos*, yellow) and *Cyanic* (Gr. *kuanos*, blue). Each group begins with green (which results from the union of yellow and blue) and ends with red, as follows:

	Green.	
Yellow-green.		Blue-green.
Yellow.		Blue.
Yellow-orange.		Blue-violet.
Orange.		Violet.
Orange-red.		Violet-red.
	Red.	

LESSON XXII.

CALYX—COROLLA.

243. Flower-forms. 244. Monopetalæ. 245. Labiatae. 246. Polypetalæ. 247. Papilionaceæ. 248. Forms of sepals and petals. 249. Nectaries. 250. Neutral flowers. 251. Texture, persistence.

243. Flower-Forms.—In a monopetalous corolla and a monosepalous calyx the lower part is the Tube, the upper part the *Limb*, or Border; the part between these two is the *Throat*. In a polypetalous corolla the upper part of each petal is the Limb; the lower part, when prolonged and narrow, as in the Pink and Wall-flower, is the *Claw*, or *Unguis* (L. claw).

244. *The monopetalous corolla and monosepalous calyx are Calcarate (Spurred) when prolonged into hollow projections, like spurs; corolla of Pinguicula, calyx and corolla of Larkspur; Calyptrate, Calyptriform, when the upper part of the calyx does not open at top, but remains closed and pointed, like the calyptra of the Mosses; in the*

Eucalyptus this upper part separates from the lower part, which is adherent to the ovary (Fig. 157); in the *Escholtzia* the whole of the free calyptra comes off, like the extinguisher of a candle; *Calceolate*, one lobe, slipper-like; *Calceolaria*, *Moccasin Orchis*; *Campanulate*, bell-shaped; corolla of *Harebell*; *Cleft*, *Lobed*, divisions extending not more than half-way; *Egg-plant* (Fig. 158); *Cyathiform*, wineglass-shaped; *Kalmia*; *Digitaliform*, fingered, like a glove; *Foxglove*; *Entire*, with an even border; *Morning-Glory*; *Gibbous*, swollen or inflated more in one part than another; tube of *Petunia*; *Hypocrateriform*, salver-shaped, with flat, spreading border; *Phlox*, *Cypress*, *Morning-Glory*; *Inflated*, *Tumid*; corolla tube of *Tobacco*; *Infundibuliform*, funnel-shaped; tube of *Morning-Glory*; *Labiate*, lipped, like the mouth of some animal; *Broom-rape* (Fig. 159); *Ligulate*, strap-shaped; ray-florets of *Chamomile*; *Parted*, divided nearly to base; corolla of *Fringe-tree*; *Pappose*, consisting of beards or hairs; calyx of *Dandelion*; *Rotate*, wheel-shaped; corolla of *Irish Potato*; *Tubular*, disk-florets of *Sunflower*; *Urceolate*, pitcher-shaped; *Whortleberry*, *Heath*; *Ventricose*, more than gibbous.

245. Labiatae.—The Labiate form is so persistent throughout the *Sage Family* (Fig. 160) that it gives name to the Order. The corolla is *Galeate*, or helmeted, when one lip curves like a helmet (*L. galea*); *Personate*, or masked, when the throat is closed by a protuberance of the lower lip (which is the *Palate*); *Snap-dragon* (Fig. 161); *Ringent*, grinning, when the two lips are wide open; *Saccate*, lower part sac-like; *Snap-dragon*.

246. Polypetalous flowers often have a monosepalous calyx. The terms here used, then, refer only to the corolla. This is *Caryophyllaceous*, or pink-like, when there are five clawed petals, the claws enclosed in a tubular calyx, the limbs free, as in the *Pink*, *Catch-fly*, etc.; *Cruciform*, cross-shaped, with four clawed petals, the four limbs making a Greek cross, as in the *Mustard*

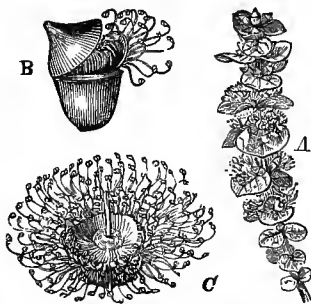


FIG. 157.—A, *Eucalyptus pulverulenta*. B, single fl. C, fl. fully opened.



FIG. 158.—Egg-plant (*Solanum melongena*).

Family (Fig. 162). This invariable character gives the name *Cruciferae*—Cross-bearers—to the Order.

247. *Papilionaceae* flowers are so called because they resemble a butterfly (*L. papilio*). They characterize the main divisions of the *Pea Family* (Fig. 163). Other resemblances, however, give the parts of the corolla their botanical names. The large upper petal (*c*) is the *Vexillum* (*L.* banner, standard); the two side petals, next to this, are the *Alae* (*L.* wings); the two smallest and middle petals, partly united and curved (*d*) form the *Carina* (*L.* keel), which encloses the pistil and



FIG. 159.—*a*, Broom-rape (*Orobanchis rubra*); *b*, base of stem; *c*, corolla laid open; *d*, middle lobe of lower lip, mag., showing fringe of glandular hairs; *e*, fr.



FIG. 160.—Germander, Wood-sage (*Teucrium Scorodonia*): *a*, corolla; *b*, calyx, with pistil.



FIG. 161.—Snap-dragon (*Antirrhinum majus*); separate fr.

stamens. Instead of a butterfly, then, we have a royal barge, in

which the pistil-queen and her stamen-courtiers are seated, with winged sails on either side and a banner floating above them.

248. *Separate Petals and Sepals* are usually described in the terms applied to the corolla; they are calcarate, saccate, etc. In the Columbine and Dutchman's Breeches the petals are *Cucullate*, or hooded. In some of the Pinks they are *Fimbriate*, or fringed; here, too, they are *Unguiculate*, or clawed. In the *Balsams* (Fig. 164) one sepal is prolonged into a spur.

249. *Nectaries* are glan-

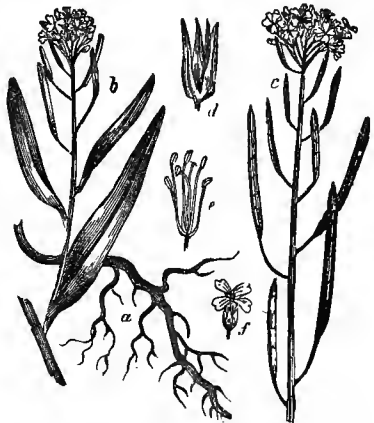


FIG. 162.—Treacle-Mustard (*Erysimum cheiranthoides*): a, rt.; b, inflorescence; c, same, with fr.; d, calyx; e, floral organs; f, fl.



FIG. 163.—a, Bird's-foot Trefoil, or Lotus-pea (*Lotus corniculatus*); b, calyx; c, vexillum; d, carina; e, style; f, g, stamens.

dular enlargements or appendages in which the sweets of most honey-bearing flowers are secreted. The term was formerly applied to the spurs of flowers like the Violet, Balsam, etc., because they contain these glands; but it is now restricted to the glands themselves. Nectaries are usually developed from the torus, but often from any other part of the flower. When on the corolla, they are generally at the base of the petals, on their inner face; sometimes sessile, as in the Crown Imperial; sometimes on stalked hairs, making a lovely fringe, as in the Broom-rape (Fig. 159, d). Very often the nectary is only a glandulose couch, as in the spur of the Columbine petal.

250. *Neutral flowers* are really only floral envelopes; they are without reproductive organs. They are seen in the cultivated Hydrangea



FIG. 164.—a, Balsam, Touch-me-not (*Impatiens Noli-me-tangere*); b, pod; c, same, open.

and the Guelder Rose, or Snow-Ball. In the Wild Hydrangea the central flowers of the cyme are perfect, but small and inconspicuous; the outer flowers (called *radiant*) are large, white, showy, but neutral.

251. *Texture and Persistence*.—The texture of sepals and petals is described in the terms used for leaves. In persistence they are *Accrescent* when they grow after flowering and persist with the fruit, of which they often form a part; Bois d'arc, Breadfruit, Ground-Cherry calyx; *Caducous*, *Fugacious*, when they fall early; petals of Sweetbrier; *Ephemeral*, enduring but a day; Poppy; *Marcrescent*, when they wither, but persist with the fruit; calyx of Hollyhock.

LESSON XXIII.

THE MAN'S HOUSE (ANDRŒCIUM).

252. Number of Stamens. 253. Position in regard to Calyx and Corolla. 254, 255. Position in regard to one another. 256. Position in regard to the gynœcium. 257. The three modes of insertion. 258. Gynandrous flowers. 259. Dynamic stamens. 260. Filament. 261. Anther: 262. Its attachment; 263. Its facing; 264. Its cells or lobes; 265. Its forms; 266. Appendages. 267. Dehiscence. 268, 269. Pollinia. 270. Formation of Pollen. 271. Pollen-grains.

252. *Number of Stamens*.—Taking the Greek numerals already given (235) and prefixing them severally to the Greek *andros* (man,

stamen), we have the terms *Monandria*, *monandrous*, *Diandria*, *diandrous*, etc., up to *Decandria*, *decandrous*, to represent the number of stamens in the andrœcium. When there are more than ten, the andrœcium is *Polyandrous* (Gr. *polus*, many), and the stamens are Indefinite (111). When their number is equal to that of the corolla-lobes, as in the Primrose (Fig. 5), or to the petals in a polypetalous flower, as in the Sedum, the flower is *Isostemonous* (Gr. equal-stamened). When their number is less or greater than the number of the corolla-parts, the flower is *Anisostemonous*,—unequal-stamened.

253. Position in regard to Calyx and Corolla.—

When adherent to the sepals, as in the *Banksia* (Fig. 165), the stamens are *Episepalous*; when adherent to the corolla, as in the Primrose (Fig. 5), they are *Epipetalous*. They are usually *Alternate* with the lobes or petals, as in the Sedum; but sometimes *Opposite* or against them, as in the Primrose. They are *Eserted* when they project beyond the corolla, as in the Columbine (Fig. 154); *Included*, when quite within it; Primrose.



FIG. 165.—*Banksia littoralis*.

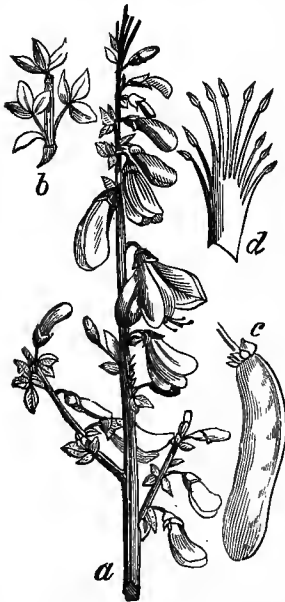


FIG. 166.—*a*, Broom (*Cytisus scoparius*); *b*, lvs.; *c*, pod; *d*, andrœcium.

254. Position in regard to one another.—The stamens are *Ascending* when they rise obliquely (Pennyroyal); *Connivent* when they lean towards each other around the pistil, with their anthers touching, but not cohering (Irish Potato, Egg-plant, Fig. 158); *Declinate* when all turned in one direction (Azalea); *Erect* when rising vertically (Herb-Robert); *Inflexed*, curving in towards the pistil (Almond, Peach); *Pendulous*, reverse of erect (Columbine).

255. When coherent, the stamens are *Monadelphous*, or in one brotherhood (Gr. *adelphos*, brother), with their filaments united into one set, as in the Broom (Fig. 166), the Mallow, and Cotton. They are *Diadelphous* when their filaments are in two sets, as in the Pea (Fig. 167, A); *Triadelphous* when in three sets, as in St. John's-wort; *Polyadelphous*, in many sets, as in the Castor Oil and Cream-nut. They are called *Syngenesious* (Gr. *syn*, together, *genesis*, birth), or born-together, when they cohere by their anthers, as in the Sunflower Order (Fig. 167, B), in

which this is a permanent character; here the filaments are distinct. In the *Lobelia* both filaments and anthers cohere into a tube, making

the andrœcium monadelphous and syngenesious. The monadelphous filaments of the Milkweed (Fig. 172, A), which make a tube surrounding the pistil, are called a *Gynostegium* (Gr. woman's cover).

256. *Position in regard to Gynœcium.*—The stamens are *Epigynous* (above the woman) when they are on a disk adnate to the top of the ovary, as in the Carrot; *Hypogynous* (below the woman) when inserted below the ovary, as in the Geranium, Magnolia, Lotus-Lily, and Buttercup; *Perigynous* (around the woman) when borne on the rim of the calyx, as in the Cherry.

257. These three modes of insertion were found by De Jussieu to be so constant that he gave them the third place in his relative values (81). They give rise to the Divisions *Ovary Free*, *Ovary Adherent*, and to the poly-petalous Subdivisions *Calycifloræ*, *Discifloræ*, *Thalamifloræ*.



FIG. 167.—A, Sweet Pea (*Lathyrus odoratus*). B, Floret of *Catananche cerulea*.

(Gr. *gyn*, woman, *andr*, man) have the anthers adnate to the style, as in the Orchis (Fig. 152) and the Aristolochia; or to the stigma, as in the Milkweed (Fig. 172).

259. *Dynamic Stamens.*—In the Labiate flowers (Fig. 160, a) there a

258. *Gynandrous* flowers

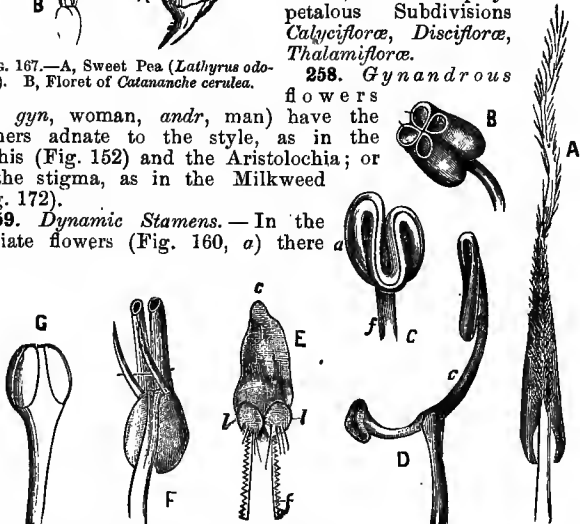


FIG. 168.—Stamens. A, Oleander (*Nerium*). B, *Poranthera ericifolia*. C, Cucumber (*Cucumis*). D, Sage (*Silvia officinalis*). E, *Humirium balsamiferum*. F, Whortleberry (*Vaccinium uliginosum*). G, *Hepatica*.

are four stamens, two of which are longer (stronger) than the other two; they are called *Didynamous* (Gr. *dynamis*, strength), or twice-strong. In the Cross-Flowers (Fig. 162, e) there are six stamens, four longer than the remaining two; they are *Tetradynamous*.

260. *The Filament* has various shapes. It is *Capillary*, or hair-like, in the Grasses; *Clavate*, or club-shaped, in the Begonia; *Filiform*, or thread-like, in the Lily; *Petaloid* in the Canna.

261. *The Anther*, as we know, is a transformed leaf, the filament being its petiole. The two anther-lobes are the halves of the leaf-blade. The connective is the midrib; sometimes it is scarcely perceptible, as in the Grasses and Lilies; again it is a mere prolongation of the filament, as in the Hepatica (Fig. 168, G); or it is *Produced* (prolonged beyond the anther-lobes), as in the Wild Ginger, the Hand-flower, the Lotus-Lily; in the Humirium (Fig. 168, E) the produced connective is fleshy and much larger than the anther-lobes.



FIG. 169.—Gamboge (*Hebradendron gambogioides*): a, ♂ fl.; b, same, showing stamens; c, anther; dehiscence circumscissile.

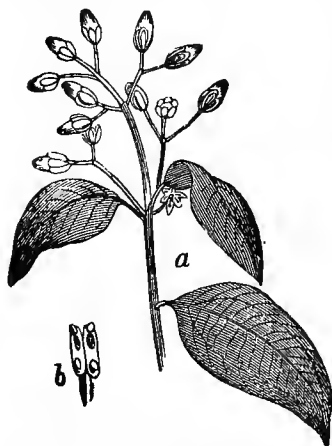


FIG. 170.—a, Cinnamon (*Cinnamomum zeylanicum*); b, separate anther.

262. *Attachment*.—The Anther is *Adnate* when one face is attached to the side of the filament (Magnolia); *Innate*, when attached by its base to the apex of the filament (Hepatica, Fig. 168, G); *Versatile*, when attached by its middle to the apex of the filament (Grasses, Lilies).

263. *Facing of the Anther*.—The Anther is *Extrorse* when it faces outward from the pistil (Tulip-tree); *Introrse* when it faces inward towards the pistil (Vine, Magnolia).

264. *Anther-Cells, or Lobes*.—Nearly all anthers are *quadri-ocular*, or four-celled (*L. locus*, little cell), when young. Sometimes this condition persists, as in *Poranthera* (Fig. 168, B); but usually the anther becomes *Bi-ocular* (2-celled) at maturity, as in the Hepatica (Fig. 168, G).

(1) *confluence* (the running together of the two cells), as in the Gamboge (Fig. 169, c) and Marsh-Mallow, or through (2) *obliteration* (the entire disappearance of one cell), as in the Canna, or through (3) *separation*, in which the two cells are separated by a long, transverse connective, as in the Sage (Fig. 168, D), the anther being *Dimidiate* (L. cut in half). The anther of the Mistletoe (Fig. 65, B) is many-celled (*plurilocular*), and opening by pores.

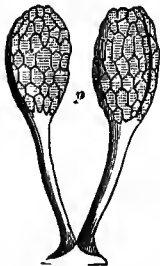


FIG. 171.—Pollinia of *Orchis Morio* attached to the retinaculum; rostellum not seen.

265. *The Forms* are as variable as those of leaves; the descriptive terms are nearly the same. The Oleander anther is *Sagittate* (Fig. 168, A); that of the Cucumber is *Flexuose* (Fig. 168, C).

266. *The Appendages* are also innumerable. The Oleander connective has a long ciliate plume (Fig. 168, A); the filament of the Humirium has glandular teeth (Fig. 168, E). The Milkweed (Fig. 172, B) has a lovely hood and horn.

lobes is: (1) *Circumscissile* (L. cut around); here the lobes are cut transversely, the upper part serving for a lid, as in the Gamboge (Fig. 169, c) and the Pyxidantha, or Box-anther (Gr. *pyxidion*, little box), which gets its botanical name from this character. (2) *Longitudinal*; here each cell is marked with a longitudinal seam, or *Suture*, by

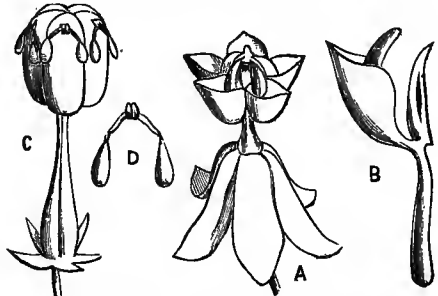


FIG. 172.—A, fl. of Milkweed (*Asclepias tuberosa*). B, separate stamen, with its appendages (horn and hood). C, gynoecium, with pollinia adherent to the stigma. D, two separate pollinia.

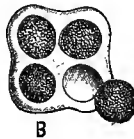
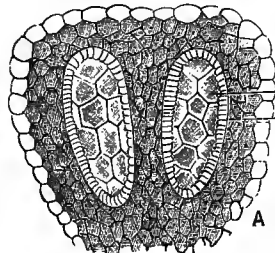


FIG. 173.—A, Anther of Squash (*Cucurbita Pepo*), with two pollen-mothers. B, ripe pollen-mother, with pollen-grain escaping.

which it opens, as in the Hepatica (Fig. 168, G), the Oleander (Fig. 168, A), the Grasses and Lilies; it is the commonest mode. (3) *Porcous*; here the Sutures remain closed, and each cell opens by a pore at the top, as in the Whortleberry (Fig. 168, F) and the Poranthera (Fig. 168, B), which gets its name from this character.

The pores of the Mistletoe anther perforate it in every part (Fig. 65,

B), so that it resembles a honeycomb. (4) *Valvular*; here the sutures remain closed, and the face of the anther is cut into portions which lift like a hinged trap-door or valve (L. *valva*, folding-door). This mode characterizes the Laurel Family (Fig. 170, *b*).

268. *Pollinia* are pollen-grains generated—as all pollen-grains are—in mother-cells which persist, instead of being obliterated (as is usual); and thus the grains are retained in masses.

269. In the Orchids (Fig. 171) the *pollinium* often lengthens into a stalk, called a *Caudicle* (L. little tail); the caudicle is attached to a viscid disk, called *Retinaculum* (L. stay). This stay lies loosely in a cup-shaped, beaked body, called a *Rostellum* (L. beak). The rostellum is an abortive stigma transformed. In the Milkweed (Fig. 172, D) each pollinium is provided with a tail, called a *Qucue*; the two queues are attached to a common gland, and when ready for fertilization, this gland adheres closely to the stigma, whilst the pollinia open and discharge their grains upon it.

270. *Formation of Pollen*.—The anther develops before the filament, and is therefore always sessile at first, appearing as a small swelling composed of similar cells. Presently some of these cells destroy themselves, as it were,—they change into *lacunes*, or empty spaces; these are at first small and linear; then they enlarge, become oblong, and are usually four in number, two for each anther-lobe. Soon they are filled with a mucilaginous fluid, which forms cells (Fig. 173, A); the outermost of these cells become the fibrous envelope of the anther; the inner cells, which are much larger, are the *Pollinic Utricles*, or Pollen-Mothers. Each pollen-mother forms four cells; each cell (Fig. 173, B) forms a pollen-grain. The pollen-mothers are usually obliterated, as has been said, after the grains ripen; but in the Orchis and Milkweed they persist.

271. *Pollen-grains* are as varied as flowers; their adornment is more wonderful than that of the flower. The pollen-grains of the Squash and Passion-flower are elegantly chased and sculptured. Those of the Pines (Fig. 4, 6) are triangular; the extine swells on either side into two little balloons, evidently contrived to assist in transporting the pollen, which is borne by the wind to the female flower. Those of the Hollyhoek are round (Fig. 4, 5) and bristling with pointed prickles. Those of the Milkwort (Fig. 4, 2) have longitudinal furrows. Those of the Cherry are round; of the Evening Primrose triangular (Fig. 4, 3, 4). Most of these forms and carvings are designed to attach the grains to the proboscides of insects, or to the feet, which are also pollen-bearers. The pollen-grains of the *Zostera*, or Sea-wrack (which is a marine plant), have but one coat, the intine; they are exquisitely slender and delicate, lying side by side, like skeins of silk, in the anther-lobe. The *Fovilla*, or nourishing fluid, in the pollen-grain we remember in Lesson II. (19).

LESSON XXIV.

THE WOMAN'S HOUSE (GYNŒCIUM).

272. Number of Pistils. 273. Position. 274. Form. 275. Divisions, Appendages. 276. Style. 277. Gynobase. 278. Torus. 279. Disk. 280. Ovary; 281. Monocarpous; 282. Syncarpous. 283. False dissepiments. 284. Placentation. 285. Number of cells. 286. Abortion. 287. Ovule; its position in the cell; 288. Its position on the funiculus. 289. Analogies between reproductive and vegetative organs. 290. Difference between *Ovule* and *Seed*; Embryogeny.

272. Number of Pistils.—Taking the Greek numerals, with the Greek poly,—as we did for the stamen,—and prefixing them to the root *gyn* (woman, pistil), we have the same descriptive terms for the gynœcium,—*monogynia*, etc. Besides these, the pistil—which is also called *Carpel*, especially when there is more than one in the gynœcium—is: *Monocarpous* when there is but one ovary, as in the Pea (Fig. 5, 6); *Syncarpous* when there are two or more ovaries, as in the Lily (Fig. 5, 4); *Apocarpous* (Gr. *apo*, from, separate) when there are many distinct carpels, as in the Buttercup (Fig. 9, 1).

273. The Position of the Stigma in regard to the Style is *Terminal* when the conducting tissue is at the apex (Lily); *Unilateral* when on one side (Custard-Apple); *Bilateral* when on both sides (Plantain).

274. In Form the Stigma is *Capitate* (head-like) in

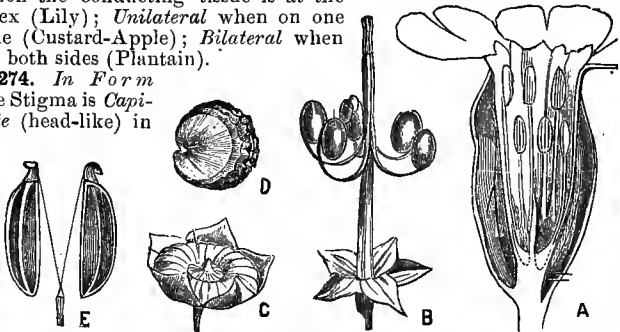


FIG. 174.—A, vert. sec. of fl. of *Melandrium dioicum*. B, fr. of *Geranium sanguineum*. C, fr. of *Malva sylvestris*. D, separate coccus, X. E, fr. of Fennel (*Feniculum officinale*).

the Mezereon; *Lamellate* (bladed) in the Begonia; *Pellate* and *Stellate*

in the Poppy; *Petaloid* in the Canna. The 5 united petaloid stigmas of the *Sarracenia* (Fig. 114) imitate a parasol.

275. *The Divisions and Appendages* of the Stigma are as varied as those of the flower and leaf; they are described in the same terms. In the Dock the stigmas are lacinate (Fig. 189, A); in the Grasses *plumose* (Fig. 52, B); *penicillate* (*L. penicillus*, a painter's brush), with diverging hairs, as in the Burnet and Pellitory.

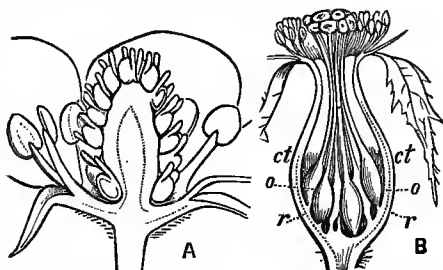


FIG. 175.—A, vert. sec. of fl. of Strawberry (*Fragaria vesca*). B, do. of fl. of Sweet-brier (*Rosa rubiginosa*).

276. *The Style*, in its position on the ovary, is *Apical* (*Terminal*) when it arises from the apex, as in the Myrtle (Fig. 178); *Lateral* when it rises from the side, as in the Strawberry (Fig. 175, A); *Basal*, *Basilar*, when from the base, as in the Sage and Comfrey (Fig. 5, 2). We are thus brought to

277. *The Gynobase* (woman's base), a central column, which is a growth formed by confluent basilar styles and their ovaries, which separate from it at maturity. Here the carpels, which are 1- or 2-seeded, are called *Cocci* (*L. coccus*, berry); this column is called also a *Columnella*. In the Geranium (Fig. 174, B) the cocci, at ripening, *fracture* or separate from one another, and hang suspended by their long, persistent styles from the top of the column; the fruit is called a *Regma* (*L. fracture*). In the Mallow (Fig. 174, C) the cocci do not wholly separate from the column.

278. *The Torus* has many forms. In the Rose it is

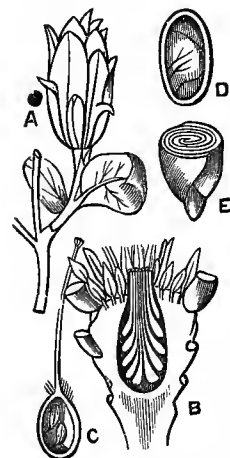


FIG. 176.—A, fl. of *Calycanthus floridus*. B, vert. sec. of same, sepals removed. C, separate carpel, vert. sec. D, section of fruit. E, trans. sec. of embryo; cotyledons convolute.



FIG. 177.—Caper (*Capparis spinosa*).

urceolate (Fig. 175, B), lining the calyx-tube. In the Strawberry

we see the reverse; here (Fig. 175, A) it bulges up into a fleshy mass (the fruit), in which the small apocarpous pistils are embedded. In the Calycanthus (Fig. 176) it is urceolate, but there is no calyx-tube; the distinct sepals are in spirals on its outer surface. Sometimes its centre is *stipitate*, prolonged into a stalk, or *stipe*; this is called an *Anthophore* (flower-bearer) when it lifts petals, stamens, and pistils above the calyx, as in the Pinks (Fig. 174, A). It is a *Carpophore* (carpel-bearer) in the Fennel (Fig. 174, E); here the fruit is called a *Cremocarp* (hanging fruit); the 2 separate carpels are *Mericarps* (half-fruits); their line of union is a *Commissure*. The stipe becomes a *Gonophore* (Gr. family-bearer) when it lifts the stamens and pistils above the other floral parts, as in the Magnolia (Fig. 133, A) and Custard-Apple Family; a *Gynophore*, or woman-bearer, when it lifts the pistil alone, as in the Caper (Fig. 177) and Passion-flower (Fig. 155).

FIG. 178.—1, vert. sec. of fl. of Myrtle (*Myrtus communis*). 2, branch, with fls.

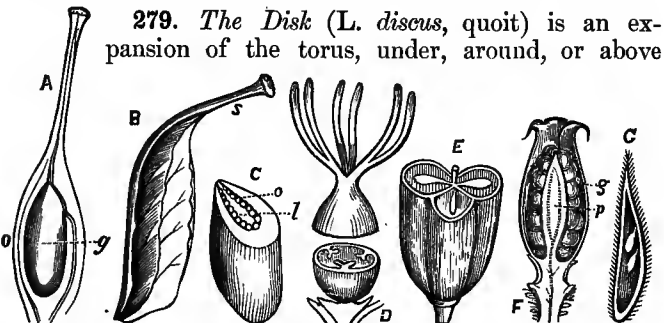


FIG. 179.—B, Pistil of Flowering Cherry (*Cerasus sinensis*) reverting to lf. form. A, true pistil, vert. sec. C, carpel of *Butomus umbellatus*, trans. sec. D, ovary of *Drosera filiformis*. E, ovary of *Vochysia rotundifolia*. F, ovary of *Agrostemma Githago*. G, do. of *Brosnia peltata*.

the ovary. It is *Epigynous* when above the ovary, as in the Myrtle (Fig. 178); *Hypogynous*, below the ovary, as in the Orange, Vine (Fig. 4), and Cashew (Fig. 76);

Perigynous, around the ovary, as in the Buckthorns (Fig. 77).

280. The Ovary.—The pistil is a transformed leaf, its upper face folded inward. Its lower part forms the ovary (Fig. 179, A, B); its apex, prolonged, forms the style; here the inner margins, turned outward and without a skin, form the stigma. The united leaf-margins of the ovary form the *Ventral Suture* (L. abdominal seam); the mid-rib forms the *Dorsal* (backbone) suture. The ventral suture turns invariably towards the axis (centre) of the flower. The two halves of the ovary are *Valves*. The ovaries are usually attached to the ventral suture, as in the Pea and Lily (Fig. 5, 4, 6), the Cherry and *Vochysia* (Fig. 179, A, E).

281. A monocarpous (simple) ovary has but one cell and one placenta. The cell may be 1-ovuled, as in the Cherry, or many-ovuled, as in the Pea. The placenta (17) is double when the ovules are on the ventral suture, because there it is formed by the two leaf-margins.

282. In the syncarpous ovary the united or adjacent walls of the cells are called *Dissepiments*, or double-partitions, as in the Lily and *Vochysia*.

283. False dissepiments are sometimes formed by a projection from the dorsal to the ventral suture, thus making a 5-celled ovary 10-celled, as in the Flax.

284. Placentation (the position of the placentæ in the cell) is *Axile* (ventral), *Central*, *Dissepimental*, *Dorsal*, and *Parietal*:

I. When *Axile*, the placentæ are on the ventral suture; Cherry, Pea, Lily, *Vochysia*; this is the usual form.

II. When *Central*, the dissepiments are obliterated (making the ovary 1-celled), with the placentæ forming a thick axis, as in the Primrose (Fig. 5, 1) and the Pinks (Fig. 178, F).

III. When *Dissepimental*, the placentæ are on the dissepiments, as in the Flowering Rush (Fig. 179, C).

IV. When *Dorsal*, they are on the dorsal suture; Water-Shield (Fig. 176, A).

V. When *Parietal*, the ovaries are not folded (Fig. 179, D). Their open valves cohere by the neighboring edges, thus making one cell, though normally there are as many ovaries as placentæ. These open ovaries are called *Parietes* (L. *paries*, *parietis*, wall). We see them in the Violet and Fly-Trap (Fig. 179, D).

285. *The number of cells is determined by the styles; the free stigmas; the stigma-lobes; the placentæ.*

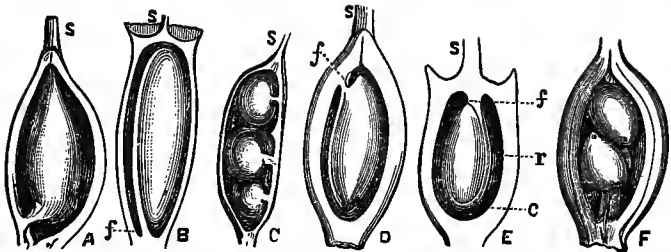


FIG. 180.—Ovules. A, Pellitory-on-the-Wall (*Parietaria officinalis*). B, Groundsel (*Senecio vulgaris*). C, Pea (*Ononis rotundifolia*). D, Mezereon (*Daphne*). E, Mare's-tail (*Hippuris vulgaris*). F, Horse-chestnut (*Aesculus hybrida*).

286. *Abortion.*—The Filbert is 2-celled at first; each cell is 1-ovuled; but the rapid growth of one ovule soon destroys the other, and the ovary becomes 1-celled, 1-seeded. The same thing occurs with the Acorn, which is at first 3-celled, with 2 ovules in each cell.

287. *The Ovule, in its position in the cell, is*

Ascending when it rises obliquely, as in the Pellitory (Fig. 180, A);

Erect when it rises directly from the base: Groundsel (B);

Horizontal when at right angles with the axis: Pea (C);

Pendulous when hanging from the upper part: Mezereon (D);

Suspended when hanging directly from the top: Mare's-tail (E).

In the Horse-chestnut there are two positions (F); one ovule is erect, the other suspended.

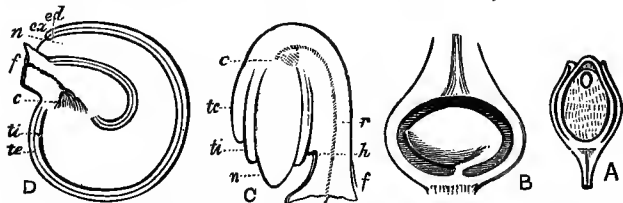


FIG. 181.—A, Ovule of *Olax stricta*. B, *Lemna minor*. C, *Chelidonium majus*; r, raphe; c, chalaza; h, hilum; f, funiculus; n, nucleus; ti, tegmen; te, testa. D, Wall-flower (*Cheiranthus Cheiri*).

288. *The position of the Ovule on the funiculus is very important.* It is *Orthotropic*, or straight (Gr. *orthos*, straight; *tropo*, I turn), in the Smartweed (Fig. 3, a) and *Olax* (Fig. 181, A); here the ovule has the chalaza and hilum coincident (on the same line), with the micropyle opposite to them. The ovule is *Anatropic*, or inverted (Gr. *ana*, up), in the Celandine (Fig. 181, C); here it is reversed on the funiculus, which is prolonged into a stalk, the greater part of this

stalk being hidden by the coats (testa and tegmen); this hidden part (*r*) is called the *Raphe* (Gr. seam); here the hilum (*h*) and the chalaza (*c*) are no longer coincident, but widely separated. The ovule of the Duck-meat (Fig. 181, B) is *Semi-anatropous*, or half-inverted.

The ovule is *Campylotropous*, or bent (Gr. *kampylos*, bent), in the Wall-flower (Fig. 181, D); here the base, or chalaza (*c*), is straight; the micropyle is brought close to it; the funiculus and hilum (*f*) are coincident.

289. The *analogies* between the reproductive and vegetative organs are thus traced by Sachs:

When the ovule is single, erect, and orthotropous (thus terminating the floral axis), it is a transformed stem, as in the Smartweed (Fig. 3, *a*) and Olax (Fig. 181, A);

When the ovules have central placentation (thus growing laterally from the floral axis), they are transformed leaves, as in the Primrose (Fig. 5, 1) and Pink (Fig. 179 F);

When the ovules have strictly axile placentation (thus growing from the margins of the carpel-leaves), as in the Pea (Fig. 5, 6), the Cherry (Fig. 179, A), and the Vochysia (Fig. 179, E), they are transformed leaflets.

He finds no clear analogy for dorsal and dissepimental ovules, but sees a resemblance to the spore-cases of *Lycopodium*, which proceed from the leaf-surface.

290. *Difference between the terms Ovule and Seed.*—Whilst the ovule is fitting itself to its permanent position in the cell or ovary, the embryo-sac is developed, the embryonic vesicle is formed, the stigma develops the delicate papillæ (20) of its conducting tissue, which secrete a special fluid, and all is made ready for the great work of fertilization, or *Embryogeny* (Embryo-creation), which is the most important in nature. Before fertilization the female organ is technically an *ovule*; after fertilization it is technically a *seed*. In the parthenogenesis of Hemp, Bryony, etc., there is no fertilization; but the distinctions remain, for the organ is at first an ovule, then a seed.

LESSON XXV.

POLLINATION—FERTILIZATION.

291. Pollination. 292. Leaf-pollination. 293. Cleistogamy. 294. Parthenogenesis. 295–297. Foreign pollination. 298. Dichogamy. 299. Homomorphous, heteromorphous flowers. 300. Modes of foreign pollination. 301, 302. Entomophilous flowers. 303. Sensitive motion. 304. Fertilization.

291. Pollination.—The transportation of pollen, either to the naked ovule in Gymnosperms or to the stigma in Angiosperms, is called Pollination (L. *pollen*, *pollinis*). This has two modes: I. *Self-pollination*, in which the flower is monoclinal and the stigma receives pollen from the anthers of the same flower; here the stigmas and anthers, of course, ripen at the same time; II. *Foreign pollination*, in which the stigma is pollinated by pollen from another flower.

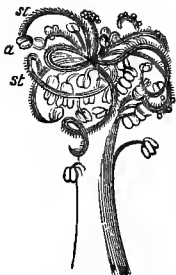


FIG. 182.—Gynoecium and Androecium of *Malva rotundifolia*.

Furthermore, whilst nearly all other orchids are incapable of self-pollination, and resort to every form and color to attract insects, the Bee Orchis takes the shape of the bee itself, as if to deceive insects into the belief that a bee is already in possession of the flower and that no other visitor need seek admission.

292. Self-Pollination is called **Autogamy** (Gr. *autos*, self; *gamos*, marriage). It is performed in several ways. In the Mallow (Fig. 182) the stigmas curl about the anthers, receiving the pollen by immediate contact; though even here the pollen may be brought to them by insects from the anthers of a distant flower, thus securing foreign fertilization. In the Bee Orchis the anthers open as soon as the flower expands, and the pollinia hang directly over the stigmatic surface, with which the lightest breath of air brings them in contact.

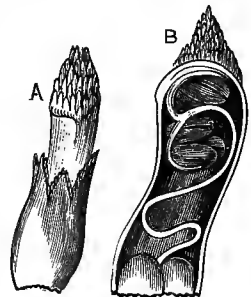


FIG. 183.—Autumnal flower of Dead Nettle (*Lamium amplexicaule*).

293. Cleistogamy (Gr. *kleis*, key), or locked marriage, is seen in the

autumnal flowers of the Dead Nettle (Fig. 183), the Violet, *Oxalis*, and *Trifolium subterraneum*. In the spring these plants produce normal flowers; but in the autumn the flowers scarcely look like flowers at all. There is no stigmatic surface; the ovules and anthers are in the same cavity or ovary; this cavity does not open; the pollen-tubes (white cords in the illustration) bore holes through the anther-lobes at the top of the cavity and penetrate the ovules below, which ripen perfect seeds. Masters



FIG. 184.—*Bryonia dioica*, ♂ and ♀ plants.

tells us, in his "Vegetable Physiology," of plants in which pollen-grains are produced in the ovule itself. One step further, and we see

294. *Parthenogenesis*, or Virgin parentage, already defined (40). Spallanzani (the latter part of the last century) found that the ♀ flowers of the Hemp (which is dioecious) produce perfect seeds without the aid of pollen; Naudin and Decaisne grew a second generation of Hemp from virgin seeds. Naudin discovered the same thing in the Common Bryony (Fig. 184), which is also dioecious.* The most remarkable plant with this habit is the *Cœlebogyne*, or Virgin-flower (*L. cœlebs*, unmarried; *Gr. gyne*, woman). It was discovered in New Holland, and introduced into the English Botanical Gardens in 1829. It is dioecious, and placed in the Euphorbia Family; its fruit resembles that of the Three-seeded Mercury. No male plant was brought to Europe; the flowers show no sign of pollinic action by cross-fertiliza-



FIG. 185.—Milkwort (*Polygala vulgaris*).

* The Weeping Willow produces new generations in this way continually and perfectly, Herbert Spencer tells us. He calls the process *Agamogenesis*,—*Gr. agamos*, without marriage.

tion; yet they produce perfect seeds, which produce perfect plants, continuing the generation. Fertilization is the rule among phanerogams. These plants being diœcious, however, may often be too widely separated for the pollen of one to reach the stigma of the other; and this parthenogenesis is perhaps—with all respect to Mr. Darwin—a “survival of the fittest;” the fittest being the mother, who has the chief, often the whole care of her young.

295. Many self-pollinating flowers require foreign aid, from insects, the wind, or other agencies. The ten stamens of the *Kalmia* are confined by their anthers in as many little pouches in the corolla. There they remain, incapable of extricating themselves, until released by some insect, or the wind, or a blow of some sort; then they spring up towards the pistil mechanically, like a bow unstrung, and their pollen is shed upon it. The Barberry stamens lie out against the petals. The sun's heat arouses them; or an insect, foraging for honey in the nectaries of the petals, touches the irritable base of the stamen, which immediately springs up by spontaneous action and projects its pollen on the stigma. Here, and in the *Kalmia*, the insect bears off pollen to another flower, thus securing foreign pollination also. In the Milkwort (Fig. 185), which is self-pollinating, special provision to secure foreign fertilization also is made in the viscid disk behind the stigma, to which pollen brought by an insect will cohere.

296. Foreign Pollination is the prevailing habit throughout the vegetal kingdom. In monœcious plants the stamens and pistils of flowers on the same plant usually ripen at different times.

297. This rule governs the greater number of monoclinal flowers also; they are furnished with both organs, as a reserve, apparently, in case of the failure of pollen from distant flowers. At any rate, we are taught, from the first hint at two sexes in the Diatoms (44), that foreign pollination gives the best results, almost invariably.

298. Dichogamy.—Monoclinal flowers with pistils and stamens ripening at different times are termed *Dichogamous*, or separate-wedded (Gr. *dike*, separate). When the pistils ripen first, as in the *Aristolochia* (Fig. 186), the flower is *Proterogynous* (Gr. *protos*, first). When the stamens ripen first, as in the Sage (Fig. 187), the flower is *Proterandrous*. The proterogynous flower is, therefore, first female and then male; the proterandrous flower first male and then female.

299. Homomorphous and Heteromorphous flowers.—In most flowers the stamens and pistils have relatively the same length and position towards each other in the same species; they are therefore termed *Homomorphous* (Gr. *homo*, similar; *morphe*, form). Sometimes, however, we find *Heteromorphous* flowers (Gr. *heteros*, another, unlike),—that is, with stamens and pistils different in length and posi-

tion. The same species of the Primrose (Fig. 5; 1) shows two forms, and is therefore called *Dimorphous*; one form (Fig. 5, 1) has a short style with the stamens inserted on the corolla-throat above it; the other has a long style with the stamens inserted on the corolla-tube below it. These forms are evidently contrived for the visits of insects. The Yellow Jessamine (*Gelsominum*) is dimorphous; the Loose-Strife is *Trimorphous*.

300. Modes of Foreign Pollination.—Flowers pollinated by the wind are termed *Anemophilous*, or wind-loving (Gr. *anemos*, wind; *philos*, loving). The Pines, Grasses, Poplars, and Birches are examples. Their stigmas are usually feathered, to catch the pollen readily (Figs. 51, 52); their pollen-grains are dry and smooth (Fig. 4, 6; Fig. 47, A, B). Anemophilous flowers are never conspicuous; they are usually diclinous, and the male flowers produce great quantities of pollen.

301. Entomophilous, or insect-loving flowers (Gr. *entomos*, insect), are pollinated by insects. These flowers are much more interesting and varied; they use every device to



FIG. 186.—*Aristolochia Serpentaria*: a, flower; b, same cut open, showing stamens and stigma; c, d, stamens; e, stigma-lobes.

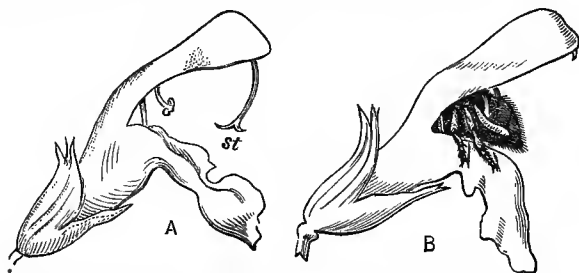


FIG. 187.—Fls. of Sage (*Salvia officinalis*). B, stamens ripe, bee entering flower. A, pistil ripe, ready for pollen.

allure insects. The bee, the moth, and the butterfly are the

chief actors in this pretty courtship, though many humbler folk—the gnat, the ant, the fly—take part in it.

302. Each flower has her own favorites: the Sage secretes honey to attract the bee; the Pinks and Morning-Glories deck themselves in gay colors to allure the butterfly; the Evening Primrose unfolds and shines the livelong night, exhaling her sweets for the humming troubadour moth, who knows so well how to find the honey in that deep corolla-tube with his long proboscis; the Orchids assume all forms and colors to entice visitors of every type. Entomophilous flowers include nearly the whole of the higher phanerogams. Their stigmas (Figs. 172, 187) are broader and more solid than those of the anemophilæ; their pollen-grains (Fig. 4) are more viscid, and variously carved, grooved, and appendaged, that they may the more readily cling to the insect which bears them. It is no unusual thing to see a



FIG. 188.—Rue (*Ruta graveolens*), with insects.

bee carrying on his legs the pollinia of the Orchis or Milkweed (Figs. 171, 172) like a pair of saddle-bags. The Poppy secretes no honey; it is visited for the sake of its pollen, which makes Bee-bread; its broad sessile stigma (Fig. 197, E) affords a fine foothold for operations.

303. Sensitive Motion.—At the time for pollination and fertilization, the temperature of the stamens and pistils rises, and they become highly sensitive, sometimes exhibiting spontaneous motion, as in the pistils of the Mallow and the stamens of the Barberry. In the Dancing Orchids the whole flower engages in this motion. The labellum is very lightly poised, and furnished with fascicles (bundles) of fine hairs which catch the slightest breath of wind. This, added to the increased floral temperature,—and why not to the sportive spirit which infects all other young lovers?—gives them the grotesque contortions which are so curious and amusing. The Artillery Plant (*Pilea*) gets its common name from the behavior of the stamens. The flowers are diclinous; the male has 4 stamens in a 4-parted calyx which covers them. When ripe, the least moisture causes the stamens to spring outward and elastically project their pollen to the distance of a foot. This act is accompanied with repeated audible explosions, and the pollen being very fine and smoke-like, the process resembles mimic artillery. The same thing occurs in the male flowers of the Paper Mulberry (*Broussonetia*), which is in the same Order. The stamens of the Rue (Fig. 188), which bears monoclinal flowers, lie outspread at right angles to the pistil, and ripen in succession. The first ripe stamen rises, hends over the pistil (against which its filament presses), opens its anthers, and sheds its pollen; it

then falls back, to be followed by the others, each in turn. The flowers are usually proterandrous; but the bee, fly, or other insect visiting them receives the pollen and bears it off; whilst, after the pistil ripens, other insects bring pollen from some distant flower.

304. Fertilization has already been described (15, 20), and also the embryo resulting from it (21). This subject alone would fill volumes; in this elementary book we can but glance at its phenomena.

LESSON XXVI.

THE SEED.

305. Seed. 306. Radicle, its direction. 307, 308. Embryo, its position. 309. Size of radicle and caulicle. 310-312. Cotyledons. 313. Plumule. 314. Perisperm. 315. Exalbuminous seeds. 316, 317. Seed-coats. 318. Micropyle. 319. Chalaza. 320. Raphe. 321. Funiculus. 322. Hilum. 323. Seeds dissected.

305. The Seed consists of the ovule and embryo. The base of the seed is the hilum (Fig. 189); its apex is the opposite point; its axis is the straight or curved line between. The base of the embryo is the radicle; its apex is the extremity of the cotyledons; its axis is the straight or curved line between. The position of the seed in the ovary (pericarp) is determined by the radicle, which almost invariably points to the micropyle, and usually lies close to this opening (Fig. 189, A). On account of the constancy of this character,

306. The Direction of the Radicle holds the fifth place in the values (31). It is

I. Superior when it points to the apex of the ovary, whether the ovule be orthotropous (Fig. 189, A) or anatropous (Fig. 180, E);

II. Inferior when it points to the base of the ovary, as in the *Pretty-by-night* (Fig. 189, B);

III. Centripetal when it points to the central axis, as in the *Lily* and *Pea* (Fig. 5, 4, 6);

IV. *Centrifugal* when it points to the circumference, as in the Violet (Fig. 204) and Fly-trap (Fig. 179, D);

V. *Vague, Excentric*, when it has no definite direction, as in the Primrose (Fig. 189, D).

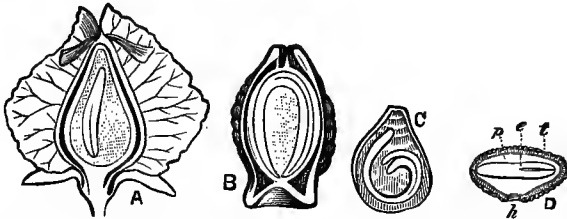


FIG. 189.—A, vert. sec. of fr. of Dock (*Rumex*). B, do. of fr. of Pretty-by-night (*Mirabilis jalapa*). C, do. of sd. of *Cistus symphitifolius*. D, do. of sd. of Primrose (*Primula elatior*): e, embryo; h, hilum; t, tegmen and testa; p, perisperm.

307. *The position of the embryo in regard to the Seed.*—The three typical positions of the ovule being known, we have the following positions for the embryo: I. Ovule orthotropous, embryo *antitropous*; that is, the radicle and micropyle turned from the hilum (Fig. 189, A); II. Ovule anatropous, embryo *homotropous*; that is, the radicle and micropyle turned towards the hilum (Fig. 193, B); III. Ovule campylotropous, embryo *amphitropous*, or bent (Fig. 189, B). IV. The embryo is *heterotropous* when, from the unequal growth of the seed-coats, neither extremity corresponds to the hilum, and the radicle no longer points to the micropyle. This unusual form is found in the Primrose (Fig. 189, D), in which the axis of the embryo is parallel to the plane of the hilum; and in the Grasses (Fig. 6, A), in which it is oblique. The radicle is in these cases termed *excentric*.

308. The embryo is *axile* when its axis corresponds with

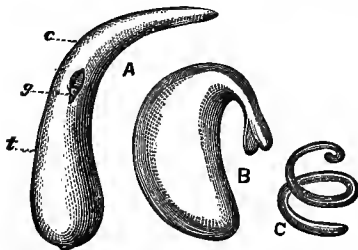


FIG. 190—A, emb. of Pondweed (*Potamogeton perfoliatus*); r, radicle; t, caulicle; c, cotyledon; g, plumule. B, emb. of South American Butternut (*Caryocar butyrosun*, *Pekea butyrosa*). C, emb. of Dodder (*Cuscuta Epilinum*).

the axis of the seed, whether it be straight (Fig. 189, A) or curved (Fig. 189, C); it is *peripheric* when it follows the periphery (circumference), as in the Pretty-by-night (Fig. 189, B); it is *transverse* when at right angles with the axis (Fig. 189, D).

309. *The Radicle and Caulicle* are usually small.

Very often, however, the caulicle is conspicuous. In the Pines (Fig.

47) it is elongated. In the Pondweed (Fig. 190, A) it is large, club-shaped, and called a *Macropod* (Gr. big foot). In the South American Butternut (Fig. 190, B) the large caulicle and radicle form almost the

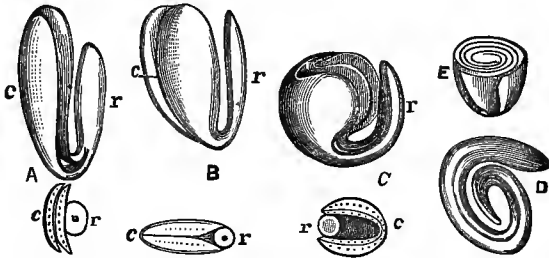


FIG. 191.—A, emb. of Woad (*Isatis tinctoria*). B, emb. of Wall-flower (*Cheiranthus Cheiri*). C, emb. of Cabbage (*Brassica sativa*). D, emb. of *Bunias orientalis*. E, emb. of *Terminalia Catappa*.

entire embryo. In the Dodder (Fig. 190, C) the cotyledons are entirely suppressed and the embryo consists of a cord-like caulicle and radicle, coiled in scant perisperm. It is uncoiled and removed from the perisperm in the figure; the plumule is at its smaller extremity. The Dodder is a leafless parasite (Fig. 93), and is well prefigured in its embryo. The Snake-nut gets its botanical name *Ophiocaryon* (Gr. *ophis*, snake) from its large, spirally-twisted caulicle.

310. The Cotyledons, being leaves, are subject to leaf-law: they take as varied forms and habits and are described in the same terms. In the Mustard Family we find all the types of Veneration: the Cotyledons are *open* (Fig. 191, A, B), *folded* (C), and *rolled* (D). In the *Calycanthus* (Fig. 175, E) and the *Terminalia* (Fig. 191, E) they are convolute; in the Cabbage (C) conduplicate; in the *Bunias* (D) circinate.

311. In Cruciferæ the cotyledons invariably have one or another of the following positions, the ovule being always campylotropous or semi-anatropous: I. They are *accumbent* when they bend at base so as to touch the caulicle (radicle of old botanists)



FIG. 192.—Horse-Chestnut (*Æsculus Hippocastanum*); fr. sprouting; separate stamens.

they bend at base so as to touch the caulicle (radicle of old botanists)

by only one of their united edges (Fig. 191, B); II. *Conduplicate*

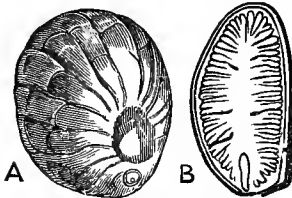


FIG. 193.—A, seed of Ivory-nut (*Phytelaphus macrocarpa*), showing the aperture (with a circular lid) through which the small excentric embryo will pass out at germination. B, vert. sec. of sd. of Custard-Apple (*Anona triloba*).

when they bend at base so as to clasp the caulicle by both of their united edges (Fig. 191, C); III. *Incumbent* when they bend at base so that their midribs are in the same plane with the caulicle; the cotyledons may be straight (Fig. 191, A) or coiled (Fig. 188, D).

312. *Fleshy Cotyledons* characterize most of our nuts. Sometimes the two cotyledons are consolidated into one, as in the Horse-chestnut (Fig. 192); they are then called *Confer-ruminate* (L. *conferro*, I bring together; *rumen*, teat, dug, paunch);

the cotyledon being compared to the dugs of an animal, or to the stomach in which the food is stored.

313. The Plumule is governed by the laws of both stem and leaf, and is equally instructive and interesting.

314. The Perisperm is very different in different plants.

It is *farinaceous* (floury) in the grains; *corneous* (horny) in the Coffee, etc. The Ivory-nut (Fig. 193, A) gets its English name from the appearance and quality of its perisperm; and it is used for the same purposes as ivory. The perisperm of the Cocoa-nut is the white meat, which is fibrous, hollow, with milk in its cavity, the milk being a part of the perisperm. In the Papaw and Custard-Apple (Fig. 193, B) the perisperm is *ruminated*; that is, the testa projects into it, making folds like those in the double stomach of an animal that *ruminates* (chews the cud). The Nutmeg (Fig. 196) is also ruminated, from the foldings of the tegmen. The perisperm performs the same office in all seeds; no matter how firm its texture, it softens when the embryo is ready to sprout; the greater part of it is changed into sugar, starch, and other substances to feed the growing plant. Seeds with perisperm are termed *Albuminous*, because formerly the perisperm was called Albumen on account of its position, which resembles that of the albumen (white) of an egg. But it is not at all albuminous in structure, and the term is now discarded.

315. *Exalbuminous seeds* have no perisperm. Here the nutriment is stored in the cotyledons (Almond, Walnut, Cream-nut, Yonquapêne) or the caulicle (South American Butternut, Dodder).

316. The Seed-Coats are as varied as the other parts of the plant.

317. In the Gymnosperms (except Gnetaceæ) there is but one seed-coat, and this becomes thick, fruity, and

edible. In Angiosperms there are usually two seed-coats; but the Mistletoe (Fig. 65, C) has none at all, and the seed is a simple nucleus from which the embryo protrudes. The Filbert and Walnut have but one coat, which is thin and fine. Two-coated seeds are the rule, however, in the Angiosperms. The tegmen is sometimes united to the testa so that it is indistinguishable; but it is usually free, and often elegantly developed. In the Cotton (Fig. 194) the testa is dark (green or black), firm in texture, and appendaged with the long, white, silky hairs which furnish the staple of commerce.



FIG. 194.—Seed of Cotton (*Gossypium herbaceum*): testa dark green (seen only at hilum, *h*), covered with a fleece of long white hairs.

In the Milkweed it is *alate*, or winged all around (Fig. 195, A). The testa of the Cream-nut is flint-like in hardness, imitating a pericarp, and thus giving the name *nut* to the seed; whereas the true nut is the great Monkey-pot, or Cannon-ball, in which these seeds (from 18 to 24 in number) are enclosed. The testa of the Magnolia is fleshy and red, imitating a berry (Fig. 133, B); in the *Pancretium* it imitates a bulb or corm.

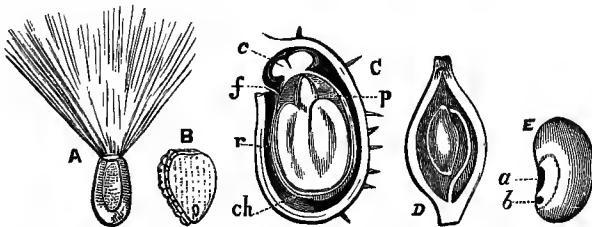


FIG. 195.—A, sd. of Milkweed (*Asclepias incarnata*). B, vert. sec. of sd. of Wild Ginger (*Asarum canadense*). C, vert. sec. of cell and sd. of Castor-oil (*Ricinus communis*): *c*, arillode; *f*, funiculus; *r*, raphe; *ch*, chalaza; *p*, perisperm surrounding the large embryo, of which the radicle and 1 broad cotyledon are seen. D, vert. sec. of ovary of *Armeria vulgaris*. E, sd. of Common Bean (*Faba sativa*): *a*, hilum; *b*, micropyle.

318. The Micropyle is visible in the Pea and Bean, in which it persists as a small hole (Fig. 195, E, *b*). Often it is closed, and variously enlarged and transformed. In the Milkweed it is *Comose*,—furnished with a *coma*, or tuft of long, soft hairs (Fig. 195, A). In

the Castor-Oil it is a thick, fleshy disk (Fig. 195, C); in the Polygala it is three-lobed and fleshy. In the Spindle-tree it becomes a free, succulent bag around the seed; in the Nutmeg (Fig. 196) it becomes the free, fleshy, honeycombed, and lacinate envelope known as *mace*.

These forms are called *Arillodes*, or *false arils*.



FIG. 196.—Nutmeg (*Myristica moschata*).

319. The Chalaza is often appendaged. In the Willow-herb (Fig. 75, 3) it is comose (like the micropyle of the Milkweed), and is called a *Strophiole* (*L. strophiolum*, garland). In the Aristolochia it is fleshy, and called a *Caruncle* (*L. carunculus*, small bit of flesh).

320. The Raphe is often invisible externally; but in the Wild Ginger (Fig. 195, B) it is prominent, and also in the Heart's-ease and Celandine, forming a crest on the side of the seed. These enlargements are called *Strophioles*, or *Caruncles*.

321. The Funiculus is usually short exteriorly, or wanting. In the Plumbago Order it is finely developed. Here (Fig. 195, D) the ovary is one-celled; its single ovule is anatropous and suspended from a long funiculus fixed at the base of the cell. The funiculus is often appendaged with accessory (helping) organs called *Arils*. In the Yew the aril is the red succulent cup which envelops the naked seed. In the Willow it is comose, completely hiding the seed. In the Prickly Pear it at first consists of two boat-shaped expansions springing laterally from the funiculus; the ovule is developed within these; they afterwards harden into an accessory envelope, which becomes a sort of stone covered with pulp. In the White Water-lily (*Nymphaea*) it is a free, transparent bag, nearly closed, prolonged beyond the enveloped seed; in the Passion-flower it is similar, but fleshy and with a large opening.

322. The Hilum, or Eye, is sometimes hardly discernible, as in the Canna; but frequently it is conspicuous, as in the Pea Family.

323. Seeds are easily dissected, as a rule; no implements are needed for this purpose except a careful eye, patient fingers, and a needle, pin, or pocket-knife. The study of their parts is the most important as well as the most interesting branch of botanical science.

LESSON XXVII.

THE FRUIT—DEHISCENT FRUITS: PODS.

324–326. Fruits defined. 327. Pod. 328. Legume. 329. Loment. 330. Follicle. 331. Boll, or Capsule. 332. Pyxis, Pyxidium. 333. Silique. 334. Silicle. 335–341. Dehiscence.

324. The Fruit is the ripened *spore* (Cryptogamia), *seed* (Gymnosperms), or *ovary* (Angiosperms), with all other parts of the flower adherent to it. Fruits are: *I. Dry* when the pericarp has no pulp: Pea-pod; *II. Fleshy* when it has pulp: Melon, Peach; *III. Dehiscent* when it opens: Pea-pod; *IV. Indehiscent* when it remains closed: Melon, Peach.

325. A Simple Fruit is the product of a single flower: Pea, Peach. *A Multiple Fruit* is the product of an inflorescence: Mulberry, Pine-apple.

326. Simple Fruits are classed as: *I. Pods*, usually dehiscent; *II. Nuts, Drupes, Berries*, usually indehiscent.

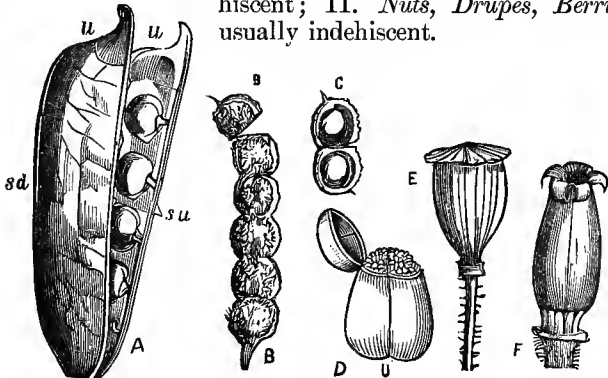


FIG. 197.—A, legume of Pea (*Pisum sativum*): *sd*, dorsal suture; *su*, ventral suture; *u, u*, valves. B, loment of *Hedysarum coronarium*, dehiscence first circumscissile; C, then valvular and sutural. D, pyxidium of *Hyoscyamus niger*. E, boll of Poppy (*Papaver Rhæas*). F, boll of Corn Cockle (*Agrostemma Githago*).

DEHISCENT FRUITS: PODS.

327. A Pod is a dry dehiscent pericarp, one- or many-celled, one- or many-seeded. Pods are thus classed:



FIG. 198.—Tonka Bean (*Dipteryx odorata*); fl., pod, calyx.

strictions, called *joints*, which divide it into 1-seeded closed cells (Fig. 197, B); the cells first separate transversely, and then open by both sutures (C), like the legume.

330. A *Follicle* is the fruit of an apocarpous ovary, and opens by one suture only, as in the Columbine (Fig.

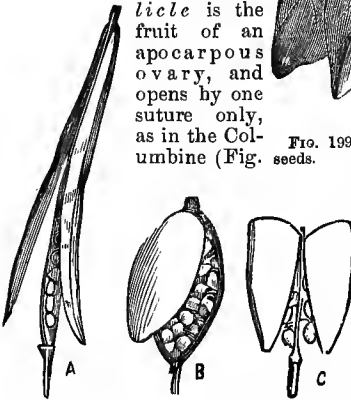


FIG. 200.—A, silique of Wall-flower (*Cheiranthus Cheiri*). B, silicle of *Erophila*; X. C, do. of Shepherd's-Purse (*Capsella Bursa-pastoris*); X.

328. A *Legume* (the true pod or cod) is the fruit of a monocarpous ovary, usually many-seeded and opening by both sutures: Pea (Fig. 197, A).

Exceptions: The cod of the Sophora is indehiscent; the cod of the Tonka Bean (Fig. 198) is indehiscent, 1-seeded, and fleshy, imitating a drupe. The cods of the Bush Clover (*Lespedeza*) are similar, but dry, imitating akaines.

329. A *Loment* is a legume or cod with false dissepiments or con-

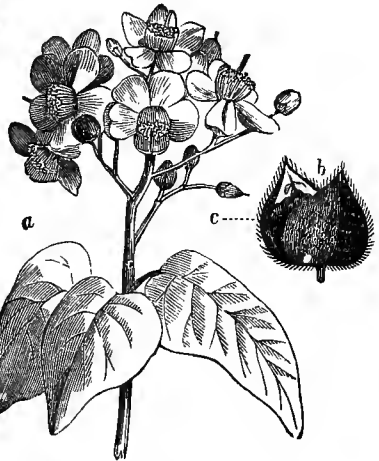


FIG. 199.—a, Arnotto (*Bixa Orellana*); b, boll; c, seeds.

9, 4), the Dogbanes (Fig. 145), and the Milkweeds, in which the follicles open by the ventral suture; and the Magnolia (Fig. 133, B), in which they open by the dorsal suture.

331. A *Boll*, or *Capsule*, is the fruit of a syncarpous ovary: it may retain all its cells, like the Cotton (Fig. 10) and Narcissus (Fig. 202); or be 1-celled, like the Corn Cockle (Fig. 197, F) and Brazil-nut

(Fig. 201), which have central placentation, and the Arnotto (Fig. 199) and the Violet (Fig. 204, E), which have parietal placentation.

332. A *Pyxis* or *Pyxidium* (Gr. *pyxis*, *pyxido*, box) is a capsule which opens by circumscissile dehiscence, the upper part lifting like a lid (L. *operculum*), as in the Henbane (Fig. 197, D), the Monkey-pot (Fig. 156), and the Plantain.

333. A *Siliqua* is a long, slender capsule, 2-valved, with parietal placentæ, and opening from bottom to top. It is 1-celled in the Celandine; in Cruciferæ it is 2-celled by a false septum (Fig. 200, A), called a *Replum* (L.

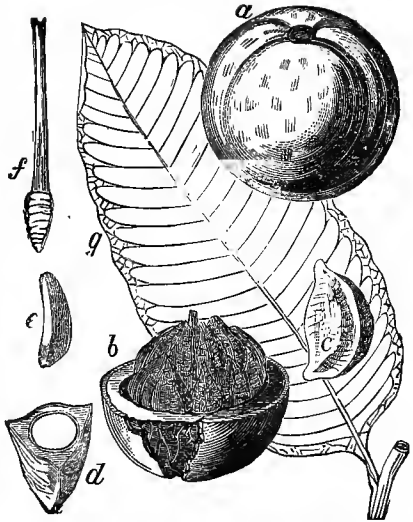


FIG. 201.—a, boll of Brazil-nut (*Bertholletia excelsa*), with large pore at top; b, same, sawed in half, showing ada. and central columnar placenta; c, a seed the ac-called nut; d, same, cut transversely, showing the thick tegmen and testa and the creamy embryo or kernel; e, embryo removed; f, placenta removed; g, leaf.



FIG. 202.—A, boll of *Narcissus Tazzetta*. B, diagram of same.

door-case); in both cases the seed-bearing placentæ persist.

334. A *Silicle* is a short, broad siliqua. Its valves are parallel to the broad replum, as in the Satin-Flower and the Erophila

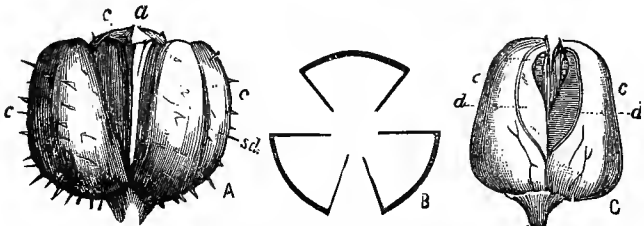


FIG. 203.—A, boll of Caator-Oil Plant (*Ricinus communis*); 3 cocci, with a columella, or gynobase. B, diagram of same. C, boll of Foxglove (*Digitalis purpurea*); 2-celled.

(Fig. 200, B), or keeled and pouch-like, with a narrow replum, as in

the Shepherd's-Purse (Fig. 200, C), which gets its name from its resemblance to a Scotch shepherd's sporran.

335. Dehiscence is Circumscissile, Porous, and Valvular.

336. Circumscissile dehiscence gives us the first opening of the loment (Fig. 197, B). It gives us the pyxidium: here the ovary may be free (Fig. 197, D), with its upper part cut off as a lid; or adherent (Fig. 156). In the Monkey-pot the ovary is more than half adherent to the calyx, forming the pot; its upper part has an epigynous disk which forms the lid. *Porous* dehiscence is effected by pores or small openings at the top of the boll, which otherwise remains closed. In the Poppy (Fig. 197, E) the pores are just beneath the broad, sessile, persistent stigma. In the Brazil-nut (Fig. 201, a) the large sessile stigma falls off, leaving a pore, through which the germinating seeds send their first roots; but for this the boll would be indehiscent and classed as a nut.

337. Valvular dehiscence is always vertical; it is the most common mode. It has four expressions: *Loculicidal*, *Septicidal*, *Septifragal*, and *Sutural*.

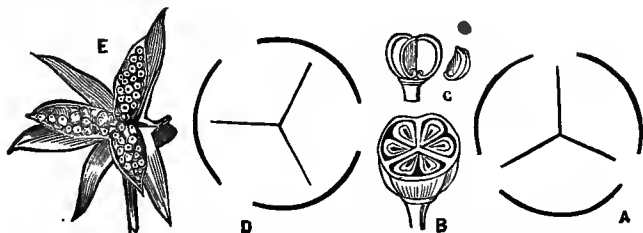


FIG. 204.—A, diagram of *Pharbitis hispida*. B, boll of same, trans. sec. C, dissepiments and seed. D, diagram of Heart's-ease (*Viola tricolor*). E, boll of same.

338. *Loculicidal* (*L. locus*, cell; *cædo*, I cut). Here each carpel opens at the dorsal suture, thus *cutting into the cell*; as in the Narcissus (Fig. 202), the Lily, the Okra, and Cotton.

339. *Septicidal* (*L. septum*, partition). Here the dissepiments separate (are *cut apart*, as it were), leaving each carpel or cell closed. Each cell then opens either by the dorsal suture, as in the Castor-Oil Plant (Fig. 203, A), or by the ventral suture, as in the Foxglove (Fig. 203, C).

340. *Septifragal* (*L. frango*, I break). This is a modification either of the loculicidal or of the septicidal mode. Here the valves break away from the partitions. Jussieu compares this mode to the rents which sometimes occur in our garments; the seam does not rip, but the cloth tears away on each side of the seam. The Morning-Glories (Fig. 204, A, B, C) show the septifragal modification of the septicidal mode; the Violets (Fig. 204, D, E) show the septifragal modification of the loculicidal mode.

341. *Sutural* (dehiscence by the sutures) is the common mode, and usually occurs at the ventral suture, as in the Pea (Fig. 5, e).

LESSON XXVIII.

INDEHISCENT FRUITS: NUTS, DRUPES, BERRIES.

342-349. Nuts. 350. Brazil-nut. 351. Drupes. 352-355. Berries. 356. Apocarpous Berries. 357. Anthocarpous Fruits. 358. Multiple Fruits. 359. Artichoke, Strobilum.

342. Nuts.—A Nut is a dry, indehiscent pericarp, usually 1-celled and 1-seeded. Nuts are classed as follows:

343. The *Akaine* (85) and the *Caryopsis* (82), already described. The apocarpous nutlets of the Rose, Strawberry, and Buttercup are akaines.

344. The *Coccus* (277) and the *Cremocarp* (278), described.

345. The *Cypselæ* (Gr. *kypselis*, cavity, box), an akaine with an adherent calyx-tube. It characterizes the Compositæ (Fig. 142, b).

346. The *Glans* or *Gland* (*L. glans, glandis*, name of



FIG. 205.—Sycamore Maple (*Acer Pseudo-Platanus*); samara and separate ♂ fl.

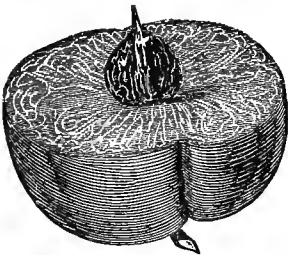


FIG. 206.—Trans. sec. of a Peach (*Prunus Persica*).

the acorn and chestnut), the fruit of a syncarpous ovary, 2- to 6-celled, with 1 or 2 ovules in each cell, but which becomes 1-celled and 1-seeded at maturity, and which has an adherent calyx. The Acorn, Chestnut, and Filbert are examples.

347. The *Regma*, described (277).

348. The *Samara*, the winged fruit of a free syncarpous ovary,

which becomes 1-celled and 1-seeded at maturity. In the Maple (Fig. 205) each fruit has two samaræ united at base. In the Ash there is but one to each flower; its long wing gives it the name *languette* (little tongue, Fr.). In the Ailanthus and the Elm the samara is winged all around.

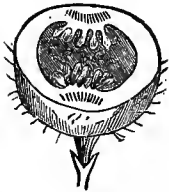


FIG. 207.—Trans. sec. of Gooseberry (*Ribes Grossularia*).

349. The *Utricle*, an akaine with an inflated pericarp, as in the Pigweed.

350. The Brazil-nut (Fig. 201) is usually classed as a nut; but it is many-seeded and has a large pore at top.

pericarp (called

351. **Drupes.**—The drupe (Gr. *druppa*, an over-ripe olive) is a fruit with an outer pericarp, or stone (called *Endocarp*, or *Putamen*). It may be monocarpous (Peach) or syncarpous (Olive); free, as in these, or with adherent calyx, as in the Walnut. It usually becomes 1-celled and 1-seeded at maturity. When the epicarp is fleshy, as in the Peach (Fig. 206), it is called *Sarcocarp* (Gr. *sarx*, flesh).

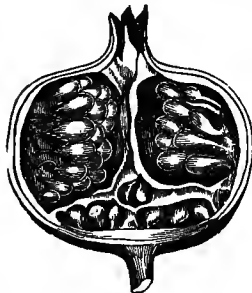


FIG. 208.—Vert. sec. of Pomegranate (*Punica granatum*).

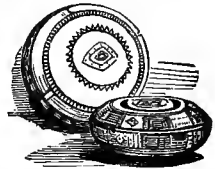


FIG. 209.—Carved Calabashes (fruit of *Crescentia Cujele*).

The Coconut is a drupe with a fibrous epicarp.

352. **Berries.**—The *Berry* is an indehiscent fleshy fruit (rarely dehiscent, rarely dry) from an ovary usually with parietal placentation, and containing one or many ligneous or bony seeds; as in the Gooseberry (Fig. 207), which is from an adherent ovary, and

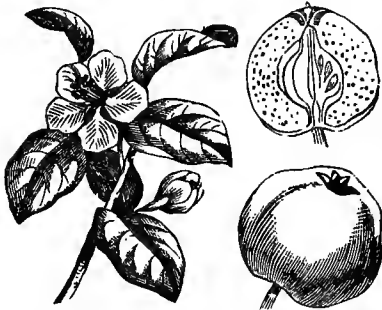


FIG. 210.—Quince (*Cydonia vulgaris*); fr. whole and in vert. sec.

the Egg-plant (Fig. 158), which is from a free ovary.

The Red Pepper is a dry, inflated berry; the Nutmeg (Fig. 196) is a



FIG. 211.—Dog-rose (*Rosa canina*):
a, hip cut open; b, separate akaine.



FIG. 212.—Pine-apple (*Ananassa sativa*).

fleshy, dehiscent, one-seeded berry. The Pomegranate (Fig. 208) is a dry berry, from an adherent ovary, with two sets of cells; the lower set has three cells with central placentation; the upper set five to seven cells with parietal placentation; the cells many-seeded; the seeds baccate, or berry-like, with a succulent testa.

353. *The Hesperidium* is the fleshy berry which characterizes the Orange, Lemon, Citron, etc. (Fig. 127). It is so called because it is believed that these fruits are the fabled golden apples of the Hesperides.

354. *The Pepo* (Gr. *pepon*, soft, mellow) is a berry with a succulent interior and fleshy rind, as in the Melon and Cucumber, or with a fibrous interior and woody rind, as in the Gourd. It characterizes the Melon Family. The Calabash (Fig. 209) is a fleshy berry with a hard, gourd-like rind; it is the fruit of a tree about the size of the Apple-tree; the hard shell of the fruit, a foot in diameter, is used for various utensils, and often beautifully carved, by the natives of tropical America.

355. *The Pome* (L. *pomum*, apple, etc.) is a fleshy berry with from 2 to 5 horny cells, each cell with 2 or more seeds, as in the Quince (Fig. 210), the Apple, etc. The edible part is the adherent calyx, which becomes fleshy in ripening; the core is the true pericarp. The *Haw* is a small pome with 1 to 5 bony, 1-seeded cells, resembling akaines, and called *pyrenes* (L. *pyren*, stone); it gives name to the Hawthorns. The *Hip* is a hollow pome with many separate akaines on the torus which lines its fleshy calyx-tube; it belongs to the Rose (Fig. 211).

356. *Apocarpous berries*.—The Strawberry has a fleshy torus, with separate akaines fixed on its surface. The Raspberry consists of many fleshy drupelets (little drupes) lightly cohering together, but separable

from the dry, conical torus. The Blackberry has its drupelets and torus united, and both edible.

357. Anthocarpous fruits.—A part of the flower not



FIG. 213.—Breadfruit (*Artocarpus incisa*); with 2 heads of ♀ fls. and 1 catkin of ♂ fls.

which are the product of an inflorescence.

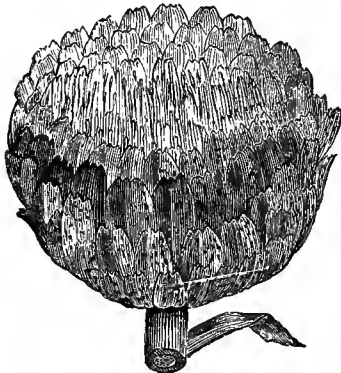


FIG. 214.—Hd. of Artichoke (*Cynara Scolymus*).

where it is indigenous. The fruit is a head of female (fertile) flowers. The Mulberry is the same, except that here the flowers are in a raceme. It is called *Sorosis* in old botanies, from the Gr. *soros*, a heap; but this

adherent to the ovary sometimes assists in forming the fruit. In the Wintergreen (*Gaultheria*) the calyx becomes accrescent and berry-like. The same thing occurs in the Oleasters (*Elæagnaceæ*), which furnish the Buffalo-berry, Silverberry, and Sea-Buckthorn. Such single fruits are termed *anthocarpous*, or flower-fruited.

We are thus led to

358. Multiple fruits,

which are the product of an inflorescence. They include the galbule (Fig. 45) and pine-cone (Fig. 46); the Pine-apple (Fig. 212), which in its wild state runs up to a spike of flowers, producing seeds; the Fig (Fig. 140), which is called *Syconus*; the Bois d'Arc, and the Breadfruit (Fig. 213).

The Breadfruit often weighs 50 pounds, and is a foot in diameter. It is prepared in more than a dozen ways for food, and is the chief sustenance of the natives of the South Sea Islands and Southern Asia,

word is in universal use as the name of the spore-case (*Sorus*) of the Ferns, and is no longer applied elsewhere.

359. *The Artichoke* (Fig. 214) is the true *Strobilus* (L. artichoke) of the ancients; the term, changed to *strobilum*, is now applied to the pine-cone and the fruit of the Hop. The Artichoke fruit consists of the fleshy scales of the involucre and the receptacle. The florets themselves are dangerously inedible, on account of their bristles; they form what is vulgarly called the "choke."

PART THIRD.—PHYTOTOMY, OR PLANT ANATOMY.

LESSON XXIX.

CELLS—FIBRES—VESSELS.

360. Tissues. 361. Osmose. 362. Spaces. 363. Cell-shapes; 364. Cell-sizes; 365. Cell-markings. 366. Cellular tissue. 367. Fibrous tissue. 368. Vascular tissue. 369. Laticiferous Vessels. 370. Tissue-Systems.

360. Tissues.—All plants are essentially the same in material structure; the cells, however, vary in size, shape, texture, and arrangement. The first cells of a phanerogam (Fig. 215, B) are identical with the Red Snow (Fig. 11); but the Red Snow never rises above the condition of a single cell; whereas the higher plants multiply their cells indefinitely and combine them into tissues, which are called *Cellular*, *Fibrous*, and *Vascular*.

361. Osmose.—All cell-walls are closed in living tissues; there is no opening from one cell to another; yet the sap and all the juices of the plant flow through them under the law called *Osmose* (Gr.). This is the mutual attraction of two fluids of different densities, by which each passes through a separating membrane until both acquire the same density.

362. The Spaces between the cells, when small and irregular, are called *Intercellular Spaces* (Fig. 215, A). When large, they are called *Intercellular Passages*; also *Lacunæ*, from the Gr. *lakos*, a hollow; *L. lacus*, a lake (Fig. 215, D). Their chief function is air-circulation; they communicate with the outer air through the pores of the bark and the leaves.

363. Cell-Shapes are various; each plant being always true to its own types. In the Elder and Water Crowfoot (Fig. 215, A, D) the cells are *dodecahedral*—12-sided; in the Beet (B) they are *hexagonal*; in the Bean (C) they are *ramose* (branching) and *stellate* (star-shaped). The cotton of the Cotton-seed (Fig. 216),

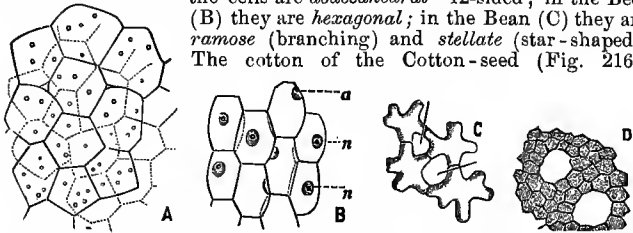


FIG. 215.—Cells: A, Elder pith (*Sambucus nigra*). B, young cells of Beet (*Beta vulgaris*): n, n, n, nuclei. * C, Bean (*Phaseolus vulgaris*). D, Water Crowfoot (*Ranunculus aquatilis*).

which gives us the most important staple of commerce, consists of long, tubular hairs, each hair a single cell, which becomes flattened and twisted as it ripens, and thus adapted for spinning.

364. Cell-sizes vary also. The usual size is $\frac{1}{200}$ to $\frac{1}{300}$ of an inch in diameter. The Elder cell is $\frac{1}{200}$ of an inch; that of the Cork only $\frac{1}{1000}$ of an inch.

365. Cell-markings.—The young cell at first has a wall of even thickness. As it grows, it deposits an inner layer, which, however, is interrupted, leaving thin places, called *dots*; through these the fluids pass from cell to cell; the dot in one cell being complementary to the dot in the cell adjoining. Different deposits give different markings; so that we have *Dotted*, or *Punctate*, cells in the Elder (Fig. 217, A); *Rayed* and *Reticulate* cells in the Mistletoe (B); *Annular* cells in the



FIG. 216.—Apex of a cotton-seed (*Gossypium herbaceum*); $\times 30$ diameters; showing one long hair, the rest being removed. The fine down as seen on the seed in the cut is invisible to the naked eye.

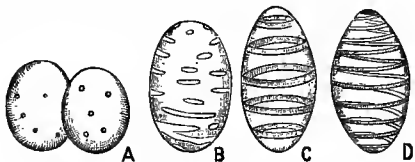


FIG. 217.—Cells: A, Elder pith (*Sambucus nigra*). B, C, Mistletoe (*Viscum album*). D, Orchis Morio.

same (C); *Spiral* cells in the Orchids (D). In the Conifers (Fig. 218) the thin places are circular and surrounded by a double ring; they are called *Pits*; and these are *Pitted* cells.

366. Cellular Tissue forms the pith of all young stems; the green pulp of leaves; the flesh of fruits; the fibrils of roots; the tender parts in all new growths. It is here called *Parenchyma* (Gr. *parenchio*, I pour in beside),

on account of its protoplasmic fluids. Thallogens consist almost entirely of cellular tissue; it abounds in Acrogens and in the lower Gymnogens (*Cycas*, etc.). It is prominent in the higher Gymnogens (*Pines*, etc.) and in the Endogens. In Exogens it is confined to the pith, bark, leaves, and tender growing parts.

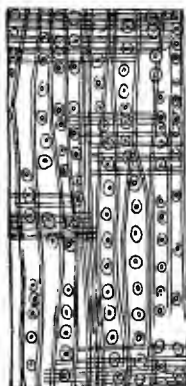


FIG. 218.—Coniferous wood; pitted cells.

367. Fibrous Tissue (*Prosenchyma*) forms the woody parts of plants. It is at first cellular; but the cells soon thicken by internal layers, and lengthen into firm, slender tubes with tapering ends, which usually overlap, making the wood tough and strong (Figs. 218, 219).

When the cells are thick and compact the wood is hard, as in the Oak, Hickory, etc. When they are thin and loosely arranged the wood is light, as in the Linden or Lime. When they cross one another variously the wood is difficult to split, as in the Sweet-Gum (*Liquidambar*).

368. Vascular Tissue (*L. vasculum*, a little vessel) consists of large wood-cells, either single or placed end to end, forming *Vessels*, which are also called *Ducts*. They make the wood porous. They are variously combined, and their markings by the internal deposit (which often takes the form of a thread, and is always without tube or channel) are the same as those of the cell.

In the Melon we see various marks made by this thread: (1) *Annular* (Fig. 220, B); (2) *Dotted* (*Porous, Punctate*), making what are called *Sieve-ducts* (Fig. 220, D); here the duct consists of several superimposed cells, making it moniliform; (3) *Spiral* (Fig. 220, A), in which two threads wind along the inner surface of the thin cell-wall. The Banana (in whose Order they abound) has twenty threads, forming a ribbon, which unroll altogether. Spiral ducts are called *Tracheæ* (*L. trachea*, windpipe).

The Fern (Fig. 220, C) has its threads parallel on the sides of the

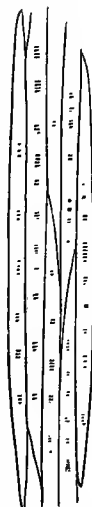


FIG. 219.—Fibrous tissue of Traveller's-Joy (*Olema-tis Vitifolia*).

vessel, like the rounds of a ladder; this vessel is called *Scalariform* (*L. scala*, ladder).

369. Laticiferous Vessels, or Ducts (*L. latex, laticis*, any kind of juice), are formed by lacunes (362). At first they are mere canals or passages between the cells (Fig. 215, A, C). Their office is the carrying of the special secretion of the plant,—turpentine in the Pine, milk in the Milkweed, etc.;

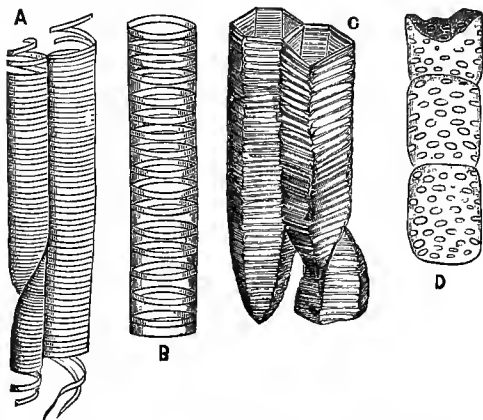


FIG. 220.—A, spiral vessel of Melon (*Cucumis Melo*). B, annular vessel of do. D, moniliform sieve-duct of do. (dotted, porous, punctate). C, scalariform vessel of Fern (*Pteris aquilina*).

after a little, however, the secretion often deposits a thin layer, which forms a wall, and the canal simulates a true vessel, or duct, which may be detached (Fig. 221, B).

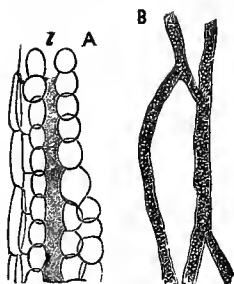


FIG. 221.—A, section of young Celandine (*Chelidonium majus*); showing the laticiferous canal *L*. B, same, elder; canal formed into a branching duct and detached from the plant.

370. Tissue-Systems.—Sachs proposes to systematize tissues as follows:

1. *Fundamental*, consisting of the unmodified tissues found in all except the lowest plants;
2. *Epidermal*, consisting of boundary-cells (surface of root, stem, leaf), with their appendages (hair, stomata, etc.);
3. *Fibro-vascular*, consisting of the thread-like masses abounding in the higher plants.

LESSON XXX.

ROOT—STEM.

371. Root. 372. The two cones. 373–375. Root-growth. 376. The Stem: Acrogenous; 377. Endogenous; 378. Exogenous. 379. Pith. 380. Wood-wedges; 381. Section. 382. Sap-wood, Heart-wood.



FIG. 222.—
Young root of
Seedling Maple
(*Acer campe-*
stris); *p*, pileo-
rhiza; *f*, fibrils;
X.

371. The Root has the same structure as the stem to which it belongs, and usually imitates it. In Endogens the radicle dies early; its place is supplied by adventitious roots springing around the collum or often above it. In the Pines the radicle persists, forming a long tap-root. In the Oaks and other Exogens it persists also, but becomes solvent. The root has no tracheæ nor medullary rays.

372. The higher plant consists of two opposed vegetative cones, one subterranean, the other superterranean; their point of union and departure is the collum, which is usually a mere mathematical point, having position without dimensions: the root, therefore, is a subterranean leafless tree; the stem a superterranean leafy one. It has been said that an exogenous tree, with all the needful conditions of climate and soil, would exhibit the perfect model; its root, rootlets, and fibrils exactly corresponding to the trunk, branches, and leaves; with this marked difference, however, that the root elongates only at the extremity of its branches, whereas the stem and its branches elongate throughout.

373. *The young root*, in all plants, is at first purely cellular. It is furnished with *fibrils* (Fig. 222, *f*), which are prolongations of the outermost cells, and whose office is to increase the absorbing surface. They are fine, soft, thin-walled, without openings or pores. As the root grows, wood-cells and vessels appear, and in the higher plants

(exogens) these take the place of the pith, which rarely persists. The outermost cells harden into a skin, called *Epidermis* (Gr. outer skin). New cells are constantly formed at the extremity of the root; through these absorption is chiefly carried on, though the epidermis absorbs also. The new cells are most active in spring and summer, when the plant is growing. In winter, when the plant rests, they rest also; the fibrils die with the leaves, to be renewed with them again in the spring. The tips of the fibrils—called *Spongioles*—have no epidermis.

374. *The root* grows by extension at its extremity only, thus penetrating the soil sometimes to a great depth. Its growing force is tremendous. Rocks are often split asunder by the energy of its tiny cells; it blasts and undermines with a patient skill surpassing that of the most accomplished engineer. This little sapper and miner is provided with an armor of thick, strong cells, called a *Pileorhiza* (Gr. root-cap), which it uses not only as a weapon of defence, but as a tool for excavations (Fig. 222, *p*).

375. The long fibrous roots of the Blue-grass pierce through stiff clay to a depth of several feet, making this the most valuable of meadow-grasses, on account not only of its sweetness, but of its perennial habit. The winged seed of the Mahogany, falling among rocks, sprouts in some fissure and grows to such size and with such strength that the stone is rent as if by gunpowder. Thus anchored, and feeding almost literally upon air, the tiny plant in a few years becomes the magnificent and valuable tree.

376. *The Stem.*—*Acrogenous stems*, as we know, are chiefly cellular; they have a few wood-bundles in a broken or sometimes in a continuous circle near the circumference (Fig. 42); in these woody tissues occur the scalariform ducts (Fig. 220, C). They are of little economic use to man, except in their fossil form of coal; but as teachers they are of the highest value, showing the gradual development in the scale of organic life. *Gymnogenous stems* are partially exogenous (81).

377. *Endogenous stems* (Fig. 61) are composed of cellular tissue interspersed with wood-bundles. The growth here, as in all other plants, is at first entirely cellular; wood-fibres, however, are soon developed (Fig. 223); they are formed in the leaf, and carried down, first inward and then outward across the older wood-bundles, which are thus pushed to the circumference, where they make a hard and usually inseparable rind. This rind serves as bark, though it is really wood of the most durable quality, as in the palm, bamboo, and cane. The central part sometimes remains cellular, forming a cylinder; but it is not strictly pith, because it has neither medullary sheath nor rays. As the stem



FIG. 223.—
Stem of *Iris germanica*, cut vertically.

grows, the wood-bundles nearest this central tissue often cohere, and the central tissue disappears, making the stem hollow, as in the grasses. Sometimes it persists at certain distances, making joints, or stories, as it were, to strengthen the walls of this aerial house, as in the cane and bamboo.

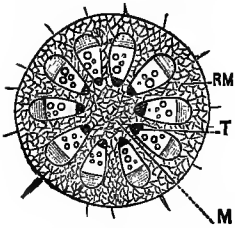


FIG. 224.—Horizontal section of young Melon stalk (*Cucumis Melo*): M, medulla, or pith; RM, medullary rays; T, tracheæ, or spiral vessels, forming the medullary sheath. The points along the circumference are hairs on the epidermis.

inner portions of the wood-wedges are the tracheæ (T); they become the *medullary sheath*; these tracheæ, which are the spiral vessels (Fig. 220, A), are usually found nowhere else in the plant. They are the first vascular tissue in the stem. The dark outer portions of the wedges are the fibrous tissue of the inner bark. As the stem grows, the wood-wedges enlarge, their tracheæ form a sheath around the pith,

and the medullary rays contract into narrower lines, as in Fig. 81, but still keep up communication between the pith and the bark.

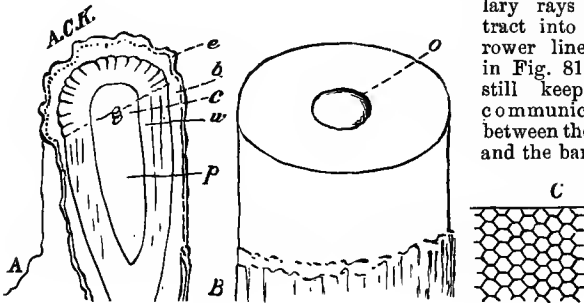


FIG. 225.—A, section of stem of Rice-paper-tree (*Fatsia papyrifera*): p, pith; central cavity loosely filled with large, round cells, of which 3 are seen; c, large central pith-cells; w, wood; b, bark; e, epidermis. B, same, pith separated from wood, showing a partial cavity in the centre (o) filled with large cells. C, a slice of the pith as it appears in the paper.

379. *The Pith* in all growing parts is full of juices. As the parts mature, the pith is emptied; it becomes dry and light, containing nothing but air, and is of no further use

to the plant. In many trees it is torn into shreds or obliterated, making them hollow. In others it persists, as in the Rice-paper shrub of China (Fig. 225); here it is white, abundant, firm, and durable. Its lovely cells are plainly discernible in the paper, which is made by cutting the pith into very thin slices.

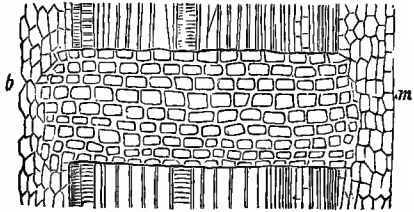


FIG. 226.—Radiant section of Maple wood (*Acer campestre*), 1 year old, showing the medullary ray crossing the stem from pith (*m*) to bark (*b*).

In some Aralias, and in the Pretty-by-nights, there are a few wood-bundles in the pith; but these are anomalous instances.

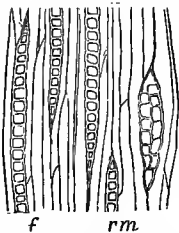


FIG. 227.—Same, tangential section; pith and bark removed; *f*, wood-fibre; *rm*, medullary rays.

380. The Wood-wedges are deposited in circles, usually one circle each year in cold climates; so that we can tell the age of the felled tree by the number of its wood-circles. In warm climates two or more circles are often deposited in a year; and in many garden vegetables—notably in the beet—

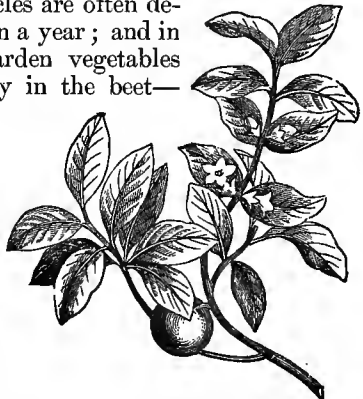


FIG. 228.—Ebony (*Diospyros Ebenum*).

in a n y circles are formed in a few weeks in the root, which, as we know, has the same growth as the stem. In the tropics the circles are not so well defined, because the stems have no winter rest from continual growth. The wood of the tree-cactus forms a continuous stratum without rings, though the tree lives many years. In the Cycas the wood-rings are few; yet this is one of the most long-lived plants.

381. If we make a radiant section of the wood—that is, a vertical section in the same plane with the medullary ray—the ray will be fully displayed with its shining cells (Fig. 226). These form the *Silver grain* of Maple, Oak, etc. They are called *muriform tissue* (*L. murus*, wall), because they resemble bricks in a wall. If we make a tangential section (*L. tangens*, touching)—that is, a vertical section which touches or nearly cuts across the rays—we shall see the wood as it is usually split or sawed (Fig. 227), showing the vertical wood-fibres, with glimpses of the rays.

382. In the young stem all the wood-cells carry sap, and are therefore called *Sapwood*, or *Whitewood* (*L. alburnum*), on account of the usual color. But after a few years the inner cells near the centre are thickened and hardened by solid deposits, and become *Heartwood* (*L. duramen*, hardening). These deposits are variously colored, giving to each stem its characteristic hue,—red to the mahogany, cedar, and cherry; green to the laburnum; brown to the locust and walnut; black to the rosewood and ebony (Fig. 228). The grain of the ebony is so fine that it is not discernible when the wood is polished. The Ebony family (which includes the Persimmon) furnishes many valuable woods as well as fruits.

LESSON XXXI.

BARK—LEAF.

383–389. Bark. 390. Epidermis. 391–393. Leaf. 394. Respiration. 395. Cuticle.

383. The **Bark** is separated from the wood—and at the same time kept in communication with it—by a thin semi-fluid tissue (Fig. 229, *ca*), called the *Cambium Layer* (*L. cambio*, I exchange). Of this cambium we shall learn more in the next Lesson. There are three kinds of bark (Fig. 229):

1. *Liber*, or inner bark (*Gr. endophlœum*);
2. *Green*, or middle bark (*mesophlœum*);
3. *Cortex* (*Suber*), or outer bark (*epiphlœum*).

384. **Liber.**—Liber-cells are of two kinds:

1. *Proper liber-cells*, which consist of parenchyma (young

cellular tissue). They lie next the cambium, and are active in the work of circulation. They belong to the pith-system.

2. *Fibrous cells*, sometimes called *Bast-cells*, though bast is merely a German word meaning the same thing. They belong to the wood-system. In gymnogens, as we know (81), there is little difference between the wood and the bark, though the stem is exogenous in structure. In the fully-developed exogens, however, the liber is composed of fibres much longer, finer, and stronger than those of the wood; they are also of dazzling whiteness and extreme flexibility.

The liber abounds in hemp and flax, furnishing the well-known staples. The liber of the linden, or lime-tree (sometimes called bass-wood, a corruption of bast), is used to make Russia matting. The lace-bark-tree of the West Indies (Fig. 230) gets its names from its abundant and exquisitely fine liber, already woven into lace in the

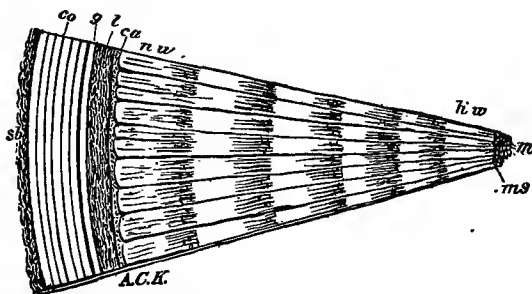


FIG. 229.—Transverse section of part of a trunk of Cork Oak (*Quercus Suber*), 6 years old; showing 6 layers of wood and 6 layers of cork: *m*, medulla, or pith; *ms*, medullary sheath; *hw*, heartwood; *nw*, new wood, or sapwood; *ca*, cambium layer; *l*, liber; *g*, green bark; *co*, corky bark, in 6 layers, 1 for each year; *sb*, surface-bark, consisting of broken cork-flakes.

tree, which needs only to be removed and made up into shapes. It is more durable than lace, and more easily laundried. Our leatherwood (*Dirca*) belongs to the same Order; its liber is made into thongs. These fibrous liber-cells are not essential to the life of the plant. In the beech-bark few fibrous cells are produced after the first year. In the linden and lace-bark they continue, increasing each year by a layer applied to the inner surface of the older liber. They grow longitudinally, like the wood.

385. Green, or Middle, Bark (Fig. 229, *g*) is purely cellular, full of parenchyma, and abounding in chlorophyl. It does not increase after the first year, and is finally obliterated.

386. Cortex (Cork), or Outer, Bark is purely cellular,

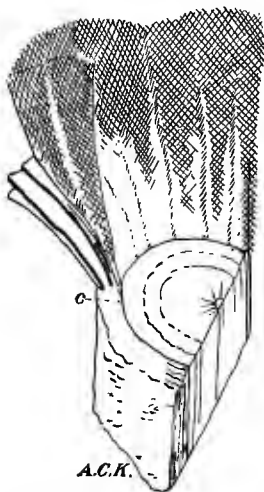


FIG. 230.—Sections of a stem of the Lace-bark-tree (*Lagetta linearia*) of the West Indies, showing one of the lace-like layers of the liber, the outer layers still unopened and cut squarely off; c, cambium layer. Corky bark (outer) very thin and smooth.

consisting of empty cells, which are small, cubical, flattened, usually colorless, and always impervious to water. Ordinarily, it increases for a few years only; but in the Cork Oak of Spain (Fig. 229) it continues to grow from year to year, and is highly developed, furnishing the staple which gives its name to the tree.

387. Cork is first cut when the tree is 25 years old (Frontispiece, Lesson I.). The tree is then left untouched for 8 or 10 years, for the cork to be renewed, when the harvest or cutting is repeated. This process continues at like intervals for a hundred and fifty years, the trees producing good cork for that period. The cuttings do not injure the trees, because the living parts are not disturbed.

388. Surface-bark.—When the corky bark ceases to grow its cells are no longer active. The continued growth of the wood and liber therefore stretches the corky bark until it splits into seams, and forms a surface-bark which is characteristic in each species. In the oak and pine the seams are longitudinal and the cork persists, its surface becoming blackened. In the plane (sycamore) and birch the cork splits both longitudinally and horizontally, falling off in plates.

389. The bark sometimes interrupts the usual form of the wood. In the Cross-stem (*Bignonia capreolata*) three or four wood-circles are deposited, and then an extraordinary development of cellular tissue takes place in the proper liber-cells next to the cambium; this tissue usurps the wedge-form itself, and throws the wood-layers into four rectilinear shapes, so that the wood, in transverse section, has the form of a Greek cross, from which the stem gets its common name. In spring the bark is easily removed, leaving the four angles finely exhibited.

390. The Epidermis, or skin, is a tissue of thin, empty cells investing every part of the higher plants, except the spongioles of roots and the stigma of the pistil. The Thallogens, and submerged water-plants among phanerogams, have no epidermis.

In the young cherry stem the epidermis is a colorless membrane which readily peels off in transverse rings. On old trunks it is displaced by the corky bark. Its function is to prevent too rapid evaporation of the juices of the plant.

391. The Leaf has its origin in both wood and bark; the fibres of which, vertical in the stem, turn outward horizontally in the leaf, forming the ribs and veins.

These are beautifully seen in skeleton leaves, from which the pulp has been removed by maceration. In endogenous leaves the long, parallel veins sometimes have cross-veins, or venules. In the Lattice-leaf of Madagascar (Fig. 231) the pulp, or parenchyma, is often wanting between the venules; this handsome water-plant (submerged) gets its specific name *fenestralis* (L. *fenestra*, window) from this circumstance.

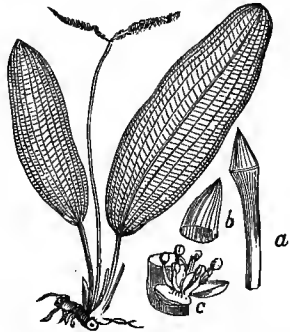


FIG. 231.—Lattice-leaf (*Ouvirandra fenestralis*) in flower; lf. a foot long. *a*, young fl., spike enclosed in a conical spathe; *b*, spathe removed; *c*, single fl. on part of spike.

392. Leaf-pulp is an expansion of the green (or middle)

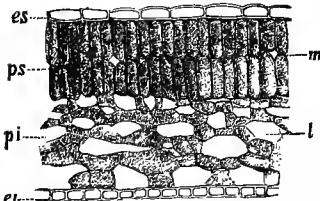


FIG. 232.—Vert. sec. of lily leaf (*Lilium candidum*), enlarged: *es*, epidermis of upper surface; *ei*, of under surface; *ps*, upper, *pi*, lower, parenchyma; *m*, intercellular spaces; *l*, lacunes.

bark. It is usually in two layers (Fig. 232); the upper (*ps*) faces the sky; the lower (*pi*) faces the earth.

The cells of the upper layer stand endwise, closely compacted; those of the lower face lie lengthwise, loosely arranged, with many air-chambers between them, which communicate with the epidermis and inhale air through its stomata (Fig. 233). In submerged water-plants there is no epidermis, and for the slight respiration they need large lacunes (Fig. 215, D) are provided.

393. Leaf-epidermis.—The cells of the leaf-epidermis (Fig. 233) are flattened, coherent by their edges, and variously shaped. Here and there between the walls of two adjacent cells small openings appear (Fig. 233, *s, s*); these are the stomata.

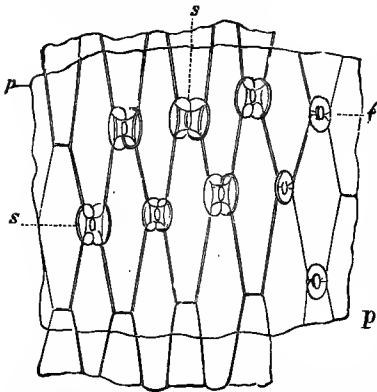


FIG. 233.—Epidermis of lf. of Flower-de luce (*Iris germanica*): *s, s*, stomata; *p, p*, cuticle, or pellicle; *f*, opening in the cuticle, corresponding to the stomata of the epidermis, which has been removed.

seen them in the Acrogens (Fig. 29). Thallogens.

394. The plant respire through the stomata as animals do through the pores of the skin, exhaling certain elements and inhaling others.

Each stoma consists of two oblong cells, which have been compared to lips; they open or shut the orifice, thus controlling respiration. These tiny door-keepers do their work with exemplary fidelity; opening wide when the air is moist, that inhalation may be promoted, but closing promptly when it is dry, lest the precious juices should be consumed by drought. The stomata, like the air-chambers, are most abundant on the under surface of the leaf. The vine has none on its upper face, and 13,000 to the square inch on its lower one. The lilac has few on its upper face, and 160,000 to the square inch on the lower. The mistletoe has nearly an equal number on each face,—200 to the square inch.

395. The Cuticle, or Pellicle (*L. pellicula*, little skin), is a thin membrane covering the epidermis (Fig. 233, *p, p*). It has no cells, but is a mere expansion of the cell-wall, and separable from it. It is pierced with little openings (*f*) corresponding to the stomata.

The stomata communicate with the air-chambers and lacunes (*l*) in the parenchyma, thus making direct connection between the plant and the open air and establishing thorough circulation from the topmost leaf of the tallest tree to the fibrils of its deepest root. We have already

There are no stomata in

PART FOURTH.—CHEMISTRY.

LESSON XXXII.

PHENOMENA OF GROWTH—CONSTITUENTS OF THE PLANT.

396. Active parts. 397, 398. Circulation. 399. Digestion. 400. Formed Material. 401. Camphor-trees. 402. Inorganic Constituents. 403. Tabasheer. 404. Raphides, Cystoliths. 405. Phosphorescent plants. 406, 407, Organic Constituents; Fibrine; 408. Cow-tree. 409. Food; 410, 411. Foods and Poisons. 412. Saprolegnia.

396. The active parts of an exogenous tree—which we take as the model plant—are: 1. The rootlets and their fibrils, which are organs of absorption; 2. The newest wood, the newest bark, and the cambium-layer, which are organs of circulation; 3. The leaves, which are organs of digestion.

397. Circulation.—The cambium-layer is the medium of communication between the wood and the bark. Its cells are filled with a mucilaginous juice, called Crude sap, or *Pabulum* (38), which is rich in protoplasm.

In temperate climates it is most abundant in spring; the cambium-cells are then so soft that the bark is easily separable from the wood. In the tropics the cells maintain an even habit throughout the year. The cambium-layer is the market-place of the plant, the great exchange, as its name implies. On the side next the wood it deposits new wood-fibres (Fig. 229, *wo*); on the side next the bark new bark fibres and cells (*l, g, co*). Here, in both wood and bark, the laticiferous vessels abound. Through these new cells, fibres, and vessels the sap circulates, ascending and descending; the ascending sap is the pabulum. At the extremities of the roots, stems, branches, and buds the cambium is called *primary*. If a ring be chopped around a tree-trunk, and deep enough to cut through the new bark, the cambium-layer,

and the new wood, the tree will die, because deprived of its circulation.

398. Acrogens and Endogens have no cambium-layer; being without differentiation into pith, wood, and bark, they do not need it. In annual exogenous stems, like the Melon, it is not fully organized; but in perennial ones it becomes a complicated zone, communicating with the bark-layers on the one hand, the wood-layers on the other.

399. Digestion.—The pabulum absorbed by the fibrils and roots is sent up to the leaves through the circulation just described. The leaves themselves absorb or inhale food also from the air; it is taken in through the stomata (Fig. 234, *s, s*). The fresh elements thus received enter the parenchyma, or pulp-cells (*pi, ps*), where they mingle with the elements brought up by the pabulum. Here all are subjected to the action of *sunlight and chlorophyl*, the substance which gives the green hue to leaves, and with which we became acquainted in the first living cell (37).

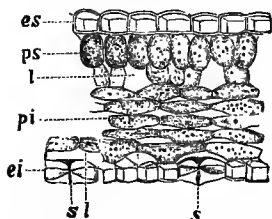


FIG. 234.—Vert. sec. of Balsamina lf. (*Impatiens Balsamina*): *es*, epidermia of upper surface; *ei*, of lower surface; *s, s*, stomata; *l, l*, lacunae; *pi*, parenchyma of lower surface; *ps*, of upper surface; \times .

These two agents are the chief factors in the work of digestion, which takes place in the parenchyma alone, and in this only when acted upon by sunlight. After digestion, the juices are sent down as *Elaborated sap*; but this sap does not pass through the vessels which carried up the pabulum; it goes through the bark-cells. As it passes it is distributed wherever it is needed, from stem to root; first on the under-surface of the leaf; then in the leaf-stalk; then in the liber; food in the young cells of incipient buds; a rich supply in the cambium; wood to the wood, bark to the bark. The remainder is taken down to the roots, where it lies dormant in cold climates through the winter, to be used as the base of operations in the spring. Thus the tree grows in height and size; the old wood pushed to the centre becomes heartwood; the old bark pushed to the circumference is split and furrowed, forming surface-bark.

400. Formed Material.—When the protoplasm has done its work of absorption, circulation, digestion, and deposit, it leaves the old cells and passes on, forming new ones, in which the same processes are carried forward. The com-

pleted cells, fibres, and vessels are no longer active; their builder has left them. They are now storehouses, technically called *Formed material*; this makes the greater part of all trees, including every part except the active cells, which are in and near the cambium and in the parenchyma.

401. Formed material stored up in the laticiferous vessels is finely exhibited in the Borneo camphor-trees. The best camphor is in the heartwood. It is found by making repeated incisions in the large, fine trunks of the older trees. When camphor is discovered, the tree is felled and cut into logs, which are carefully split by experts. The camphor is then removed with sharp instruments, the masses being often a foot and a half long and as thick as a man's arm. Valuable as it is, however, it seems a shame that so many noble trees should be sacrificed in the search for it when a good quality is furnished by less beautiful trees in other Orders.

402. Inorganic Constituents.—If we burn a plant, only a few ashes remain; all the other parts are reconverted into air and vapor. These ashes are mineral (inorganic); they consist of Potash, Soda (in marine plants), Silix, or Silica, Lime, Magnesia, Iron, Manganese, Sulphur, Phosphorus, Chlorine, and a few other elements, those in greater proportion being mentioned first in this list. But they do not enter into the real texture of the plant; and they never make more than 1 to 10 per cent. of its fabric. Many of these elements seem to be taken up by mere physical force (capillary attraction) into the cell, and are left incrustated there after its fluids have been consumed.

403. Yet the plant evidently likes certain of them, which are invariably found in it. To some plants they seem to be necessary, as chlorine to Buckwheat. Silix is abundant in the Grasses (giving strength to their slender stems), so that the rind, when split, often cuts the flesh like a knife. We have already seen how the Diatoms clothe themselves with it. *Tabasheer*, so prized as a remedy by Eastern physicians and so interesting to the chemist, is a secretion in the laticiferous vessels about the joints of the Indian Bamboo. It occurs in lustrous, pearl-colored masses, and is purely mineral, consisting of 70 parts of silica and 30 of potash and chalk. "It is indestructible by fire, resists all acids, unites by fusion with alkalis into a white, opaque mass, or into a permanent, transparent glass; and is again separable from these compounds, being unchanged by acids."—*Hogg*.

404. Besides the laticiferous vessels, special cells are found containing minerals which have crystallized in

them, the same mineral crystallizing differently, according to the tissue of the plant in which it is formed. These crystals are called *Raphides*

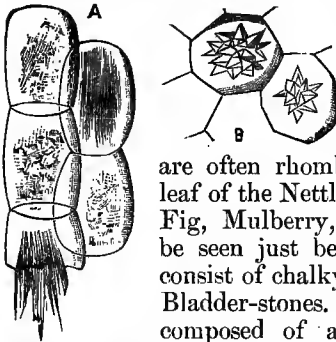


FIG. 235 — A, needle-shaped Raphides in two cells of Dock (*Rumex*), one cell open, with raphides escaping. B, rhomboidal raphides in cells of Beet (*Beta*).

(Gr. *raphis*, needle), on account of their usual shape (Fig. 235, A), though they are often rhomboidal (Fig. 235, B). If the leaf of the Nettle Family be examined—Hop, Fig, Mulberry, etc.—transparent spots will be seen just beneath the epidermis. These consist of chalky deposits, called *Cystoliths*, or Bladder-stones. Each cystolith (Fig. 236) is composed of a layer of crystals grouped “around a nucleus (*n*) formed at the expense of the cell-wall (*c*), which has been pulled aside, and which has lengthened into a delicate stem (*s*), from which the cystolith is suspended.”—*L. and D.* The dark cells below the dilated cell are normal cells filled with chlorophyl.

405. Phosphorescent Plants.—Many living plants contain *Phosphorus*, which is abundant in decaying organic matter. It is so combustible that it takes fire in the air, emitting a white smoke with the smell of garlic. It shines in the dark. At a temperature of 148° Fahrenheit it burns with a bright flame. The cryptogams abound in it, especially the Fungi and their allies, which have no chlorophyl; yellow being the color in which phosphorus is best developed. The Olive Mushroom (*Agaricus olearius*), which grows at the roots of olive-trees in Italy, shines so resplendently at night that the trees are lighted by it. The *Agaricus Gardneri* of Brazil is parasitic on the leaves of a palm, and glows like heaps of red-hot coals. The *Polyporus annosus* in the mines of Wales shines so brightly that ordinary print may be read by it. Sometimes the mycelium (55) is phosphorescent. Rev. M. J. Berkeley observed a mycelium under the bark of a log of timber which made the wood glow with a light like white heat, and which shone through five folds of paper. Phanerogams are also phosphorescent. The yellow lilies contain phosphorus. The Screw Pine is phosphorescent, especially at flowering-time; when the spatha bursts it emits flashes like miniature lightning, and which are considered electrical. Phosphorescence usually appears in the inflorescence, both in cryptogams

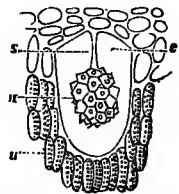


FIG. 236.—Part of India Rubber lf. (*Ficus elastica*): c, dilated cell with cystolith, n; s, stem; u, small surrounding cells.

and phanerogams, but is found in the vegetative parts. It is seen in the mycelium of Fungi; in the Euphorbias among phanerogams it is especially manifest. One of these—*E. phosphorea*—gets its specific name from this quality. The plant grows luxuriantly in the jungles of Brazil. Wild animals, hunted at night, break down the plants in their flight; the phosphorescent milky juice clings to their hides, which seem to drip streams of fire, giving the most weird character to the scene. The Sunflower Family is highly phosphorescent, notably the French and African Marigolds. So are the Evening Primroses, the Nasturtions (*Tropæolums*), and the Poppies. In all these, however, the glow is confined to the flowers, emitting mimic flashes or surrounding them with a soft halo. It is seen in its greatest brilliancy between sunset and midnight.

406. Organic Constituents. Cellulose.—In burning a plant we see 90 to 99 per cent. of its substance disappear, being reconverted into water (vapor) and air, out of which the embryo drew its first pabulum. We remember that the vegetal cell consists of cellulose and protoplasm (37), and that cellulose consists of water and carbon. Water is composed of Hydrogen and Oxygen; so that cellulose has three constituents,—Carbon, Hydrogen, and Oxygen; it is therefore called a *ternary compound*.

It gets its hydrogen and oxygen chiefly from the moisture which is absorbed by the roots, and these two elements are in the same proportion in cellulose as in water. The roots also absorb a little carbon, which exists in the water. The greater part of the carbon, however, is provided by the leaves, which inhale it in the air they breathe. It is in the form of carbonic acid gas (carbonic anhydride) both in water and in air. Hydrogen, oxygen, and carbon are inorganic; but the protoplasm in the leaf and in the green bark, aided by sunlight and chlorophyl, combines them, digests them, and converts them into the starch of wheat, the flesh of fruits, sugars, gums, resins, oils, etc.

407. Protoplasm (sometimes called *Proteine*, from Proteus, on account of its many changes of form).—Sugar and starch, though good as food, will not make animal flesh or muscle; and animals (which use organic food alone) must get the elements of flesh from the plant also. Nature provides for this need. Air consists of Oxygen and *Nitrogen*. In every thunder-storm the *Electricity* combines some of this nitrogen with the hydrogen in vapor or water, making *Ammonia*, which is also given out by decaying vegetal and animal matter. Ammonia is readily soluble in water; the rain washes it into the earth; young roots eagerly absorb

it; they appropriate its nitrogen, which enters the pabulum and is carried up to the leaves. There it is mixed with oxygen, hydrogen, and carbon; the four elements,—*Oxygen, Hydrogen, Carbon, Nitrogen*,—acted upon by sunlight and chlorophyl, form *Protoplasm*, which is a *quaternary compound*. It makes the *Caseine* in the curd of milk; *Gelatine* in bones; *Fibrine* in flesh and muscles. The *Gluten* in Wheat and the *Legumine* in Beans represent it; it gives their best value to our grains as food. Its quantity is usually small in proportion to the other constituents.



FIG. 237.—West Indian Papaw (*Carica Papaya*); plant in fruit, with separate ♂ and ♀ fls.

in the juices of the Papaya in great abundance, and has the property of making the toughest meats tender. The exhalations produce the same effect when meats are suspended from the tree or wrapped in its leaves. If old animals are fed on the fruit or leaves, their flesh becomes tender when cooked soon after slaughtering; left raw, however, it spoils rapidly. Still more remarkable is the Cow-tree of South America (Fig. 238), which yields milk of the same constituents as that of a cow, and of as good quality. It has the taste of sweet cream, and an agreeable, balsamic fragrance. A cheesy scum, like cream, rises on it, and in a few days it sours and putrefies like animal milk. The tree grows to the height of 100 feet, with a diameter of 6 feet, its shaft 60 to 70 feet long below the first branches. It forms great forests on the mountains near the sea-coast of Venezuela. The trees are milked daily, by incisions made in the

408. Fibrine was supposed to be exclusively an animal fabric until its discovery in the West Indian Papaya (Fig. 237) by the eminent French chemist Vauquelin. It exists



FIG. 238.—Cow-tree (*Galactodendron utile*).

bark. It flows most freely at sunrise, when the natives (with whom it forms a chief article of food) flock in troops to fill their bowls with it.

409. Food is usually stored up in the cell itself. *Fecula* (starch) is the chief ingredient; it occurs in the form of fine grains, called *granules*, which are characteristic in each plant, like the form of its cells (Fig. 239).



FIG. 239.—A, cell of Irish Potato (*Solanum tuberosum*), with many starch-grains. B, starch-grains of Wheat (*Triticum vulgare*). C, do. of Indian Corn (*Zea Mays*).



FIG. 240.—*Strychnos Nux-vomica*.

The pulp of the Nux-Vomica fruit (Fig. 240) is perfectly harmless,—birds devour it eagerly,—while the seeds contain the deadliest poison. The Sarsaparilla (Fig. 241) is a medicine or a poison in proportion to the quantity used.

411. The food of plants is the poison of animals. Carbonic acid gas, a necessary element in plant food, is destructive to animal life. Animals exhale it from their lungs, where it is formed by the union of the

410. Foods and Poisons.

—Plants differ not only in form and habit, but in the substances into which they transmute the same inorganic elements. The Deadly Nightshade and the Orange grow side by side, absorbing the same moisture, inhaling the same air; yet by some law still unexplained the juices of the Nightshade are turned to poisons, whilst those of the Orange become fragrant oils and delicious fruits. The same plant sometimes creates both foods and poisons.



FIG. 241.—Sarsaparilla (*Smilax papyracea*).

carbon in the blood with the oxygen in the air; and they inhale oxygen, which is vitally necessary to their support. Plants consume this animal poison and convert it into food for both plants and animals, whilst they give off quantities of the oxygen, which animals need. Plants therefore maintain the equilibrium of life: this is why parks and gardens with herbage and trees are so important to the health of cities.

412. The *Saprolegnia*—one of the lowest cryptogams—is a curious exception to this law of plant life. It absorbs oxygen, and is often parasitic on flies, which are thus destroyed for want of their proper food. It attacks young live fishes in their breeding-houses, and after killing them it flourishes on their remains as a *Saprophyte* (Gr. *sapros*, putrid). *Saprolegnia ferax* is easily procured: Fill a glass with water from a garden-tub, throw a dead fly in it, and the *Saprolegnia* will develop in a few days. The body of the fly will be covered with *hyaline* (nearly transparent) threads, radiating around it in the form of a zone. Under the microscope these threads are seen to be continuous, simple, or slightly branched. They have a motion similar to that of the hairs of phanerogams. They rapidly produce spores either by fission or fertilization,—the same plant often exhibiting both forms of reproduction.

LESSON XXXIII.

FORCES: PHYSICAL, CHEMICAL, VITAL, VOLUNTARY.

413. Physical and chemical forces. 414. Vital force; Cyclosis. 415. Special movements. 416. Sensitiveness. 417. Cunning; Sport. 418. Voluntary motion. 419. Sleep.

413. *Physical force* is prominent in absorption and circulation; *chemical force* in digestion. These we have considered.

414. *Vital Force. Cyclosis.*—But in the midst of the operations of these two forces we see still another power at work, which leads us back to the threshold of life, with its impenetrable secret, as jealously guarded here as in the cell of the Red Snow. If we take a many-celled hair from the

epidermis of the Spiderwort and place it under the microscope (Fig. 242) we shall see the protoplasm at work, going round and round each cell with a motion as vital as that in our own blood. This rotary motion is called *Cyclosis*, or *Intercellular Circulation*, because it is restricted to the cell, and also to distinguish it from sap circulation, which is ostensibly carried on by physical force alone. Yet the protoplasm guides and controls every movement, whether physical or chemical, with the skill of a master-builder. It not only creates, but sends to every part the needed materials and arranges them in their places. It carves the form of each leaf; it moulds the pollen-grains in the cells of the pollen-mothers; it makes the flower-palace for the pistil; it engenders the embryo which is to continue the family line.



FIG. 242.—Bit of epidermis from the calyx of Spiderwort (*Tradescantia virginica*): *e*, *e*, epidermis with small cells, one of them with a stoma; *s*; *p*, a long, jointed hair, each joint a cell; *n*, nucleus. The arrows indicate the direction of the circulation.

415. Special Movements of the plant as an individual.—If a Morning-Glory seed be planted with its radicle uppermost, in a dark cellar, where no light can possibly reach it, the radicle will twist about until it regains its true position. The caulicle and plumule will do the same, curving upward; then, when light is admitted, they will bend towards it by contracting the cells on the illuminated side. This contraction is not the result of growth; it is independent of growth; for if we split the stem vertically, the illuminated side curves still more, while the shaded side straightens; proving that the light, though a strong agent, is not the only force at work, and that this movement is directed by a vitality within. The shoots, as they

grow,—especially in the Cypress-leaved Morning-Glory,—reach out like the arms of a baby coaxing to be embraced; they move slowly in a circle until they find a support, then they twine about it, keeping the same direction of motion, which no artifice can reverse or change. The tendrils of the Passion-flower behave in the same way; but here we see a higher intelligence,—for as soon as a prop is found the tendril fastens by its tip to this stay, and then, coiling upon itself (Fig. 155), it brings the stem close to the support, thus enabling it to climb higher.

416. *Sensitiveness*.—Sensation, the power to feel, has nerves for its seat in the animal; it is in the nerves of the eye, ear, nose, tongue, and skin that the five senses reside and through which they communicate with the brain. And because even the Oyster has nerves (though it has no brain) it is the custom to say of certain animal actions that they result from Will, which in the lower Orders is called Instinct, whilst in Man it is called Reason.

We find no nerves in plants, but in many of them a high degree of sensitiveness. In the Pea Family, which includes the Mimosa and Sensitive Plants, this is finely exhibited. The Mimosa gets its botanical name (Gr. *mimos*, a mimic) from the animal-like faculty of moving and folding its leaves at the slightest touch; they close upward, too, contrary to the law of gravitation. The sensitiveness of stamens and pistils at flowering-time have already been noticed (303). The stamens of the Rock-rose (Fig. 243) are so irritable that if touched during sunshine they spread out upon the petals.

417. *Cunning Sport. Free Locomotion*.

—We have seen in Lesson XVI. with what cunning the Fly-trap, Nepenthes, and Sarcenia entrap flies and other insects for the sake of obtaining animal food. Their movements, however, depend somewhat upon outside force, like those of the sensitive plants; the fly must alight on the plant to



FIG. 243.—British Rock-rose (*Helianthemum vulgare*).

arouse it to action. But we see an independent motion in the Telegraph Plant of East India, which belongs to the Pea Family and has ternate leaves, like our common Tick Trefoils. The end leaflet slowly changes its position, following the light; the two small leaflets below it move spontaneously with quick jerks up and down in elliptical curves, which give the plant its specific name (*gyrans*). One leaflet descends whilst the other rises, as if they were sporting with each other. Cold water poured on the plant stops the motion (as it would stop that of any other dancer), but with returning warmth it begins again. It is most rapid in fair, moderate weather, and ceases at night. The free locomotion of the spores of the Algæ we have known from the beginning (Lesson V.). Their gambols are less surprising after we examine

the higher plants, for these are fixed in the earth, whilst the zoöspore floats free in water, with nothing to restrict its motions.

418. *Voluntary Motion* is defined as action done from choice by the will (L. *voluntas*, will or choice). Like sensation, it presupposes the existence of nerves, and still more of nerve-centres, or brain, and therefore *Mind*, or its lower expression, *Instinct*. Plants have neither nerves nor brain, yet much of their behavior seems as voluntary as the lying-in-wait of a spider to entrap a fly, the sport of kittens in the sunshine, or even the loves of human beings. The common Eel-grass (Fig. 244), a well-known inhabitant of clear, still water or slow-running streams, is dioecious.



FIG. 244.—*Vallisneria spiralis* (Eel-grass): a, female plant; b, male plant.



FIG. 245.—a, *Cyclamen europæum*; b, separate fruit.

The male and female plants, however, always grow near each other. The flowers are produced under water. The females grow singly, each on a long peduncle, which twists spirally (Fig. 244, a). The males, which are minute, are sessile on a spadix with a peduncle so short that they must remain below water unless detached from the spadix (Fig. 244, b). Both males and females develop under water; when ready for fertilization, the females slowly uncoil their long peduncles and rise to the surface; the male

flowers at the same time detach themselves voluntarily from the spadix, and each rises separately to the surface.

Then the male flowers float—shall we not say they swim?—towards the females, and project their pollen elastically, so that it reaches the stigma of the female flowers. After this the male flowers die; the females sink again to the bottom by recoiling their peduncles, and ripen their seeds beneath the water. The tenderest human mother is not more careful of her little ones than our homely Gooba Pea and the European Cyclamen (Fig. 245), which bear their flowers erect in the open air until after fertilization, and then twist on their stalks, descend against all law except the law of volition, and bury their young pods to ripen under ground.

419. Sleep.—Many plants sleep, like other living things. The Mimosa, Albizzia, Sensitive Plant, and Locust fold their leaves at night. The Kentucky Coffee-tree is a sound sleeper; it does not fully awake until nine o'clock in the morning; the lowest leaves open first, then the others, by degrees, as if the circulation of the sap were concerned in the process, like the circulation of our blood when we sleep. All these above-named plants belong to the Pea Family, in which sensitiveness and sleep are prominent characteristics. Some of the Wood-Sorrels sleep also. So do some of the Grasses, notably the *Strepium* of Guiana.

SECTION II.—SYSTEMATIC BOTANY.

PART FIRST.—TAXONOMY, OR CLASSIFICATION.

LESSON XXXIV.

NATURAL SYSTEM.

420, 421. Natural System. 422. Natural Analysis; its Rules applied to the Olive; 423, and to the Sage. 424. Orders. 425. Sub-Orders, Tribes. 426. Varieties, Races. 427. Wild Wheat. 428. Hybrids. 429. Scale of Classification. 430. Herbarium.

420. The **Natural System** is so called because it groups plants according to their natural resemblances and—as far as we can discover it—their common origin from an ancestral type.

421. Its principle was discovered by Antoine Laurent de Jussieu, of France (1748–1836), who was a Member of the Academy of Sciences and Professor in the Garden of Plants. Jussieu made faithful and exhaustive comparisons among plants of every type then known, but especially among seven of the best known Orders,—Grasses, Lilies, Labiates, Composites, Umbelliferæ, Leguminosæ, and Cruciferæ. He found that their characters must be “weighed, not counted,” to use his own words; that the fundamental principle of all order in nature is the Relative value of characters,—a principle so simple we might wonder how it chanced to remain so long unnoticed if we did not remember that other principles equally simple, such as gravitation, etc., were unknown three hundred years ago.

422. *Natural Analysis*, as compared with Artificial,—which is given in Lesson XXXVI.,—is not so readily mastered. The Artificial Method exacts only that the plant shall come within the requirements of its 24 Classes and their simple Orders; the characters of these are so few and so easy to find out that no trouble can be had in discovering them. But the student, after filling his herbarium with representatives of each, will have no knowledge of their natural relations. Let us take the Olive (Fig. 71) and Sage (Fig. 187) by way of illustration. Both belong to the Series Phanerogamia. It is simple enough to classify these two plants by the Artificial System: The flower in each has 2 stamens, 1 style; both, then, belong to the Class Diandria, Order Monogynia (441, 443). We see at a glance, however, that they are very distantly related. Remembering what Linnæus himself said about studious inquiry into nature's methods, let us follow the lead of Jussieu and apply his rules (31) as we proceed to analyze and classify the same plants according to the Natural Method:

Rule I. The Olive and Sage have visible flowers producing seeds containing *an embryo with differentiated organs*; they belong, therefore, to the Series Phanerogamia. They have an *ovary*; they therefore belong to the Class Angiospermæ. They have an embryo with 2 *cotyledons*; they therefore belong to the Sub-Class Dicotyledonæ, or Exogens.

Rule II. We next examine the *petals*. They *cohere* into a tube at base; the plants are therefore in the same Division Monopetalæ.

Rule III. Next the *Stamens*. In both plants the stamens are epipetalous (253, on the corolla); the corolla is free, which makes the stamens free also. Both plants are therefore in the same *Subdivision Ovary Free*. But from this point the plants diverge widely; nature has separated them. So we "weigh" their distinctive characters separately. Beginning with the Olive, we apply the remaining Rules:

Rule IV. The Olive seed has abundant perisperm;

Rule V. The Radicle superior;

Rule VI. The corolla valvate in æstivation;

Rule VII. The *calyx* regular, 4-toothed; the *corolla* regular, 4-parted; the *stamens* 2, inserted on the corolla-tube and alternate with its divisions; the *style* simple; the *ovary* free, 2-celled, the cells 2-ovuled, the ovules pendulous, anatropous. The fruit is a drupe, 2-seeded, or 1-seeded by abortion.

We examine the stem; the wood is hard and tough. The leaves; they are opposite, entire, coriaceous. The plant is a tree 20 to 25 feet high, of bushy habit. We find a small number of plants resembling the Olive; among them the Jasmin, Fringe-tree, Lilac, and Ash; these are accordingly grouped around the Olive, and form the Order *Oleaceæ*.

423. We next examine the Sage in the same way (Fig. 187):

Rule IV. Seed without perisperm;

Rule V. Radicle inferior;

Rule VI. *Calyx* irregular, bilabiate, lips 2-fid and 3-fid. *Corolla* ditto, lips in reverse order to those of the calyx; *stamens* 2, inserted on the corolla-tube, anthers dimidiate; *ovary* free, 4-celled, cells nearly separate, making the ovary appear 4-lobed; cells each 1-ovuled; ovules erect, anatropous; *style* simple, basal, or gynobasic; *stigma*

2-cleft; *fruit* 4 separate akaines around the base of the style, loose in the calyx and resembling naked seeds.

We examine the stem; it is herbaceous, tetragonous (4-angled, square); the leaves are simple, opposite; the whole plant is aromatic. At every step we find plants resembling the Sage: Basil, Lavender, Mint, Pennyroyal, Thyme, Catnip, Hoarhound; sometimes with 2 stamens, many times with 4 didynamous ones, but always with the same fruit. The plants are never trees, very rarely shrubs. They are grouped with the Sage, and called *Labiatae*.

424. Orders.—When Jussieu completed the Natural Method there were only 100 known Orders. Since that time discoveries have greatly increased the number; yet all the Orders, Genera, and Species are so carefully grouped that a few thousand words serve to name them. The study of relationships had led the later botanists—Le Maout and Decaisne, Lindley, Hooker, and Bentham—to break up some Orders and redistribute their Genera, or to unite several Orders into one. Jussieu regarded apetalous and diclinous flowers as *arrested conditions of perfect types, which masked affinities without annulling them*. The student will thus account for the occasional placing of such forms among perfect types,—such as the Ash with the Olive, the Meadow-Rue with the Buttercup; also the Nutmeg Order near that of the Magnolia. In the Manual (at the end of this volume) the Orders are grouped into Alliances, after the method of Lindley, but following Jussieu's sequence. It is not easy to settle the relationship of some Orders; these doubtful ones are marked with an asterisk.

425. Sub-Orders, Tribes.—In some Orders the plants differ in so many respects that they are separated into Sub-Orders, and these again into Tribes; Genera, too, have Sub-Genera, or Sections. For example: In the Order *Leguminosae* (Pea) the common characters which link its genera into one family are a free simple ovary, embryo without perisperm, and fruit a legume, or loment. Yet there are such differences in their stamens, petals, and habits that they have been separated into 3 Sub-Orders,—viz.: 1. *Papilionaceae* (Peas); 2. *Cæsalpineae* (Logwoods); 3. *Mimoseae* (Mimosas); each Sub-Order being named after its representative type. The Genera of each Sub-Order have likewise some common trait; but they differ in other characters, and are therefore separated into Tribes,

of which the Peas have 11, the Logwoods 7, the Mimosas 3.

426. Varieties, Races.—If we plant two peas from the same pod, or two seeds from the same apple, in different soils and climates, giving to each a different course of treatment, we produce *Varieties*, such as the different sorts of cultivated Peas and Apples. In many cases these *Varieties* persist under cultivation, thus establishing *Races*; though both races and varieties are apt to revert to the original type if left to run wild. Our cultivated Wheat is a persistent race from the Wild Wheat (*Ægilops ovata*) which abounds in Southern Europe, Sicily, and Asia Minor.

427. Galen (A.D. 180-200) states that his father and himself had observed that Wheat degenerates into *Ægilops*; but this statement led to no inquiry until M. Esprit Fabre, of Agde, France, proved the fact. In 1839 M. Fabre sowed the seeds of *Ægilops triticoides*,—a form of *A. ovata*,—and after twelve years of industrious experiments he obtained cultivated Wheat as we now have it.

428. Hybrids are made by cross-breeding; that is, by applying the pollen from one flower to the pistil of another flower of a different Species, but in the same Genus. The Azaleas hybridize freely; so do the Pelargoniums. But nature does not like cross-breeding; it rarely occurs among wild flowers, and hybrids usually produce no seeds. Natural species, therefore, should be examined for classification; Varieties, Races, and Hybrids, though valuable to the gardener and florist, are worth nothing to the botanist.

429. Scale of Classification.—In classifying plants Jussieu begins with the lowest or simplest and ascends to the highest or most complex. De Candolle (1778-1841) adopted Jussieu's method, but reversed it; he begins with the highest and descends to the lowest. De Candolle's method was adopted in England and America; most of the class-books published in this country thirty years ago—many of which are still used in the schools—are based upon it. But this was as great a mistake as it would be to put a student to the solution of Euclid's 47th Proposition before teaching him the Multiplication Table; and the rapid advance made in the science of education has resulted in the universal adoption of the inductive method of

Jussieu,—the ascending scale,—upon which all branches of Natural Science are now arranged, and which has always been used on the Continent of Europe. The student will find no difficulty, however, when he wishes to consult Manuals or Catalogues of plants classified after the Candollean method (descending scale), for the relationships and succession are the same as in the ascending scale; their order only is inverted.

430. Plants for a herbarium should be gathered whole, and, after being carefully displayed, placed between layers of soft, blank bibulous paper,—like ordinary newspaper; they should then be pressed between smooth boards under weights making a uniform pressure, the weights varying according to the delicacy or the thickness of the plants. The papers must be changed once in two or three days,—oftener in very warm or moist weather. After drying, the plants can be fastened to separate sheets of paper by means of narrow paper slips strapped here and there across the stems and pasted down at each end. Every plant should be placed in the herbarium according to its classification; and the whole collection of sheets should be preserved in portfolios suited to their form. Where the fruit and flower are not ripe at the same time, or where they are too dissimilar to be pressed together, the fruits can be separately dried, tabulated, and placed conveniently so as to be used for examination with the rest of the plant. The same may be said of the root, wood, bark, and secretions.

LESSON XXXV.

RULES FOR NOMENCLATURE AND PRONUNCIATION.

431. Nomenclature. 432. Genera. 433. Species. 434. Initial letters. 435 to 438. Rules for Pronunciation.

431. **Nomenclature** (Terminology).—The names of CLASSES and ORDERS, whether derived from the Greek, Latin, or any other language, are treated as *Latin Adjectives of the First Declension, Feminine Gender, Plural Number, and Nominative Case, to agree with Plantæ, the Latin nominative plural of Planta, a plant.* For example: Plants in the Exogenous Class are called *Exogenæ*; æ, the ending of the Latin feminine plural, being suffixed to the Greek *Exogen*; and

plants of the Rose Order are called *Rosaceæ* from the Latin *Rosacea* (belonging to the rose, rose-like).

432. The Names of Genera are *Latinized Nouns of the Singular Number, Nominative Case*. They may be masculine, feminine, or neuter, according to the choice of the person who names the plant. The name is often that of a person: *Magnolia* is the name of the French botanist Magnol, with a Latinized feminine ending (a). Or it may be given on account of some characteristic of the plant. Lettuce is called *Lactuca* (*L. lac, lactis*, milk) on account of its milky juice; here the ending is feminine. Geranium is from the Greek *geranion*, which is from *geranos*, a crane; the name is given on account of the resemblance the fruit bears to a crane's bill; the Greek ending *on* is here changed to the Latin neuter *um*. The Raspberry is called *Rubus* from the Latin *ruber*, red; the *er* is changed to the masculine ending *us*. Sometimes the aboriginal name is retained as a generic one; like the Greek *Phlox* and the Mexican *Fucca*.

433. The Names of Species are *Latinized Adjectives agreeing in Gender with the Generic name to which they are appended*. They usually specify some characteristic: as *Magnolia grandiflora*, large-flowered Magnolia. Sometimes the specific name is given in honor of a person: as *Maurandia Barclayana* (*Barclay Maurandia*). Or it is the name of a place: as *Rubus Idaeus* (*Mt. Ida Raspberry*). Sometimes it is the name of the person who discovered the plant; and then it is in the genitive singular: as *Phlox Drummondii* (*Drummond's Phlox*),—*Drummond* being first Latinized into the nominative masculine *Drummondius*; whence the genitive masculine *Drummondii* is taken. Sometimes the specific name is one which was formerly generic: as *Quercus Robur*; here the generic name *Quercus* is Latin for oak, the specific name *Robur* Latin for *hard oak*. In this case the specific name is a noun; and in all such instances it is not declinable.

434. Initial Letters.—*Classes, Orders, and Genera* are written with a capital initial. *Species* have a capital initial when the name comes (1) from a person (*Phlox Drummondii*); or (2) from a place (*Rubus Idaeus*); or (3) from a generic name (*Quercus Robur*). In all other cases the specific name is written with a small letter, as *Magnolia grandiflora*, *Agave americana*. (Adjectives derived from a country—as *americana*—should never be written with a capital initial. The custom of writing them with a capital initial prevails only in the United States; it is entirely unknown to scientific nomenclature elsewhere throughout the world.)

435. The Rules for Pronunciation given here are those of the Italian method. Italy being the mother-seat of the Latin language, it is presumable that Italian scholars are best acquainted with its traditions and its genius. The letters *y* and *w* are not in the Latin alphabet. They are introduced into scientific nomenclature from other languages.

436. The Vowels are *a, e, i, j, y, o, u, w*. Their sounds are approximately as in the following English words:

Long	{	<i>f</i> àther,	<i>f</i> èign,	<i>m</i> achìne,	<i>h</i> òme,	<i>r</i> ùle,	<i>bo</i> ot.
Short	{	<i>a</i> ,	<i>e</i> ,	<i>i, j, y</i> ,	<i>o</i> ,	<i>u</i> ,	<i>w</i> .
	{	<i>f</i> át,	<i>p</i> én,	<i>p</i> ín,	<i>p</i> ót,	<i>f</i> ún,	no short sound.

W has the same sound as in English,—that is, the sound of oo in *boot*. It has no place between consonants, no value as a final letter.

437. *The Diphthongs* are but two,—æ and œ; they have the sound of è. All other vowels coming together—ei, ie, oi, io, etc.—have their separate values; they are uttered rather rapidly, making a liquid sound.

438. *The Consonants* are as in English, with the following exceptions, which are rules:

I. Ch always has the sound of k. *Richardia* (from Richard, name of a French botanist) is pronounced *Rikardia*. Initial ch, when soft in the radical word, as in *China*, is sometimes changed to s; as *Thea Sinensis*.

II. C and g are always hard (as in *cat*, *got*, *gun*) before a, o, u; and soft before e, i, j, y. The soft c has the sound of ch in *cheese*; the soft g the sound of g in *gem*. Gn before vowels and diphthongs has the sound of ng in *king*.

III. Cc in the middle of a word before e, i, j, y, has the sound of ch in *achieve*;

IV. Gg similarly placed has the sound of dj in *adjust*.

V. H is always silent. J is always a vowel.

VI. T in the middle of a word, before ia, ie, io, is sounded like ts. It is equivalent to z in these cases and interchangeable with z.

VII. Z, or zz, has the sound of ts or ds. It has the sound of ts when preceded by e or o, and when followed by a word beginning with z.

VIII. Final letters, whether vowels or consonants, are always sounded; with the exception of w and h.

IX. Accent, or stress of voice, is

1. In words of two syllables always on the first: *Àcer*.

2. With more than two syllables, on the penultimate (last but one) when its vowel is long: *Agàve*.

3. On the antepenultimate (last but two) when the penultimate is short: *Triticum*.

4. An additional accent is given to every second syllable before the primary accent: *américàna*.

The signs used here and in the Manual (` ´) indicate not only accent, but also quantity (long or short vowel sound).

LESSON XXXVI.

ARTIFICIAL, OR LINNÆAN, SYSTEM.

439, 440. Artificial System; 441, 442. Its Classes and Orders. 443. Its imperfections.

439. The Artificial System is so called because it groups plants artificially, not according to their natural relations. Its Classes and Orders are founded upon the number and position of the stamens, and the number of the styles, without regard to the embryo, ovary, or any other part of the plant.

440. The Artificial System was invented by Carl von Linné, of Sweden (1707-1778), better known by his Latinized signature *Linnæus*; this is thence called also the Linnæan System. Linnæus revised the crude materials which in his day formed the extent of research in both Botany and Zoölogy. He gave to each genus and species a name; he established rules for the formation of these names; and so happy was he in this nomenclature—which has been universally adopted—that he should be called the poet-laureate, as well as the high-priest, of science. His artificial classification of plants was made because it was the best that could then be adapted to the masses, who had neither time nor opportunity for deeper investigation. But it was much more respected by his successors than by himself; for he says in his “Botanical Philosophy,” “The first and last desideratum is studious inquiry into the methods of nature.” Still, his system was in almost universal use for nearly a hundred years; the most valuable botanical books written during that period are based upon it. And though it has long been superseded by the *Natural Method*, the Linnæan nomenclature has become so identified with botanical science that no student can pursue the study successfully—certainly none can examine these valuable old works intelligently—without some knowledge of

THE CLASSES AND ORDERS OF THE ARTIFICIAL SYSTEM.

441. Linnæus retained the names Phanerogamia and Cryptogamia which had already been given to the two great natural Series. He separated the Phanerogamia into 23 *Classes*, leaving the Cryptogamia as *Class* 24. The classes in Phanerogamia he arranged and named according to the number and position of the stamens in a single flower (or a floret), as follows:

- Class 1. Monandria, 1 stamen—Ginger (Fig. 151); Hippuris;
 “ 2. Diandria, 2 stamens—Olive (Fig. 71); Sage (Fig. 187);
 “ 3. Triandria, 3 stamens—Oats (Fig. 52); Valerian (Fig. 78);

- Class 4. Tetrandria, 4 stamens of equal length—Plantain (Fig. 136); Smilacina;
- “ 5. Pentandria, 5 stamens—Vine (Fig. 101); Egg-plant (Fig. 158);
- “ 6. Hexandria, 6 stamens of equal length—Lily, Asphodel (Fig. 56);
- “ 7. Heptandria, 7 stamens—Horse-chestnut (Fig. 192);
- “ 8. Octandria, 8 stamens—Epilobium (Fig. 75); Fuchsia;
- “ 9. Enneandria, 9 stamens—Sassafras, Cinnamon (Fig. 170);
- “ 10. Decandria, 10 stamens—Pink; China-tree; Judas-tree;
- “ 11. Dodecandria, 11 to 19 stamens—House-leek (Fig. 148);
- “ 12. Icosandria, 20 or more stamens on the calyx—Cherry (Fig. 5); Myrtle (Fig. 178);
- “ 13. Polyandria, 20 or more stamens on the torus—Ranunculus (Fig. 9); Tea (Fig. 78); Water-lilies (Fig. 79); Sarracenia (Fig. 114); Magnolia (Fig. 133); Columbine (Fig. 154);
- “ 14. Didynamia, 4 stamens, 2 long and 2 short—Broom-rape (Fig. 159); Wood-sage (Fig. 160);
- “ 15. Tetradyndria, 6 stamens, 4 longer than 2—Wall-flower, Rocket, Mustard (Fig. 162);
- “ 16. Monadelphia, stamens coherent by their filaments into 1 set—Mallow (Fig. 182); Broom (Fig. 166);
- “ 17. Diadelphia, stamens coherent by their filaments into 2 sets—Pea (Fig. 167, A);
- “ 18. Polyadelphia, stamens coherent by their filaments into many sets—Lemon (Fig. 127); St. John's Wort;
- “ 19. Syngenesia, filaments free, anthers coherent into a tube—Sunflower Family (Fig. 167, B); Lobelia, with filaments also coherent;
- “ 20. Gynandria, stamens adherent to the pistil—Orchis (Fig. 152); Milkweed (Fig. 172);
- “ 21. Monœcia, stamens and pistils in separate flowers on the same plant—Yews (Fig. 44) and Pines; Indian Corn; Arum (Fig. 57); Walnut (Fig. 67);
- “ 22. Dicœcia, stamens and pistils in separate flowers on separate plants—Vallisneria (Fig. 244); Willow (Fig. 69);
- “ 23. Polygamia, flowers bisexual, male and female, on the same plant or on different plants of the same species—Oat-grass (Fig. 51); Pellitory; Red Maple.
- “ 24. *Cryptogamia*, all spore-bearing plants, from Protophytes to Club-moss, inclusive (Figs. 11 to 42).

442. The first Thirteen Classes have their *Orders* based on the number of pistils in a flower: *Monogynia*, 1 pistil; *Digynia*, 2 pistils, etc., up to *Dodecagynia*, which is the 11th Order, and which includes flowers with 11 to 12 styles. The 12th Order, *Polygynia*, includes flowers with more than 12 styles.

The 14th Class has 2 *Orders*:

1. *Gymnospermia*, 4 separate akaines apparently like naked seeds in the calyx at the base of the style—Sage; Comfrey (Fig. 5);
2. *Angiospermia*, the ovaries united into a capsule—Broom-rape (Fig. 159, e); Snap-dragon (Fig. 161).

The 15th Class has 2 Orders :

1. *Siliculosa*, fruit a silicle—Shepherd's Purse (Fig. 200, C);
2. *Siliquosa*, fruit a silique—Wall-flower (Fig. 200, A).

The 16th, 17th, and 18th Classes have their various Orders distinguished like those of the first Thirteen.

The 19th Class has 6 Orders :

1. *Polygamia equalis*, composite heads, florets all monoclinal—Dandelion, Artichoke (Fig. 214);
2. *Polygamia superflua*, composite heads, disk-florets monoclinal, ray-florets female—Chamomile;
3. *Polygamia frustranea*, composite heads, disk-florets monoclinal, ray-florets neutral—Blue-bottle; Jerusalem Artichoke (Fig. 95);
4. *Polygamia necessaria*, composite heads, disk-florets male, ray-florets female—Marigold (Fig. 143);
5. *Polygamia segregata*, several small heads, each with a partial involucre, collected in a compound head with a large common involucre—Everlasting; Edelweiss;
6. *Monogamia*, flowers single, not in heads, but with syngenesious anthers—Lobelia, Violet, Balsam.

The 20th, 21st, and 22d Classes have Orders distinguished like those of the first 13 Classes.

The 23d Class has 3 Orders :

1. *Monœcia*, flowers bisexual and unisexual on the same plant—Maple;
2. *Diœcia*, flowers bisexual and unisexual on separate plants—Ash;
3. *Triœcia*, flowers bisexual, male and female, each type on a separate individual—Carob-tree.

The 24th Class has 5 Orders :

1. *Ferns*; 2. *Mosses*; 3. *Liverworts*; 4. *Seaweeds*; 5. *Mushrooms*.
- (Copied from Mirbel's *Physiologie Végétale*.)

443. The Artificial System, we see, places the Indian Corn and the Walnut in the same class, though one is an Endogen and the other an Exogen. And not only do we find this arbitrary grouping of distinct and alien types, but also the separation of genera which in nature are nearly related. The Sage, for example, naturally belongs in the same Family with the Mint, yet the Artificial System puts it with the Olive, with which it has nothing in common except exogenous growth and two stamens.

GLOSSARY AND INDEX TO LESSONS.

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PART II.
PHYTOLOGY.

A

MANUAL OF PLANTS:

INCLUDING

ALL THE KNOWN ORDERS WITH THEIR
REPRESENTATIVE GENERA.

BY

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P R E F A C E.

It is hardly necessary to say to Professor, Teacher, or Student that this Manual should be used daily as a companion to the Lessons, in connection with the ever-faithful microscope. The Manual, bound separately, can be conveniently carried in pocket or portmanteau.

A Table of Etymons, or Roots (page vii.), immediately precedes the Classification. This does away the need of defining the names of individuals in the Manual, many of which are compounded from the same etymons; and thus both time and space are saved. Names of Orders are defined in their proper places. The Table of Signs and Abbreviations (page vi.) includes all that are in modern use.

ANNIE CHAMBERS-KETCHUM.

SIGNS AND ABBREVIATIONS USED IN THE MANUAL AND TABLES.

SIGNS.

Plants: ☉ Annual; ○ Biennial; ½ Perennial; ¼ Woody.
Flowers: ♂ Staminate; ♀ Pistillate; ♀ Perfect, or Monoclinous;
 " ♂ Monœcious; ♂ ♀ Dioecious; ♂ ♀ Polygamous.
Floral Parts (stamens, pistils, petals, etc.): 0 Wanting; ∞ Indefinite, or more than 20.
Measure: ° Foot; ' Inch; '' Line, or 12th of an inch; × Magnified.
Accent: ` grave vowel sound, as in open; ' acute, as in office.

ABBREVIATIONS.

Abbreviations of Months, Cardinal points, Countries, Cities, etc., the student already knows, or should learn from other sources. Abbreviations of botanical terms are as follows:

Adh. adherent.	Epig. epigynous.	Ord. order.
Æst. æstivation.	Ev. evergreen.	Orthot. orthotropous.
Ak. aksine.	Exatip. axatilpata.	Orv. ovule; Ova. ovary.
Alt. alternate.	F. French.	Pap. pappus, papposa.
Amphit. amphitropous.	Fasc. fascicle, fasciculate.	Ped. peduncle.
Amplex. amplexicaul.	Fil. filament, a.	Perig. perigynous.
Anat. anotropous.	Fl. flower, a.	Persia. persistent.
Anom. anomalous.	Fr. fruit; Ft. feet.	Pet. petal, a.
Anth. anther, s.	Fug. fugacious.	Rac. raceme; Rad. radicle.
Antit. antitropous.	Gael. Gaelic.	Reg. regular.
Ar. Arabic.	Gen. genus, genera.	Rep. representative.
Ax. axile. axillary.	Ger. German.	Rhiz. rhizoma.
Bot. botanist.	Glom. glomerule.	Rt. root; Rts. roots.
Br. branch.	Gr. Greek.	Sd. seed; Sds. seeds.
Bra. bract, a.	Hd. head, a.	Sac. section; Seg. segment, s.
Caduc. caducona.	Hypog. hypogynous.	Sep. sepal; Sepa. separata.
Cal. calyx.	Imb. imbricate.	Septicid. septicidal.
Calyc. calyculate.	Indehisc. indehiscient.	Septif. septicifragal.
Campyl. campylotropous.	Inf. inferior.	Sev. several.
Caps. capsule.	Infl. inflorescence.	Sp. Spanish.
Cat. catkin, a.	Int. internal.	Spa. spadix; Spi. apika.
Celt. Celtic.	Invol. involucre.	Spec. apiceæ.
Centrif. centrifugal.	Irreg. irregular.	St. stem; Sta. stamen, a.
Centrip. centripetal.	It. Italian.	Silp. stipule, a, stipulate.
Clna. cluster, s, ed.	L. Latin.	Sty. styia.
Cor. corolla.	Leg. legume, s.	Sup. superior.
Decid. deciduous.	Lf. leaf; Lvs. leaves.	Term. terminal.
Dehisc. dehiscent, dehiscence.	Lft. leaflet, s.	Trans. transversæ.
Diam. diameter.	Loc. loculicidal.	Umb. umbel, umbellate.
Div. division.	Lom. loment, s.	Valv. valvate.
Ellip. elliptical.	Opp. opposite.	Vers. versatilis.
Emarg. emarginata.	Orbic. orbicular.	Vert. vartical.
Emb. embryo.		

ETYMONS OF BOTANICAL TERMS.

I.

Common Words.

- | | | |
|--|---|---|
| <p>A. Gr. not, without, wanting.</p> <p>Ab. L. from.</p> <p>Abai, abi. Gr. delicate.</p> <p>Abat. Gr. solitary.</p> <p>Abies. L. fir.</p> <p>Abrot. Gr. immortal; not for mortals.</p> <p>Ac. Gr. spine; sharp.</p> <p>Acal. Gr. not comely; unpleasant.</p> <p>Acer. L. acrid, sharp.</p> <p>Acet. L. sour.</p> <p>Acetabul. L. saucer.</p> <p>Achat. L. agate.</p> <p>Achly. Gr. shade.</p> <p>Achyr. Gr. chaff.</p> <p>Acic. L. sharp-pointed.</p> <p>Acid. L. acid.</p> <p>Acinet. Gr. immovable.</p> <p>Acme. Gr. point.</p> <p>Acon. Gr. cliff.</p> <p>Acro. Gr. top.</p> <p>Act. L. carrying.</p> <p>Act, actis. Gr. ray.</p> <p>Acte. Gr. elder.</p> <p>Adelph. Gr. brother.</p> <p>Adeo. Gr. gland.</p> <p>Adhatoda. Ind. same.</p> <p>Æchm. Gr. acme, point.</p> <p>Æg. Gr. goat.</p> <p>Aesc. Gr. food.</p> <p>Aeschyn. Gr. modest.</p> <p>Ær. Gr. air.</p> <p>Aestiv. L. summer.</p> <p>Æth. Gr. acrid, burning.</p> <p>Aga. Gr. good, handsome.</p> <p>Agalm. Gr. ornament.</p> <p>Agap. Gr. love, beloved.</p> <p>Agaric. Gr. mushroom.</p> <p>Agath. Gr. excellent.</p> <p>Agav. Gr. wonderful.</p> <p>Ager, agr. Gr. L. field.</p> <p>Agla. Gr. beautiful.</p> <p>Aira. Gr. deadly weapon.</p> <p>Al. L. wing.</p> <p>Alb. L. white.</p> <p>Aletr. Gr. mealy.</p> <p>Alia. Celt. water.</p> <p>All. Celt. pungent.</p> <p>All. Gr. other, diverse.</p> | <p>Aln. Celt. alder.</p> <p>Alopec. Gr. fox.</p> <p>Als. Gr. grove.</p> <p>Altb. Gr. healing.</p> <p>Alyss. Gr. madness.</p> <p>Am. Gr. lacking, not.</p> <p>Amb. L. around.</p> <p>Amber. Gr., L. amber.</p> <p>Ambly. Gr. blunt.</p> <p>Ambros. Gr. same as Abrot.</p> <p>Ammo. Gr. sand.</p> <p>Amno. Gr. lamb.</p> <p>Ampel. Gr. vine.</p> <p>Ampbi. Gr. both.</p> <p>Amphora. L. large water-vessel with ears.</p> <p>Amygd. Gr. almond.</p> <p>An. Gr. lacking, not.</p> <p>Ana. Gr. again, intense, upward.</p> <p>Anaocha. Gr. force.</p> <p>Anassa, Gr. queen, ruling.</p> <p>Anastat. Gr. resurrection.</p> <p>Anch. Gr. strangling.</p> <p>Anchl. Gr. beat.</p> <p>Andr. Gr. man, anther.</p> <p>Andrin. Gr. little man.</p> <p>Aoem. Gr. without cover.</p> <p>Anemos. Gr. wind.</p> <p>Aneso. Gr. loosening.</p> <p>Angel. L. angelic.</p> <p>Angio, ango. Gr. vessel.</p> <p>Aois. Gr., L. anise.</p> <p>Aniso. Gr. unequal.</p> <p>Aooma. Gr. irregular; deviating from law.</p> <p>Ante. L. before.</p> <p>Antenn. L. feelers, hairs.</p> <p>Anth. Gr. flower.</p> <p>Anthor. Gr. anther.</p> <p>Anthrop. Gr. man.</p> <p>Anti. Gr. opposed.</p> <p>Aph. Gr. junction.</p> <p>Aphel. Gr. simple.</p> <p>Apios. Gr. wild pear.</p> <p>Aplo. Gr. single.</p> <p>Apo. Gr. against, upon.</p> <p>Apono. Gr. easily.</p> <p>Apostasia. Gr. desertion.</p> <p>Aqua. L. water.</p> <p>Aquil. L. eagle.</p> | <p>Arachn. Gr. spider.</p> <p>Arceuth. Gr. juniper.</p> <p>Arch. Gr. chief.</p> <p>Arctos. Gr. bear.</p> <p>Ardis. Gr. spear-head.</p> <p>Arena. L. sand.</p> <p>Argema. Gr. eye-disease.</p> <p>Argo, argyr. Gr. white, silvery, shining.</p> <p>Ariet. L. bristle, point.</p> <p>Aristos. Gr. excellent.</p> <p>Aroill. L. bracelet.</p> <p>Arn. Gr. lamb.</p> <p>Aron, aronic. Gr. lamb-skin, medlar.</p> <p>Arpo. Gr. sword.</p> <p>Arrhen. Gr. man, stamen.</p> <p>Art. Gr. bread.</p> <p>Arthr. Gr. joint.</p> <p>Arundo. L. cane.</p> <p>Ascus (plural <i>asci</i>). Gr., L. pouch, bottle.</p> <p>Asparagus. Gr. tearing (some species prickly).</p> <p>Aspas. Gr. embracing.</p> <p>Aspid, aspia. Gr. shield.</p> <p>Aster. Gr. star.</p> <p>Astragalus. Gr. joint.</p> <p>Ater, atri, atro. L. black.</p> <p>Athana. Gr. immortal.</p> <p>Athra. Gr. pressed.</p> <p>Atr. Gr. invulnerable.</p> <p>Aulac, aulax. Gr. furrow.</p> <p>Aur, aura.</p> <p>Aurant, aurum. L. gold.</p> <p>Auricula. L. ear.</p> <p>Avena. L. oats.</p> <p>Az. Gr. dry.</p> |
|--|---|---|

- Bacca. L. berry.
- Bacill. L. little stick.
- Bactrop. Gr. wand.
- Balano. Gr. acorn, bolt.
- Ballo. Gr. sent out.
- Baph, bapto. Gr. dyeing.
- Bar. Gr. heavy.
- Barb. L. beard.
- Barbar. L. barbarian.
- Bari, bary. Gr. heavy.
- Basis, basid. Gr. pedestal, foundation.

- Bell. L. beautiful.
 Belo. Gr. needle.
 Berber. Ar. Berhary.
 Betonic. L. bstony.
 Betu. Celt. beech.
 Bi, bis. Gr. twice.
 Bio, biou, bium. Gr. life.
 Blemm. Gr. appearance.
 Bleph. Gr. eyelash.
 Blit. Celt. insipid.
 Bolb. Gr. bulb.
 Bombac, hombax. Gr. raw silk.
 Bors. Gael. parse.
 Bothr. Gr. hole, cave.
 Botry. Gr. bunch of grapes.
 Bous. Gr. ox.
 Bov, bovis. L. ox.
 Brac. L. breeches.
 Brach. Gr. arm.
 Brachy. Gr. short.
 Brase. Gr. to boil.
 Brex. Gr. rain, moisture.
 Briz. Gr. nodding.
 Broch. Gr. cord.
 Broma. Gr. food.
 Bros, brot. Gr. mortals.
 Bros. Gr. edible.
 Bry. L. moss.
 Brych. Gr. devouring.
 Bryo. Gr. fast-growing.
 Bryz. Gr. nodding.
 Bu. Gr. ox.
 Bucc. L. cheek, trumpet.
 Bumel. Gr. ash.
 Bors, from Gaelic bors, parse.
 Byrs. Gr. leather.
 Cs. Gr. burrowing.
 Cacal. Gr. pernicious.
 Cact. Gr. prickly.
 Cæpit. L. turfy.
 Caio. Gr. staff; burning.
 Cal, call. Gr. beautiful, adorning.
 Calad. Gr. cup.
 Calam. Gr. reed.
 Calath. Gr. basket.
 Calcar. L. spur.
 Calceol. L. slipper.
 Calci. L. heel, spur.
 Calend. L. monthly.
 Calid. L. hot.
 Calliata. Gr. most beautiful.
 Callum. Gr. a broom.
 Calth. Gr. basket.
 Calyc. L. calyx.
 Calypso. Gr. curved.
 Calyptr. Gr. hood.
 Cam. Gr. dwarf.
 Camer. Gr. arched.
 Camp. Gr. bent, curved.
 Campan. L. little bell.
 Camppto, campyl. Gr. bent, curved.
 Canis, canin. L. dog.
 Canne. L. cane.
 Cap, capit. L. head.
 Capr. L. goat.
 Caps. L. pod.
 Caps, capt. Gr. biting.
 Car. Celt. wood.
 Cara. Gr. head.
 Card. Gr. heart.
 Carex. L. sedge.
 Caria. Gr. nut.
 Carn. L. flesh.
 Carp. Gr. fruit, carpel.
 Carph. Gr. dry, chuffy.
 Cart. Gr. smooth, thin.
 Carthem. Ar. painted.
 Cary. Gr. nut.
 Cascar. Sp. bark.
 Castan. Gr. chestnut.
 Cassy. Gr. sewed or fastened under.
 Casuarina, resembling the bird cassowary.
 Cata. Gr. through, against.
 Caod. L. tail.
 Caul. Gr. stem.
 Cecrops. Gr. tail.
 Cedr. Gr. cedar.
 Cela. Gr. dart.
 Celastr. Gr. tree late in fruit.
 Celo. Gr. sined.
 Cenchr. Gr. millet.
 Cento, centuaculus. Gr. a threadbare garment.
 Centro. Gr. spur.
 Ceo. Gr. pricking.
 Cephal. Gr. head.
 Cera. Gr. wax.
 Ceram. Gr. pottery.
 Ceras, cerato. Gr. horned.
 Cercis. Gr. shuttle.
 Cereus. L. wax taper.
 Chæn. Gr. opening.
 Chær. Gr. welcome.
 Chæt. Gr. hair.
 Chæio. Gr. staff.
 Chamaæ. Gr. on the ground.
 Chæo. Gr. opening.
 Char. Gr. joy, delight.
 Chert. L. paper.
 Chet. Gr. through, by.
 Cheil. Gr. lip.
 Cheir. Gr. hand; Ar. well-flower.
 Chelido. Gr. swallow.
 Chelon. Gr. tortoise.
 Cheno. Gr. goose.
 Chil. Gr. lip.
 Chim. Gr. winter.
 Chio. Gr. snow.
 Chlæoa, obliamyd, chlamsy, chlæna. Gr. cloak.
 Chlid. Gr. handsome, delicate.
 Chloa. Gr. grass.
 Chlor. Gr. green.
 Chondr. Gr. grain, round mass.
 Chor, choro. Gr. dance.
 Chori. Gr. division.
 Chort. Gr. fodder.
 Ohrest. Gr. useful.
 Chrys. Gr. gold.
 Chyl. Gr. juice.
 Chynch. Gr. bowl, basin.
 Chys. Gr. melting.
 Cib. L. food.
 Cibot. Gr. box.
 Cicer. L. small pea.
 Cichor. Egypt. chicory.
 Cicot. L. hemlock.
 Cimex, cimici. L. bug.
 Ciner. L. ashy.
 Cirro. L. teodril.
 Cirs. Gr. swollen vein.
 Ciss. Gr. cissus.
 Cist. Gr. bladder.
 Cithar. Gr. harp.
 Citr. L. citron, orange.
 Clad. Gr. young shoot.
 Clathr. Gr. lattice.
 Clev. L. key.
 Cle, cleis. Gr. key.
 Clem. Gr. tendril.
 Cleo. Gr. sbut.
 Clero. Gr. chance.
 Clethr. Gr. adder.
 Cili. Gr. glorious.
 Cli, clid, clit. Gr. closed, a glen.
 Clin. Gr. conch.
 Cnem. Gr. knees.
 Cneo. Gr. scraping.
 Cnic, cnid. Gr. nettle.
 Co. L. with.
 Cocc. Gr. berry.
 Cocco. L. red.
 Cochinilla. Sp. cochinsal.
 Cochl. L. snail, screw.
 Cod. Gr. poppy-head.
 Codon. Gr. bell.
 Cœleb. Gr. unmarrisd.
 Cœlo. Gr. hollow.
 Cœn. Gr. together.
 Coenobi. Gr. living together.
 Coix. Gr. a palm.
 Coleos. Gr. sheath.
 Coll. L. neck.
 Coll. Gr. glue.
 Coln. Gr. amputated.
 Coluber, colubri. L. serpent.
 Columb. L. dove.
 Comaro. Gr. arbutus.
 Comb. Gr. knotted.
 Con. L. with.
 Couferv. L. bubbling, boiling.
 Conio. Gr. doet-sprinkled.
 Conn. Gr. beard.
 Connar. Gr. sumach.
 Cono. Gr. cone, top.
 Convall. L. deep valley.
 Conyz. Gr. goat.
 Copr. Gr. dnog.
 Opt. Gr. choppsd.
 Cor. L. heart; Gr. pupil of eye.
 Coracin. L. crow-black.
 Coral. Gr. coral.
 Corhula. L. basket.

- Corch. L. pimpernel.
 Card. L. heart.
 Cordyl. Gr. club.
 Core. Gr. pupil of eye.
 Coram. Gr. a broom.
 Corethr. Gr. brush.
 Corn. L. horned, horny.
 Corol. L. corolla.
 Coron. L. crowa.
 Cory. Gr. helmet.
 Coryd. Gr. crest.
 Coryl. Gr. bonnet.
 Corymb. Gr. a head.
 Coryn. Gr. club.
 Coryph. Gr. top, summit.
 Coscio. Gr. sieve.
 Cosm. Gr. elegant, regular.
 Coton. Ar. cotton.
 Cotul, cotyl. Gr. cup.
 Cramb. Gr. cabbage.
 Cran. Gr. helmet.
 Crass. L. thick, fleshy.
 Crat. Gr. strong.
 Crem. Gr. hanging.
 Crep, crepid, crepis. Gr.
 L. shoe.
 Crin. Gr. lily.
 Cros, cross. Gr. fringed at
 border.
 Crot. Gr. bug, tick.
 Crotal. Gr. rattle.
 Crucl. L. cross.
 Cruri, crus. L. leg, spur.
 Crux. L. cross.
 Cryb, cryph, crypt. Gr.
 hidden.
 Cte, Cten. Gr. comb.
 Cucum. L. cucumber.
 Cucurb. L. gourd.
 Culcita. L. cushion.
 Cune. L. wedge.
 Cunil. L. pennyroyal.
 Cuph. Gr. curved.
 Cupress. Gr. cypress.
 Cupul. L. cup.
 Cuspid. L. toothed.
 Cyam. Gr. bean.
 Cyath. Gr. small cup.
 Cyh. Gr. head.
 Cycl. Gr. circle.
 Cyca. Gr. swan.
 Cylist. Gr. twining.
 Cymb. Gr. a hollow.
 Cyn. Gr. dog.
 Cypel. Gr. goblet.
 Cyperus. Gr. sedge.
 Cyph. Gr. curved.
 Cyrt. Gr. curved.
 Cyst. Gr. bladder.
 Cythar. Gr. lyre.
 Cyttar. Gr. wasp's nest,
 honeycomb.
 Dacry. Gr. weeping.
 Dactyl. Gr. finger.
 Dæm. Gr. cord.
 Damao. Gr. strengthening.
 Dan. Gr. burning, dry.
 Dec. Gr., L. ten.
 Dech. Gr. receiving.
 Delph. Gr. dolphin.
 Dem. Gr. cord.
 Dendr. Gr. tree.
 Dens, dent. L. tooth.
 Derm. Gr. hide, skin.
 Desm. Gr. bundle, jointed.
 Det. Gr. pipe, torch, bond.
 Di, dia. Gr. cut through.
 Di, die. Gr. twice.
 Dially. Gr. distinct.
 Diant. Gr. moisture.
 Diatom. Gr. cut through.
 Dich. Gr. divided, twofold.
 Dicli. Gr. twice closed.
 Diclia. Gr. on separate
 beds, or tori.
 Dicty. Gr. net.
 Didym. Gr. twin.
 Didynam. Gr. two strong.
 Digit. L. finger.
 Dioicus. Gr. dioecious.
 Dios. Gr. divine, God.
 Diplo. Gr. double.
 Dips. Gr. thirst.
 Disc. Gr. disk.
 Dodeka. Gr. twelve.
 Dolichos. Gr. loag.
 Donna. L. lady.
 Dor, durato, dory. Gr. spear.
 Dox. Gr. praise.
 Draba. Gr. acrid.
 Draco. Gr. dragon.
 Drimy. Gr. acrid.
 Dros. Gr. dew.
 Dru, dry, drym, drys. Gr.
 tree, oak.
 Dua, duo. L. two, dual.
 Dulc. L. sweet.
 Dur. L. hard.
 Dynsm. Gr. strength.
 Dys. Gr. ill, evil.
 Dyead. Gr. ill-smelling.
 Ebeo. L. ebony.
 Ec. Gr. from.
 Ecast. Gr. separate.
 Echal. Gr. issuing forcibly.
 Ecerem. Gr. hanging from.
 Echi. Gr. viper.
 Echin. Gr. hedgehog.
 Echit. Gr. viper.
 Eclipt. Gr. deficient.
 Ecto. Gr. outside.
 Eico, eiko. Gr. image.
 Eidos. Gr. form.
 Eiren. Gr. peace.
 Elæa. Gr. olive.
 Elaph. Gr. deer.
 Elat. Gr. fir.
 Elat. L. uplifted.
 Eleo. Gr. marsh.
 Elephas. Gr. ivory.
 Elis. Gr. twisted.
 Ell. Gr. binding.
 Elod. Gr. marshy.
 Ely. Gr. rolled up.
 Elytr. Gr. envelop.
 Em. Gr. upon.
 Emmen. Gr. casting.
 En, eudo. Gr. in, within.
 Enchy, enky. Gr. spear.
 Entero. Gr. entrails.
 Ep, epi. Gr. upon.
 Epedr. Gr. seated, trail-
 ing.
 Equi, equus. L. horse.
 Er. Gr. spring-time.
 Er, eri, erio, eris. Gr.
 woolly.
 Eremo. Gr. hermit.
 Ergot. Fr. cock-spur.
 Eric. Gr. brittle.
 Erin. Gr. wild fig.
 Eriod. Gr. earth-herb.
 Erod. Gr. heron.
 Erpet. Gr. snake, creeping.
 Ery. L. vetch.
 Eryc. Gr. anomalous.
 Eryag. Gr. halcbing.
 Erys. Gr. healing.
 Erythr. Gr. red.
 Esper. Gr. evening.
 Et. Gr. year.
 Eu. Gr. true, good.
 Euphras. Gr. delightful.
 Eury. Gr. broad.
 Euthy. Gr. straight.
 Eutoc. Gr. fruitful.
 Ev. Gr. (same as eu) true.
 Ex. Gr. out of, outward.
 Excæc. L. blinding.
 Exis. Gr. habit.
 Fab. L. bean.
 Fag. Gr., L. beech.
 Fæd. Gr. clement.
 Fæo. L. hay.
 Falc. L. sickle.
 Fasc. L. fascicle, bundle.
 Fav. L. honeycomb.
 Fed. Gr. clement, mild.
 Fen. L. hay.
 Fenastr. L. window, lat-
 tice.
 Fer. L. bearing.
 Ferr. L. iron.
 Farul. L. rod.
 Festuc. L. straw.
 Fic, ficus. L. fig.
 Fil. L. thread.
 Filic, filix. L. fern.
 Fimbr. Gr. fringed.
 Fiss. L. divided.
 Flagel. L. thong.
 Flav. L. yellow.
 Flocc. L. with woolly
 tufts.
 Flor, flos. L. flower.
 Fol. L. leaf.
 Foveol. L. pitted.
 Frag, fragr. L. fragrant.
 Frag, fraog, frax. L. break-
 ing.
 Frutil. L. chess-board.
 Fug. L. fleeting.
 Fulv. L. dull yellow.
 Fum. L. smoke.
 Fuog. L. fungus.
 Fus. L. spindle.
 Fusc. L. brown.

- Gæ. Gr. earth.
 Gal, galuc, galax. Gr. milk.
 Galb. L. galbula.
 Gale. Gr. weasel.
 Gales. Gr. helmet.
 Galiz. Gr. delighting.
 Gall. Gaul, cock.
 Gallia, galliz. Gr. delighting.
 Gam. Gr. marriage, union.
 Gano. Gr. joy.
 Gaster, gastro. Gr. stomach.
 Gaur. Gr. superb.
 Gaza. Gr. richness.
 Ge. Gr. earth.
 Geisa. Gr. tiled roof.
 Gel. L. ice.
 Gelas. Gr. exhilarating.
 Gelat. L. jelly-like.
 Gelsomino. It. jasmine.
 Gemin. L. twin.
 Gemm. L. bud.
 Gen. Gr. generation.
 Gen. Celt. hush.
 Ger, gero. L. hearing.
 Ger, gero, geroa. Gr. an old man.
 Gerao. L. crane.
 Geton. Gr. neighbor.
 Geu. Gr. well-flavored.
 Gille. Gr. exhilarating.
 Glad. L. sword.
 Gland, glaas. L. nut.
 Glaph. Gr. hollow, handsome.
 Glauc, glaux. Gr. sea-green.
 Glech. Gr. pennyroyal.
 Glob. L. globe.
 Glochin. Gr. angle, corner.
 Gloss, gлот. Gr. tongue.
 Glox. Gr. angle.
 Glum. L. husk.
 Glyc. Gr. sweet.
 Glyph, glypt. Gr. carved.
 Gnaphal. Gr. cottony.
 Gne, gni, gno. Gr. bent.
 Guet. Gr. joint.
 Gomph. Gr. nail, peg.
 Gon. Gr., L. knee, joint.
 Gossyp. Ar. cotton, silk.
 Gramin. L. grass.
 Gramm. Gr. letters.
 Graph. Gr. writing.
 Grav. L. heavy.
 Gris. L. gray.
 Grossul. L. unripe fig.
 Gutt. L. small drops.
 Gynn. Gr. naked.
 Gyn. Gr. woman, pistil.
 Gyr. Gr. whorled.
 Haben. L. thong, lash.
 Habra, habro. Gr. delicate.
 Hæd. L. a kid.
 Hæm. Gr. blood.
 Hæsil. A.-S. head-dress.
 Hal. Gr. sea.
 Hema. Gr. with.
 Haplo. Gr. see Aplo.
 Hazel. A.-S. head-dress.
 Hebe. Gr. youth, young beau.
 Hed. L. kid.
 Hede. Gr. sweet.
 Heder. Celt. cord.
 Hedra. Gr. seat.
 Hedy. Gr. sweet.
 Hegamon. Gr. chief.
 Helc. Gr. horse-collar.
 Heli, helion. Gr. sun.
 Helic, helix. Gr. spiral.
 Helle. Gr. deadly.
 Helminth. Gr. worm.
 Helo. Gr. marsh.
 Hemer. Gr. by day.
 Hemi. Gr. half.
 Hemion. Gr. mule.
 Hepat. Gr. liver.
 Herpest. Gr. creeping.
 Hesper. Gr. evening.
 Heter. Gr. different.
 Hex. Gr. six.
 Hibisc. Gr. marsh-mallow.
 Hierac. Gr. hawk.
 Hiero. Gr. holy.
 Himaath. Gr. thong.
 Himaath, himas. Gr. thong.
 Hippe. Gr. knight.
 Hippo. Gr. horse.
 Holc. Gr. pulling.
 Holo. Gr. whole.
 Homalo. Gr. regular, flat.
 Homo. Gr. similar.
 Hord. L. barley.
 Hormo. Gr. necklace.
 Hort. L. garden.
 Hum. L. moist.
 Hyæa. Gr. hyena.
 Hyal. Gr. crystal.
 Hyd. Gr. water.
 Hyda. Gr. mushroom.
 Hydr. Gr. water.
 Hygr. Gr. moisture.
 Hymea. Gr. membrane.
 Hyo, hyos. Gr. pig.
 Hyp, hypo. Gr. under.
 Hypa. Gr. woven threads.
 Hyper. Gr. through.
 Hypt. Gr. inverted.
 Hyes. Gr. dart, javelin.
 Hyssop, from Heb. Ezeb.
 Ianth. Gr. blue with red.
 Iber. L. Spain.
 Ic, icon. Gr. image.
 Ich. Gr. sticky.
 Ichn. Gr. slender.
 Ichthy. Gr. fish.
 Ict. Gr. weasel.
 Ileo. L. intestines.
 Ilax, ilic. L. flex, holly.
 Illecebr, illici. L. alluring.
 Illig. L. binding.
 Ilys. Gr. mud.
 Imant. Gr. thong.
 Iod, ion. Gr. violet.
 Ipo. Gr. bindweed.
 Ippo. Gr. ivy.
 Ir. Gr. peace, olive-branch.
 Irid, iris. Gr. rainbow.
 Is. Gr. equal.
 Ite. Gr. willow.
 Ix. Gr. sticky.
 Iz. Gr. seated.
 Jasmin, from Ar. yasmim.
 Jateo. Gr. healing.
 Jatro. Gr. remedy.
 Jug. Gr. yoke.
 Jul. L. down, catkin
 Junc. L. joined, jointed.
 Junip. L. juniper.
 Kaia. Gr. opening.
 Kentron. Gr. spur.
 Kermeesin. Ar. carmine.
 Knem. Gr. knee.
 Kyl. Gr. juice.
 Leb. L. lip.
 Lac. L. milk.
 Lacc. Gr. potherb.
 Lachaa. Gr. potherb.
 Lechn. Gr. soft hair.
 Laci. Gr. split.
 Lact. L. milk.
 Ladan. Gr. resin.
 Læd. Gr. hurtful.
 Læo. Gr. cloak.
 Læt. L. joyful.
 Lagen. Gr. bottle.
 Lego. Gr. hare.
 Lamin. L. blade, ear.
 Lamps, lampt. Gr. purging.
 Lant. L. lent, flexible.
 Lapid. L. stone.
 Lapp. L. bur.
 Laps. Gr. relaxing.
 Lard. L. lard, bacon.
 Lariç, larix. L. larch.
 Lasio. Gr. hairy.
 Lat. L. broad, lateral.
 Late, laten. L. hid.
 Latex, latic. L. juice.
 Lathyr. Gr. vetch.
 Laur. L. laurel.
 Lav. L. laving.
 Lecan. Gr. basin.
 Lecid. Gr. little basin.
 Leocyth. Gr., L. pot.
 Led. Gr. cistus, net.
 Legno. Gr. fringe, founce.
 Legum. L. pod.
 Leio. Gr. shining.
 Leipo. Gr. leaving.
 Lemm. Gr. bark.
 Lemne. Gr. scale, shell.
 Lens, lentic. L. leus-shaped.
 Leo, leoni, leont. L. lion.
 Lep, lepid, lepis. L. scaly.
 Lept. Gr. fine, slender.
 Lepurus. Gr. rind.
 Leuc. Gr. white.
 Li. Gr. emphatic.
 Liat. Gr. coming forth.
 Libau. Gr. incense.
 Lich. Gr. scale.
 Lig. L. binding.
 Lil. L. lily.

- Limn. Gr. lake.
 Limo, limuus. L. mud.
 Lin. Gr., L. thread.
 Lip. Gr. fat.
 Lipar. Gr. elegant.
 Liqu, liqui. L. liquid.
 Lir. Gr. lily.
 Lis. Gr. smooth.
 Lis. Celt. water.
 Lit. Gr. smooth.
 Lith. Gr. stone.
 Littor. L. shore.
 Lob. Gr. pod.
 Lob. L. lobe.
 Lochia. Gr. childbirth.
 Lod, lodic. L. scale.
 Loma. Gr. border.
 Lonch. Gr. spear.
 Loph. Gr. crest.
 Lor. Gr. thong.
 Lox. Gr. troop.
 Luc, luci. L. light, grove.
 Lungul, from lucciola. It.
 glow-worm.
 Luna. L. luna, moon.
 Lup, lupia. L. wolf.
 Lychn. Gr. lantern.
 Lyco. Gr. wolf.
 Lygod. Gr. wand-like.
 Lyr. L. lyre, fiddle.
 Lys. Gr. loosening.
 Lyss. Gr. rage.
 Lythr. Gr. black blood.
 Lys. Gr. rage.
- Mach. Gr. strife.
 Machær. L. little sword.
 Macr. Gr. large.
 Mai, maj. Gr. May.
 Mal. L. ill.
 Mala. L. jaw.
 Malach, malax. Gr. soft.
 Malva. L. coollent, soft.
 Mamill, mamma. Gr., L.
 nipple, breast.
 Manica. L. sleeve.
 Manis. Gr. lizard.
 Mann. Gr., L. manna.
 Mantia. Gr. prophet.
 Mar. L. sea, bitter.
 Marain, maraot. Gr. fading.
 Marces. L. withering-persistent.
 Masc. L. masculine.
 Matric, matrix. L. womb.
 Maxill. L. jawbone.
 Mecon. Gr. poppy.
 Med. Gr. measure.
 Mega, megalò. Gr. large.
 Mel. L. honey.
 Melissa. Gr. bee.
 Melo. Gr. black.
 Men, meny. Gr. moon.
 Meuth. Gr. mint.
 Mer. Gr. part, measure.
 Meri. Gr. middle.
 Moa. Gr. middle, half.
 Mesembry. Gr. noon.
 Met, meth. Gr. with.
- Metr. Gr. measure, heart-wood.
 Miaut. Gr. spotted.
 Micr. Gr. small.
 Mim. Gr. ape, mimic.
 Minth. Gr. mint.
 Mirabil. L. wonderful.
 Mit, mitr. L. mitre.
 Mni. Gr. moss.
 Modiol. L. well-bucket.
 Mola, molin. L. mill.
 Moll. L. soft.
 Molopo. Gr. striped.
 Mom. Gr. impurity.
 Momord. L. chewed.
 Mon. Gr. one.
 Mor. Gr. fool.
 Moro, morus. L. mulberry.
 Morph. Gr. form.
 Mosch. Ar. musk.
 Mn. Gr. mill.
 Mucor, mucid. L. mould.
 Mnl. Gr., L. milk.
 Mulg. L. milky.
 Mus. L. mouse.
 Musc. L. fly, moss, musk.
 Muscar. L. fly-brush.
 My. Gr. mouse.
 Myc. Gr. mycelium.
 Mycel. Gr. mushroom, spawn.
 Myl. Gr. mill.
 Myo, myos. Gr. mouse.
 Myric. Gr. perfume.
 Myrio. Gr. myriad.
 Myrist. Gr. fragrant oil.
 Myro. Gr. ointment.
 Myrrh. L. myrrh.
 Myrs, myrt. L. myrtle.
 Myst. Gr. moustache.
 Myx. Gr. hidden; L. candlestick.
 Myz. Gr. to press, suck.
- Nabal. Gr. harp.
 Naiad, naias, najas. Gr. water-nymph
 Nan. Gr. dwarf.
 Napæ. Gr. wood-nymph.
 Narc. Gr. narcotic
 Nard. Gr. spikenard.
 Narin. L. nostril.
 Narth, narthec. Gr. fennel.
 Nas. L. nose.
 Nast. Gr. thick, stuffed.
 Ne. Gr. no, without.
 Nect. Gr. nectar.
 Nectr. Gr. floating.
 Negund. Latinism of *Giguieres*, trembling, dancing.
 Nema. Gr. thread, stameæ.
 Nemo. Gr. grove.
 Neo. Gr. new.
 Neott. Gr. bird's-nest.
 Nepenth. Gr. no grief.
 Nepet. Gr. scorpion.
 Neph. Gr. snowy.
 Nephel. Gr. small cloud.
 Nephro. Gr. kidney.
- Ner. Gr. damp.
 Nes. Gr. island.
 Neur. Gr. nerve.
 Nid. L. nest.
 Nidul. L. little oest.
 Nig. L. black.
 Niph. Gr. soowy.
 Nit. L. smooth.
 Nitr. Gr. nitre.
 Niv, nix. L. snow.
 Noct. L. night.
 Nola. L. little bell.
 Noet. Gr. sweetness.
 Notho. Gr. spurious.
 Noto. Gr. back, chine.
 Nuc. L. nut.
 Nud. L. naked.
 Nnmoul. L. coia.
 Nuphar. Ar. water-lily.
 Nut. L. nodding.
 Nux. L. nut.
 Nych, nyct. Gr. night.
 Nymph. Gr. nymph.
 Nyse. Gr. pricking, tearing.
- Ob. Gr., L. inverted.
 Obeliac. Gr. obelisk.
 Obol. Gr. small coia.
 Oc. Gr. eye.
 Och. Gr. neck.
 Ocha. Gr. wild pear.
 Ochr. Gr. ochre, yellow.
 Ochrea. L. leggin, greave.
 Oci. Gr. sweet-smelling.
 Oct. Gr., L. eight.
 Ocy. Gr. sweet-smelling.
 Od, odon. Gr. tooth.
 Œc. Gr. house.
 Œd. Gr. swelling.
 Œn. Gr. wise, vice.
 Oic, oik. Gr. house.
 Olea. Gr., L. olive, oily.
 Oll. Gr. killing.
 Omæ, oms, omoi. Gr. similar.
 Omal. Gr. flat.
 Ombr. Gr. rain.
 Omphal. Gr. navel.
 Onagr. Gr. wild ass.
 Onc. Gr. tumor.
 Ono. Gr. locust, burden.
 Onos. Gr. ass, vessel.
 Ony. Gr. hoof.
 Onych. Gr. nail, hoof, onyx.
 Onym. Gr. name.
 Op. Gr. eye.
 Ophel. Gr. serviceable.
 Ophio. Gr. snake.
 Ophrys. Gr. eyebrow.
 Ophthalm. Gr. eye-disease.
 Opium, oplo. Gr. armor.
 Opo. Gr. juice.
 Oporo. Gr. autumn.
 Ops. Gr. eye.
 Opais. Gr. appearance.
 Or. L. mouth.
 Oreo, ori. Gr. mountain.
 Ormo. Gr. necklace.

- Grnith. Gr. bird.
 Oro. Gr. mountain.
 Orob. Gr. vetch.
 Orth. Gr. straight.
 Oryct. Gr. burrowing.
 Oryz. Ar. rice.
 Os. L. mouth.
 Oscillat. L. vibrating.
 Osm. Gr. smell.
 Osteo. Gr. bone.
 Oeti. L. mouth.
 Oestr. Gr. shell, scale.
 Ot. Gr. ear.
 Othon. Gr. linen, rag.
 Otik. Gr. ear.
 Our. Gr. tail.
 Ox, oxa. Gr. acid.
 Oxi, exis. Gr. sharp, pointed.
 Oxy. Gr. acid.
 Oz. Gr. smell.

 Pachy. Gr. thick.
 Pact. Gr. put together.
 Pæder. L. opal.
 Pæpal. Gr. dust.
 Pag. Gr. membrane.
 Palumb. L. pigeon.
 Pan. L. all.
 Panac, panax. Gr. all-healing.
 Panis. L. bread.
 Papp. Gr. bearded.
 Par. Gr. near.
 Pard. Gr. leopard.
 Paries, pariet. L. wall.
 Parthen. Gr. virgin.
 Paspal. Gr. millet.
 Passi. L. suffering of Christ on the cross.
 Pastin. L. forked tool.
 Pav. L. peacock.
 Pecten. L. comb.
 Pod. L. foot.
 Pedicel. L. little foot.
 Pedicul. L. louse.
 Pel, pelt. Gr. hide, shield.
 Pelargo. Gr. stork.
 Pellæa. Gr. dark-colored.
 Pen. Gr. almost.
 Peno. L. feather.
 Pent. Gr. five.
 Penth. Gr. grief.
 Pera. Gr. bag.
 Pergul. L. trellis.
 Peri. L. around.
 Perister. Gr. dove.
 Petr. Gr. stone.
 Pence. Gr. fir.
 Phaca. Gr. lentil.
 Phacel. Gr. bundle.
 Phæe. Gr. destroying.
 Phædr. Gr. gay.
 Phæn. Gr. visible.
 Phag. Gr. food, edible.
 Phai. Gr. brightening.
 Phal. Gr. cone.
 Phalsen. Gr. glow-worm, butterfly.
 Phalaog. Gr. bundle, row.

 Phalar. Gr. shining.
 Phallus. Gr. cone, spadix.
 Phan. Gr. visible.
 Phao. Gr. brightening.
 Pharb. Gr. color.
 Phaseol. L. little ship.
 Pheg. Gr. beech.
 Phil. Gr. loving.
 Phloeb. Gr. vein.
 Phlog, phlox. Gr. flame.
 Phoenic. Gr. purple.
 Phæno. Gr. bloody.
 Phol. Gr. scale, plate, feather.
 Phor, phere, phoro. Gr. bringing, bearing.
 Phorbe. Gr. food.
 Phorm. Gr. anything woven with rushes.
 Phos, phot. Gr. light.
 Phragm. Gr. wall, hedge.
 Phrym. Gr. dry.
 Phus. Gr. bladder.
 Phyc. Gr. seaweed.
 Phyl. Gr. leaf.
 Phym. Gr. swelling.
 Phys. Gr. bladder.
 Phyt. Gr. plant.
 Picr. Gr. bitter.
 Pignon. F. pine seed.
 Pil. Gr. ball; L. hair.
 Pilea, -us. Gr. cap.
 Pili, pilose. L. hairy.
 Pimel. Gr. fat.
 Pia. L. pipe; Gr. drink.
 Pingui. L. fat.
 Pizo. Celt. head.
 Pipt. Gr. falling, perish-
 ing.
 Pis. L. pea.
 Pisc. L. fish.
 Pist. Gr. drinking.
 Pitheco. Gr. ape.
 Pitt. Gr. pitch.
 Plagio. Gr. oblique.
 Plaat. L. sole of foot.
 Plat, platy. Gr. broad.
 Pleco, plecto. Gr. folded, wreathed.
 Plectr. Gr. spur.
 Plæa, plero. Gr. abundant.
 Pleur. Gr. ribs, side.
 Plex. Gr. folded, woven.
 Ploc. Gr. curled, hindling.
 Pno, pno. Gr. breathing.
 Pno. Gr. grass.
 Pod. Gr. foot, shoe.
 Pogon. Gr. beard.
 Pol. L. furrowed.
 Pol, poly. Gr. many.
 Pom. L. apple.
 Popul. L. people.
 Port. L. carrying.
 Potamo. Gr. river.
 Potent. L. powerful.
 Poterium. Gr. cup, drink.
 Præ. L. before.
 Prat. L. meadow.
 Pre. L. before.
 Prem. Gr. stalk.

 Pren. *Gr. drooping.
 Prin. Gr. red oak.
 Pricq. Gr. a saw.
 Pro. L. for.
 Prora. Gr. front.
 Prosalt. Gr. suspended.
 Prosopia. Gr. face.
 Prost. Gr. appendage.
 Prot. Gr. first.
 Protea. Gr. many forms.
 Pruin. L. frost.
 Peal. Gr. ring, pipe.
 Peamm. Gr. grassy sands.
 Pseud. Gr. false.
 Peiad. Gr. dew.
 Peid. Gr. pomegranate.
 Peil. Gr. naked, thio, bare.
 Peittac. Gr. parrot.
 Peoph. Gr. noise.
 Peoral. Gr. scabby.
 Psych. Gr. soul, coolness.
 Ptel. Gr. elm.
 Pter. Gr. wing.
 Pthalm. Gr. eye.
 Ptil. Gr. feather, plume.
 Ptych. Gr. fold.
 Pylmon. L. lung.
 Pulsat. L. beating.
 Pusill. L. small, timid.
 Pycn. Gr. dense.
 Pyr. Gr. wheat, fire.
 Pyr. L. pear.
 Pyren. L. small stone-fruit.
 Pyrethr. Gr. fice.
 Pyrol. L. little pear.
 Pyrrho, pyrrro. Gr. red.
 Pyrul. L. little pear.
 Pythoa. Gr. snake.
 Pyxid. Gr. box with lid.

 Quadri. L. four.
 Qual. L. such.
 Quater. L. four.
 Querc. L. oak.
 Quiaq, quint. L. five.
 Quis. L. who? which?
 Quivis. L. whosoever.

 Ra. Gr. easily, quickly.
 Rach. Gr. spine.
 Raco. Gr. ragged.
 Rad. L. root.
 Ragio. Gr. torn.
 Ram. L. branch.
 Ran. L. frog.
 Ranuncul. L. little frog.
 Rap. L. turnip.
 Raph. Gr. seam.
 Raphi, raphid. Gr. needle.
 Rapuncul. L. little turnip.
 Rect. L. straight.
 Rem, remus. L. oar.
 Ren. L. kidney.
 Rept. L. creeping.
 Resed. L. appeasing.
 Resupin. L. inverted.
 Ret, retic. L. net.
 Retia. Gr. resin.
 Retin, retinacul. L. stay, string.

- Rhabd. Gr. rod, switch.
 Rhama. L. buckthorn.
 Rhap. Gr. strong.
 Rhe. Gr. flowing.
 Rhex. Gr. rupture.
 Rhin. Gr. nose.
 Rhips. Gr. willow branch.
 Rhipia. Gr. fan.
 Rhiz. Gr. root.
 Rhod. Gr. red.
 Rhoë. Gr. stream, wave.
 Rhus. Gr. stomach.
 Rhus. Celt. red.
 Rhyuch. Gr. snout, beak.
 Rhyt. Gr. wrinkled.
 Ric. L. woman's cloak.
 Ricin. L. tick-bug.
 Rip, rips. Gr. osier, thong.
 Ripa. L. growing by water.
 Riv. L. belonging to rivers.
 Rops. Gr. shrub.
 Ror, rorid. L. dewy, dew-like.
 Ros. L. rose, dew.
 Rostel, rostr. L. beak.
 Rub. L. red.
 Ruf. L. reddish.
 Rupa, rupic. L. among rocks.
 Ruri, rus. L. rural.
 Russ. Gr. red.
 Ryt. Gr. wrinkled.

 Sab. L. sand.
 Sac. Gr., L. sack, bag.
 Sacch. L. sugary.
 Sacc. Gr. buckler.
 Sæm. Gr. flag.
 Sagen. L. net, seine.
 Sagin. L. gross food.
 Sagit. L. arrow.
 Sal. L. salt.
 Sal. Celt. near.
 Salp. Gr. trumpet.
 Salv. L. saving, healing.
 Sambuc. Gr. musical pips.
 San. L. healing.
 Sanct. L. holy.
 Sanguis. L. blood.
 Sant. L. holy.
 Sapo. L. soss.
 Sapr. Gr. putrid.
 Sar. Gr. adorning.
 Sarc. L. flesh.
 Sard. L. carnelian.
 Sarment. L. twig.
 Saro. Gr. to sweep.
 Sarsa. Span. bramble.
 Sart. L. etched.
 Satur. Ar. savory.
 Satyr. Gr. satyr.
 Saur. L. lizard.
 Sax. L. rock.
 Scab. Gr. itch, scabby.
 Scæv. L. left hand.
 Scal. L. ladder.
 Scaph. Gr. little boat.
 Scap. Gr. shade, cover.
 Sceptr. Gr. sceptre.
 Schis, schiz. Gr. split, rent.
- Schoen. Gr. cord, rush.
 Scia. Gr. shade.
 Sciad. Gr. umbrella.
 Scill. Gr. injurious.
 Sciöd. L. torn.
 Scirp. L. rush.
 Scitani. L. pleasant meat.
 Scler. Gr. hard.
 Scob. L. sawdust.
 Scolio. Gr. crooked.
 Scolo. Gr. thorn.
 Scolopendr. Gr. centipede.
 Scoly. Gr. thorn.
 Scopa. L. brush.
 Scord. Gr. garlic.
 Scorria. Gr. cinder, dross.
 Scorö. Gr. dung.
 Scorpio. L. scorpion.
 Scorz. Gr. viper.
 Scroph. Gr. scrofula, sow.
 Scrot. L. bag, purse.
 Scut. L. shield.
 Scutell. L. little shield.
 Scutic. L. whip.
 Scyph. Gr. cup.
 Scyr. Gr. roughness.
 Secal. L. rye.
 Sech, seco. Gr. enclosure, stall-fattened.
 Securi. L. hatchet.
 Sed. L. seat, seated.
 Selag. L. hedge hyssop.
 Selen. Gr. moon.
 Selin. Gr. parsley.
 Sells. L. saddle.
 Sema. Gr. flag, standard.
 Seme. Gr. mark, impression.
 Semm. Gr. crown.
 Semper. L. always.
 Sen. L. old.
 Sep. Gr. putrid.
 Sept. L. seven, partition.
 Sari, seric. L. silky.
 Serot. L. late appearing.
 Serp. L. creeping.
 Serra. L. saw.
 Set. L. bristle.
 Sicy. L. cucumber.
 Sid, sider. L. star.
 Sideros. Gr. iron.
 Silen. Gr. saliva.
 Silph. Gr. moth.
 Sime. Gr. bee.
 Simo. Gr. flat.
 Sinap. Gr. mustard.
 Sion. Gr. wool.
 Siph. Gr. tube.
 Sis. Gr. hog.
 Sisymp. Gr. finger.
 Smaragd. Gr. emerald.
 Smil. Gr. scraper.
 Smyrn. Gr. myrrh.
 Sol. L. sun.
 Sold. L. piece of money.
 Solen. Gr. tube.
 Solid. L. firm, united.
 Som. Gr. flock, body.
 Sonch. Gr. sow-thistle.
 Soph. Gr. wisdom.
- Sophron. Gr. modest.
 Sor. L. heap.
 Sorb. L. absorbing.
 Sparsas. Gr. torn.
 Spargan. Gr. fillet, hand-age.
 Spart. Gr. broom-plant, rope.
 Spatal. Gr. delicate.
 Spath. Gr. sheath.
 Spec. L. mirror.
 Sperg. L. scattering.
 Sperm. Gr. seed.
 Spnac. Gr. sage-plant.
 Spnar. Gr. sphere.
 Sphagn. Gr. moss.
 Sphen. Gr. wedge.
 Spinct. Gr. contraction.
 Spbodol. Gr. surpassed.
 Sphond. Gr. neck, head.
 Spic. L. spike.
 Spil. Gr. clasping, stingy.
 Spin. Gr. sparrow.
 Spin. L. spine.
 Spin, spuiid. Gr. strange bird.
 Spir. L. spiral.
 Splach, splanch. Gr. bowels.
 Splen. Gr. spleen.
 Spond. Gr. cup.
 Spor. Gr. seed, spore.
 Spum. L. froth.
 Squarros. L. spreading at right angles.
 Stachys. Gr. spike.
 Staphyl. Gr. bunch.
 Stat. L. position.
 Static. L. arresting.
 Stax. Gr. spike.
 Steg. Gr. covering.
 Stell. L. star.
 Stelm. L. dog-collar.
 Stemm. Gr. crown.
 Stemon. Gr. stamen.
 Stephan. Gr. crown, top, rita.
 Stich. Gr. row.
 Stict. Gr. pit, brand.
 Stilbe. Gr. brightness.
 Stip. L. stipe, feather.
 Stipul. L. stipule.
 Stom. Gr. mouth.
 Strat. Gr. soldier.
 Strept. Gr. twisted.
 Strig. L. with closely pressed hairs.
 Strobil. Gr. whirling; cone.
 Strobil. L. artichoke.
 Strom. Gr. couch, thallus.
 Stromb. Gr. twisted shell.
 Strophe. Gr. turned, twist-ed.
 Strum. L. swelling.
 Struth. Gr. ostrich.
 Strypha. Gr. astringent.
 Styl. Gr. style, column.
 Styph. Gr. stuffed.
 Styphan. Gr. astringent.
 Subul. L. awl-like.

- Sus. Gr. hog.
 Sym. Gr. together.
 Symbol. Gr. banner, flag.
 Symphyo. Gr. united, or growing together.
 Syn. Gr. together.
 Syring, syriux. Gr. pipe, reed.
 Sys. Gr. hog.
 Syzyg. Gr. union.
- Tæd. L. wearisome.
 Tæn. Gr. fillet, wreath.
 Tal. Gr. green branch.
 Tamar. Ar. date.
 Tapein, tapin. Gr. lowly.
 Tarax. Gr. to disorder.
 Tass. Gr. order.
 Taxi. Gr. arrangement.
 Tel. Gr. end; complete; distaot.
- Tephros. Gr. ash-colored.
 Ter. L. three.
 Termin. L. boundary, limit.
 Terpno. Gr. beautiful.
 Testud. Gr. tortoise.
 Tetr. Gr. four.
 Thal. Gr. green branch, thallus.
- Thalam. Gr. bridal chamber.
 Thalass. Gr. sea.
 Thamn. Gr. bush.
 Thanat. Gr. death.
 Thaum. Gr. wonderful.
 Thec. Gr. envelope.
 Them. Gr. arrangement.
 Then. Gr. sole of foot.
 Theo. Gr. God, divine.
 Ther. Gr. harvest, hunt.
 Therm. Gr. hot.
 Thlas p. Gr. broken, pressed.
- Thria. Gr. fig-leaf.
 Thrina. Gr. fan.
 Thuja. Gr. sacrifice to gods.
 Thyl. Gr. bag.
 Thym. Gr. conrage, inspiring.
- Thyre. Gr. thyrsus.
 Thys. Gr. fringe.
 Tiar. L. tiara.
 Tigr. L. tiger.
 Til. L. linden.
 Tipul. L. crane-fly.
 Toc. Gr. fruitful.
- Tom. Gr. cut.
 Tort. L. twisted.
 Touter. Gr. another.
 Tox. Gr. a bow.
 Toxic. Gr. arrow-poison.
 Trach. Gr. throat.
 Trag. Gr. goat.
 Trap. Old Ger. trap, snare.
 Trapez. Gr. table.
 Trem. Gr. trembling.
 Trep. Gr. turning.
 Tri. L. three.
 Tribul. L. threshing sledge with sharp spikes.
 Trich. Gr. hair.
 Triens, trient. L. third part of a foot.
 Tril. L. triple.
 Trip, trips. Gr. grinding.
 Tritic. L. beaten, threshed.
 Tritoma. Gr. thrice cut.
 Troch. Gr. wheel.
 Trol. Ger. round.
 Troll. Ger. rolling.
 Trop. Gr. turned.
 Tropæo. Gr. victory.
 Troxim. Gr. edible.
 Tryma. Fr. like hickory-nut.
- Tryp. Gr. hole.
 Tub. L. tube.
 Tulip. Pers. turban.
 Tunic. L. coat.
 Turr. L. turret.
 Turt. L. twisted.
 Tuess. L. cough.
 Tyl. Gr. a hard swelling.
 Tymp. L. drum.
 Typh. Gr. bog.
- Ud, udor. Gr. water.
 Ul. Gr. thicket, copse.
 Ulm. Celt. elm.
 Umbel. L. umbrella.
 Umbilic. L. navel.
 Umbr. L. shade.
 Un. L. one.
 Upo. Gr. under.
 Ur, urio, urium, uro. Gr. tail.
- Uran. Gr. euhlime.
 Urceol. L. cup.
 Ure, urn, urt. L. burning.
 Uet. L. burnt, scorched.
 Utric. L. bladder.
 Uv. L. grape.
- Vacc. L. cow.
 Vaccio. (*L. baccin*) berry.
 Vagin. L. sheath.
 Val. L. powerful.
 Valer. L. health-giving.
 Vasc. L. vessel.
 Vent. L. wind.
 Ventr. L. belly.
 Ver. L. truly.
 Verbasc. (*L. barbasc*) beard-ed.
- Vern. L. vernal.
 Vesic. L. bladder.
 Vexill. L. banner.
 Viburu. L. tough, pliant.
 Vicia. L. binding.
 Vinc. L. band, chain.
 Vir. L. green.
 Visc. L. viscid, mistletoe.
 Vit. L. life; the vine.
 Viticul. L. little vine.
 Vitt. L. fillet, band.
 Volv. L. rolling.
- Xanth. Gr. yellow.
 Xen. Gr. a guest.
 Xenodoch. Gr. hospitality.
 Xer. Gr. arid, dry.
 Xipho. Gr. sword.
 Xyl. Gr. wood.
 Xyr. Gr. pointed, sharp.
 Xym. Gr. a shaving, scale.
- Xyet. Gr. covered piazza.
- Yle. Gr. forest.
 Ypo. Gr. under.
- Zab. Gr. bent, wreathed.
 Zabe. Gr. coat of mail.
 Zam. Gr. loes.
 Zamia, pine-nut.
 Zea. Gr. living; name also of a sort of grain.
 Zem. Gr. loes.
 Zephyr. Gr. west wind.
 Zeux. Gr. joined.
 Zig. Gr. yoke.
 Zingiber. Gr. ginger.
 Ziz. Gr. daniel.
 Zizyph, from Ar. zizouf, jujube.
 Zo. Gr. life.
 Zom. Gr. belt.
 Zon. Gr. girdle.
 Zoeter. Gr. girdle.
 Zug, zyg. Gr. yoke.

II.

Proper Names.

- Abel, Dr., naturalist.
 Achilles, Gr. myth.
 Adanson, Fr. botanist.
 Adlum, American citizen.
 Adonis, Gr. myth.
 Albertus (Magnus), celebrated theologian.
 Aldrovandi, It. nat.
 Allamsnd, Dr., of Leyden.
 Aloneo (Zanoni), Sp. bot.
 Alstroemer, Swedish merchant.
 Amaryllis, Roman myth.
 Amazon, river, S. Am.
 Amherst, English countess.
 Ammaso, Swiss bot.
 Ameon, Am. citizen.
 Andrea, Dr., Hauover.
 Andromeda, Gr. myth.
 Angulo, Sp. naturalist.
 Aphrodite, Gr. Venus.
 Arabis, from Arabia.
 Aracania (whence Aracania), a province of Chili.
 Arethusa, Gr. myth.
 Artemis, Gr. myth.
 Asagra, for Aea Gray, Am. bot.
 Aesclepias, Esculapins.
 Atropa, Gr. myth. Fate.
 Attalus, King of Pergamos.
 Aubriet, Fr. botanist.
 Averrhoes, Arab. philos.
 Avicenna, Arab. philos.
 Azara, Sp. botanist.
- Bacchus, Gr. myth.
 Backhouse, Eng. traveller.
 Baister, Eng. missionary to Va.
 Banks, Sir J., Eng.
 Barclay, Eng. collector.
 Barker, Eng. orchidist.
 Barnadez, Sp. bot.
 Barrelier, Fr. bot.
 Barrington, Eng. antiquary.
 Barton, Am. bot.
 Basi, Fr. bot.
 Bauhin, Swiss bot.
 Beaufort, Duchess, Eng.
 Beaumont, Mrs., Eng.
 Bedford, Duke, Eng.
 Begon, Fr. amateur.
 Bejar, Sp. bot.
 Benthsm, Eng. bot.
 Bergius, Swed. bot.
 Bergsma, Dutch bot.
 Berthollet, Fr. chemist.
- Bertye, from Lambertye, Fr. count.
 Besler, bot. Nuremberg.
 Besser, Russ. bot.
 Bignon, Fr. abbé.
 Billardiére, Fr. bot.
 Billberg, Swed. bot.
 Blackwell, Eng. bot.
 Bleeker, Dutch amateur.
 Bligh, Eng. captain.
 Blumenbach, Ger. physiol.
 Boccone, Sicilian bot.
 Boehmer, Ger. bot.
 Boerhaave, Dutch bot.
 Bolivar, President of Colombia, S. Am.
 Bolton, Eng. bot.
 Bonnet, Swiss nat.
 Bontine, Dutch nat.
 Boroni, It. attendant of Dr. Sibthorp.
 Bory, Fr. savant.
 Boec, Fr. agriculturist.
 Bossien, Fr. bot.
 Boswell, Eng. author.
 Bougainville, Fr. navigator.
 Bouguer, Fr. savant.
 Boussingault, Fr. philosopher.
 Bouvard, Fr. bot.
 Bowen, Governor of Queensland.
 Boykin, Dr., Ga.
 Braganza, royal line of Portugal.
 Brayer, Fr. physician.
 Brazoria, Texas town.
 Bridel, Swiss bot.
 Brodie, Scotch bot.
 Broussonet, Fr. bot.
 Browallus, Bishop of Abo.
 Browne, Dr. P.
 Bruce, Eng. traveller.
 Brunfels, Ger. bot.
 Brunonia, latinism for Brown (Robert).
 Buchanan (Hamilton), Eng. amateur.
 Buchner, Ger. bot.
 Buckley, bot.
 Buddle, Eng. bot.
 Burchell, Eng. traveller.
 Burmson, Dutch bot.
 Bursser, Ger. bot.
 Buttaer, Ger. bot.
 Byron, Eng. Admiral.
- Cæsalpinus, It. bot.
- Calaudrini, Ger. bot.
 Callirhoé, Gr. nymph.
 Camellis, after Kamel, Jesuit father.
 Caudolle, de, Fr. bot.
 Carey, Eng. bot.
 Carludovica, after Carlos and Luisa of Spain.
 Caspury, Swiss bot.
 Cassandra, Gr. myth.
 Cassiope, Gr. myth.
 Castelléjo, Sp. bot.
 Cathcart, Ind. amateur.
 Cecrops, Gr. ruler.
 Celsine, Swed. author.
 Centaur, Gr. myth.
 Cerasus, town in Pontus.
 Cerberus, Gr. myth.
 Chaptal, Fr. chemist.
 Charlwood, Eng. seedsman.
 Chiron, Gr. centaur.
 Circe, Gr. myth.
 Clark, Am. explorer.
 Claude (Lamonreux), Fr. bot.
 Clavijo, Sp. bot.
 Clayton, Am. bot.
 Clinton, De Witt.
 Clineus, Charles de l'Ecluse, Fr. bot.
 Cobo, Sp. bot.
 Colchis, now Mingrelia, Asia.
 Cole, Gov. of Mauritius.
 Collet, bot. author.
 Colline, Z., American.
 Collinson, Eng. bot.
 Cologan, family in Tensriffe.
 Columellius, Rom. agricult.
 Colonna, It. nobleman.
 Combretum, ancient name.
 Commelyn, Dutch bot.
 Comparetti, It. bot.
 Compton, Eng. bishop.
 Cook, the navigator.
 Cordus, Ger. bot.
 Correa, Portuguese bot.
 Coesigny, Fr. nat.
 Conlter, bot. author.
 Crantz, Austrian bot.
 Crawford, Gov. of Singapore.
 Crescenzi, It. agricult.
 Crow, Eng. bot.
 Crickebanke, Eng. agricult.
 Cuning, Lady.
 Cunningham, Australian bot.
 Cupani, It. bot.
 Curtis, Eng. bot.

- Cæson, Fr. bot.
 Cypria, Gr. Venus.
 Cyrilli, bot., Naples.
- Dahl, Swed. bot.
 Dalberg, Swed. Dr., friend of Jussieu.
 Dale, Eng. bot.
 Dalechamp, Fr. bot.
 Dampier, navigator.
 Daphne, Gr. myth.
 Darlington, Am. bot.
 Darwin, Eng. bot.
 Daubenton, Fr. nat.
 Davall, Swiss bot.
 Davies, Welsh bot.
 Decaisne, Fr. bot.
 De la Beche, Fr. bot.
 Desfontaines, Fr. bot.
 Deutz, sheriff of Amsterdam.
 Diana, Gr. myth.
 Dickson, Eng. cryptogamist.
 Dierville, Fr. traveller.
 Dillen, bot., Oxford professor.
 Dione, Gr. Venus.
 Dioscorides, Gr. physician.
 Dirca, celebrated Gr. fountain.
 Dodoens, Belg. bot.
 Dombey, Fr. bot.
 Doody, Eng. cryptogamist.
 Dorsten, Ger. author.
 Douglas, Scotch collector for Hort. Soc.
 Drayton, Am. nat.
 Drummond, Scotch bot.
 Durante, It. bot.
 Duvau, Fr. bot.
- Echeveri, Mex. bot. draughtsman.
 Edwards, Eng. bot. draughtsman.
 Ehret, Ger. bot. draughtsman.
 Elliott, Am. bot.
 Elizabeth, Prussia, princess.
 Eugemann, Am. bot.
 Enslin, Austrian traveller.
 Erechtheus, Attic king.
 Escallon, Sp. traveller.
 Eschscholtz, Ger. bot.
 Espeleta, Santa Fè.
 Eugene, Savoy, prince.
 Eupator, King of Pontus.
 Euphorbus, ancient physician.
 Eurybia, Gr. myth, mother of the stars.
- Fabiano, Spaña.
 Fadyen, author of Flora of Jamaica.
 Fagon, Fr. bot.
 Fenzl, Ger. bot.
 Flacourt, Fr. commandant, Madagascar.
 Floerke, Ger. bot.
- Forestier, Fr. physiciau.
 Forskal, Swed. bot.
 Forster, Eng. bot.
 Forsyth, royal gardener, Kensington.
 Fothergill, Dr., London.
 Fourcroy, Fr. chemist.
 Franco, Spaniard.
 Frankeniuss, Swed. bot.
 Fremont, Am. explorer.
 Freycinet, Swiss navig.
 Froelich, Ger. bot.
 Fuchs, Ger. bot.
 Funk, Ger. cryptogamist.
- Gaertner, Ger. bot.
 Gage, Sir T., Eng.
 Gaillard, France.
 Garcin, Eastern traveller.
 Gardou, Dr., S. Carolina.
 Gardouqui, Sp. financier.
 Garidel, Fr. bot.
 Garry, Sec. Hudson Bay Co.
 Gaston, Fr. prince.
 Gattinger, Dr. A., physician and bot., Nashville, Tenn.
 Gaudichaud, Fr. bot.
 Gauthier, Dr., Quebec.
 Gay-Lussac, Fr. scientist.
 Gaza, Theod., 15th cent.
 Gentius, a king of Illyria.
 Gerarde, Eng. herbalist.
 Geener, Swiss bot.
 Gil, Sp. bot.
 Gillen, Dr.
 Gillies, Scotch hist.
 Glieditch, Ger. bot.
 Gleichen, Ger. bot.
 Gloxin, Ger. bot.
 Goldfuss, Ger. bot.
 Gongora, Viceroy of N. Granada.
 Good, collector for Kew Gardens.
 Goodyer, Brit. bot.
 Gordon, Dr., Aberdeen.
 Gouan, Fr. bot.
 Govenia, after Gowen, horticulturist, Eng.
 Grabowski, Ger. bot.
 Grew, Eng. bot.
 Greville, bot. patron, Eng.
 Guettard, Fr. nat.
 Gunner, bp. of Norway.
 Gustavus III., of Sweden.
 Guzman, Sp. bot.
- Hake, Ger. patron of bot.
 Hales, Stephen, author, Am.
 Hamel, du, Fr. physiol.
 Hebenstreit, Ger. traveller.
 Helen, of Greece.
 Helicon, Gr. mountain.
 Helwing, Ger. bot.
 Héracles, Hercules, Gr. myth.
 Heritier, Fr. bot.
 Hermann, Ger. bot.
 Hernandez, Sp. bot.
 Heucher, Ger. bot.
- Hibbert, George.
 Hillebrand, Dr.
 Hinds, bot.
 Hippocrates, Gr. physician.
 Hooker, Eng. bot.
 Hope, Scotch bot.
 Hosack, Dr., N.Y.
 Houtton, Dutch bot.
 Houlet, Fr. gardener.
 Houston, Eng. bot.
 Freycinet, Swiss navig.
 Hoy, Eng. gardener.
 Hudson, Eng. bot.
 Hugel, Baron, Vienna.
 Humboldt, scientist.
 Hume, Lady, Eng.
 Hyacinthus, Gr. myth.
- Iberia, Spain.
 India, Asia.
 Iris, Gr. myth.
 Ixora, Malabar goddess.
- Jacquemont, Fr. traveller.
 Jacquin, Dutch bot.
 Jefferson, President U.S.
 Jerville, de, Fr.
 Jones, Sir W., Eng.
 Jove, Ju, Jupiter.
 Jungermann, Ger. bot.
 Jussieu, Fr. bot.
 Justice, Scotch horticult.
- Kämpfer, Ger. nat.
 Kegenack, Dutch ambassador to Spain.
 Kalm, Swed. bot.
 Kennedy, Eng. nurseryman.
 Kerr, Eng. bot. collector.
 Kitahel, Hung. bot.
 Klein, Ger. bot.
 Kœreuter, Ger. bot.
 Knowlton, Eng. nat.
 Knox, of Ceylon.
 König, Brit. Museum.
 Kops, bot. author.
 Kosteletkya, Bohem. bot.
 Kramer, Ger. bot.
 Kylling, Dan. bot.
- Lachevalia, after De la Chenal, Fr. bot.
 Lagerström, Ger. bot.
 Lambert, Eng. bot.
 Landolphe, Fr. navig.
 La Pagerie, Emp. Josephine.
 La Porte, Fr. savant.
 (La) Roche, Swiss physician.
 Lardizabala, Sp. nat.
 Larrea, Sp. scientist.
 Lavater, Swiss author.
 Lavoisier, Fr. chemist.
 Lawson, Scotch florist.
 Leche, Swed. bot.
 Lee, Eng. nurseryman.
 Leschenault, Fr. bot.
 Lespedez, Gov. Florida.
 Leucothoë, Gr. myth.
 Lewis, Am. explorer.

- Leycester, Eng. judge in Bengal.
- Liebig, Gr. chemist.
- Linder, Swed. bot.
- Lindley, Eng. bot.
- LINNÆUS, Swed. bot.
- Lister, Eng. nat.
- Lobel, Fr. bot.
- Lodoicea, after Laodice, daughter of Priam and Hecuba.
- Logan, Phils., founder of Library.
- Loiselen, de Longchamps, Fr. bot.
- Lonicer, Ger. physician.
- Lopez, Sp. bot.
- Lowe, Eng. clergyman.
- Ludwig, Ger. bot.
- Luxemburg, Fr. duke.
- Lydia, country in As. Minor.
- Lysimachus, a king of Sicily.
- Mackay, Dr., Dublin.
- Maclure, Am. geologist.
- Magnol, Fr. physician.
- Maherina, anagram for Hermania.
- Malcolm, Eng. nurseryman.
- Malesherbes, Fr. author.
- Malpighi, It. microscopist.
- Mandeville, British minister to B. Ayres.
- Manetti, It. bot.
- Mangles, English bot. patron.
- Mantis, name of an insect.
- Marauti, It. bot.
- Maratti, It. bot.
- Marcgrave, Ger. bot.
- Marchant, Fr. bot.
- Maria, Virgin Mary.
- Marsilea, after Marsigli, It. nat.
- Martyn, Eng. bot.
- Masdevall, Sp. bot.
- Maton (de la Varenne), Fr. author.
- Matthioli, It. bot.
- Maurandy, Sp. scientist.
- Mauritia, after Maurice, prince of Nassau.
- Medic, from Media.
- Medinilla, Gov. of Mari-
anne (Ladron) Islands.
- Mentzel, Ger. bot.
- Mesa, Arab, 8th cent.
- Metternich, Prince.
- Micbaux, Fr. bot.
- Micheli, bot., Florence.
- Mikan, bot., Prague.
- Mirbel, Fr. bot.
- Mitchell, Am. bot.
- Mohr, Ger. bot.
- Moltke, Danish noble.
- Monardes, Sp. physician.
- Monson, Lady Ann.
- Montbret, Fr. scientist.
- Morrea, after Moore, Eng. bot.
- Morin, Fr. bot.
- Morison, Eng. bot.
- Musa, ancient Roman physician.
- Mutia, bot., New Granada.
- Napoleon, Emperor I.
- Narcissus, Gr. myth.
- Nepete, a Tuscan town.
- Neptune, Gr. sea-god.
- Nereus, Gr. sea-god.
- Nerine, Gr. myth.
- Nevius, Am. clergyman.
- Newberry, Am. scientist.
- Nicander, Gr. poet.
- Nicot, Fr. ambassador.
- Nierenberg, Sp. nat.
- Noisette, Fr. nurseryman.
- Nuttall, Am. bot.
- Nuyts, Dutch navigator.
- Nyssa, Gr. water-nymph.
- Opus (Opuntia), Gr. town.
- Orontee, river, Asia.
- Osbeck, Swed. trav.
- Osmund, Celt. deity, or perhaps St. O., Bp. of Salisbury.
- Pæon, fabled Gr. physician.
- Palinurus, African town.
- Pappia, Venus.
- Park, Mungo, Eng. traveller.
- Parkinson, Eng. bot.
- Parmentier, Fr. agricult.
- Parnassus, Gr. mt.
- Pauli, Danish bot.
- Paulownia, Russian princess.
- Pavon, Sp. bot.
- Pereskia, after Pieresk, Fr. scientist.
- Pernotty, traveller.
- Persic, Persia.
- Petiver, Eng. nat.
- Petre, Lord, Eng.
- Phoenix, from Phœnicia; also, a fabled bird.
- Pinckney, Gen.
- Pison, Dutch nat.
- Pitcairn, Eng. physician.
- Planer, Ger. bot.
- Plinnier, Fr. bot.
- Poinci, de, Gov. of Antilles.
- Poinsette, Am. minister to Mexico.
- Polemon, Gr. philos.
- Pontedera, It. bot.
- Poultney, bot. author.
- Priestley, Dr., Eng.
- Pronay, Fr. nat.
- Proserpine, Gr. myth.
- Protens, Gr. myth.
- Punic, Carthaginian.
- Quassia, a celebrated negro slave and physician in Surinam, who used as a remedy the drug which bears his name.
- Raffles, Sir W., Eng.
- Rafinesque, Fr. bot.
- Raleigh, Sir W.
- Ramond, Fr. nat.
- Rand, London bot.
- Reaumur, Fr. nat.
- Retzius, Swed. bot.
- Rhode, see Robde.
- Richard, Fr. bot.
- Riché, Fr. nat.
- Rive, Swiss bot.
- Rivinus, Ger. bot.
- Robin, Fr. bot.
- Robinson, after Robinson Crusoe.
- Roche, de la, Fr. bot.
- Roell, Dutch anatomist.
- Robds, Ger. scientist.
- Rondelet, Fr. nat.
- Roxburgh, E. Ind. bot.
- Royen, Leyden bot.
- Rudbeck, Swed. bot.
- Rudge, M. F.
- Ruell, Fr. bot.
- Russell, Dr. Alex., Scot.
- Sabbati, It. bot.
- Salisbury, Eng. bot.
- Salvador, our Saviour.
- Sanderson, Sec. Hist. Soc., Natal.
- Sansevier, Swed. bot.
- Sarmiento, Sp. bot.
- Sarrasin, Dr., Quebec.
- Sauvages, Fr. bot.
- Schlimm, collector.
- Scholler, Ger. bot.
- Schomburgk, nat.
- Schrank, Ger. bot.
- Schultz, Ger. bot.
- Schwëinitz, Am. bot.
- Seaforth, Lord, Eng.
- Senebier, Swiss nat.
- Sequoia, Cherokee noble.
- Sesban, Ar. name.
- Seymer, H.
- Shepherd, Eng. bot.
- Sherard, Eng. bot.
- Short, bot., Ky.
- Sibthorp, Eng. bot.
- Simmonds, Eng. nat.
- Sloane, founder of Brit. Museum.
- Smeathmann, Af. traveller.
- Sobral, Sp. bot.
- Solander, Swedish collector of plants.
- Sole, bot. writer, Eng.
- Solly, phytologist, F.R.S.
- Sparmann, Swed. bot.
- Spigelius, It. bot.
- Sprekel, Ger. bot.
- Stackhouse, Eng. author.
- Stadmann, Ger. bot.
- Stapel, Dutch physician.
- Staunton, Sir George.
- Stevia, after Esteve, bot. of Valencia.
- Stillingfleet, Eng. collector.

- Stokes, Eng. bot.
 Strelitz, after queen of George III.
 Stuart, John, Lord Buta.
 Sullivant, Am. bryologist.
 Sutherland, Scotch bot.
 Swainson, Isaac, F.R.S.
 Swartz, Swed. bot.
 Swart, Dutch collector of plants.
 Swieten, Dutch bot.
- Tabernæmontanus, Fr. bot.
 Tamarix, after Tamaris, now Tambro, a river of the Pyrenees.
 Tasman, Dutch navigator.
 Telfair, Mrs., Eng.
 Taucer, a Trojan prince.
 Thalius, Ger. physician.
 Theophrastus, Gr. bot.
 Thunberg, bot. traveller.
 Tillands, bot. at Abo.
 Tilli, It. bot.
- Todo, Ger. mycologist.
 Toreu, Swed. bot.
 Torrey, Am. bot.
 Tournafort, Fr. bot.
 Tradescant, gardener to Charles I.
 Trautvatter, Russ. bot.
 Trigueros, Sp. poet.
 Turner, Eng. bot.
- Urania, Gr. myth.
- Vallisneri, It. bot.
 Vallot, Fr. bot.
 Vaucher, bot., Geneva.
 Vauquelin, Fr. chemist.
 Vénéris, of Venus.
 Vernon, Eng. bot.
 Veronica, Saint.
 Victoria, Queen.
 Vigni, It. author.
 Villars, Fr. bot.
 Virgil, Latin poet.
 Viviani, It. savant.
- Wachendorf, Dutch bot.
 Wablenberg, bot. author.
 Waldstein, Count, Aust.
 Watson, London apothecary.
 Waigal, Ger. savant.
 Walwitsch, Dr., Ger.
 Whitlavia, after Whitlaw, Irish bot.
 Wigand, Bishop of Pomerania.
 Willoughby, Eng. nat.
 Wiatar (not Wistar), Am. anatomist.
 Woods, Joseph, Brit. bot.
 Woodward, Eng. bot.
- Ximieus, Sp. apothecary.
- Zanoni, It. bot.
 Zauchsuar, Bohemian bot.
 Zenobia, Queen of Palmyra.
 Zichy, Austrian countess.
 Zinn, Ger. bot.
 Zyz, Arabian bot.

SYNOPSIS OF CLASSIFICATION.

SERIES I. CRYPTOGAMIA. HIDDEN FLOWERS. ACOTYLÉDONS.
SPORES.—Plants with microscopic flowers. ♂ called *Antheridium*, containing *Antherozoids*. ♀ called *Oögonium* in Seaweeds, *Archeogonium* in Ferns; containing an *Embryo* which is one-celled, homogeneous (of one part only), without cotylédons, and which ripens into a *Spore*. *Reproduction* by Fission and Cell-Division (Parthenogénésis in a mother-cell), by Conjugation, and by Fertilization. *Two Classes*: 1. Thallogens. 2. Acrogens.

Class I. Thállogens.—Spores naked. *Structure* cellular. *Growth* periphèral—increasing at the circumference chiefly. No true stem nor foliage. Vegetative part a *thállus* without stómata. Seaweeds, Mushrooms, Lichens.

Class II. Ácrogens.—Spores covered. *Structure* both cellular and vascular. *Growth* ápical—increasing at the top chiefly. *Stem* simple. *Fronds*, or *Leaves*, fork-veined, or subulate, and furnished with stomata. Mosses, Ferns, Club-Mosses.

SERIES II. PHANEROGAMIA. VISIBLE FLOWERS. COTYLÉDONS.
SEEDS.—Plants with visible (rarely microscopic) flowers. ♂ called *Anther*, containing *Pollen-grains*. ♀ called *Ovule*, containing an *Embryo* which is many-celled, heterogeneous (of several different parts), with one, two, or many cotyledons, and which ripens into a *Seed*. *Reproduction* by Fertilization, very rarely by Parthenogénésis. *Structure* both vascular and cellular. *Growth* both ápical and periphèral. *Foliage* distinct. *Leaves* fork-veined, subulate, parallel-veined, and net-veined. *Two Classes*: 1. Gymnospèrmæ. 2. Angiospèrmæ.

Class I. Gymnospèrmæ — *Ovule* naked (without an ovary or pericarp). *Embryo* with two or many cotylédons. *Seed* usually with but one seed-coat. *Stem* excurrent, differentiated into pith, wood, and bark, but not fully exogenous; wood and bark nearly identical in structure; wood marked by circular disks. *Leaves* fork-veined, parallel-veined, subulate, or needle-shaped; never net-veined. *Cycas*, *Ginkgo*, *Pine*.

Class II. Angiospèrmæ.—*Ovule* covered by an ovary or pericarp. *Two Sub-Classes*: 1. Endogens, or Monocotylédons. 2. Exogens, or Dicotylédons.

SUB-CLASS I. ÉNDOGENS.—*Embryo* with one cotylédon. *Stem* composed of fibro-vascular bundles scattered through a mass of cellular tissue. *Growth* endógenous, by new tissues rising through the centre; no distinction of pith, wood, and bark. *Leaves* parallel-veined, rarely with cross-veins netted. Floral parts térnary, rarely binary (*Roxbúrghia*). Grasses, Lilies, Palms.

SUB-CLASS II. ÉXOGENS.—Embryo with two (very rarely four) cotylédons. *Stem* solvent, fully exógenous; differentiated into *pith*, *wood*, and *bark*; pith (cellular tissue) in the centre; fibro-vascular bundles forming a cylinder outside the pith, and separated into an inner wood-zóne and an outer bark-zóne, each zone increased by concentric layers. *Leaves* net-veined. Floral parts quinary, rarely térnary (*Magnolia*) or binary (*Cœnothéra*). Oak, Pea, Rose, *Magnolia*.

ORDERS AND THEIR ALLIANCES.

*Orders marked with an asterisk * are obscurely allied.*

SERIES I.—Cryptogámia.

Class I.—Thállogens.

Seaweed Alliance

(including the three Orders of the Class):

- Order 1. Álgæ (often phosphorescent).
 “ 2. Fúngi (often phosphorescent).
 “ 3. Lichènes (often phosphorescent).

Class II.—Acrogens.

Moss Alliance:

- Order 1. Hepáticæ.
 “ 2. Músci.
 “ 3. Charácæ.

Fern Alliance:

- Order 4. Fílices.
 “ 5. Equisetácæ.
 “ 6. Marsileácæ.
 “ 7. Lycopodiácæ.

Phanerogámia.

Class I.—Gymnospèrmæ.

Cone Alliance

(including the three Orders of the Class):

- Order 1. Cycadácæ.
 “ 2. Coníferæ.
 “ 3. Gnetácæ.

Class II.—Angiospèrmæ.

SUB-CLASS I.—ÉNDOGENS (MONOCOTYLÈDONS).

- 2 Divisions { 1. Ovary free.
 2. Ovary adherent.

- DIVISION I.—*Ovary Free.* 2 Subdivisions { 1. Ovary simple, or syncarpous.
 2. Ovary apocarpous.

Subdivision I.—Ovary simple, or syncarpous; rarely apocarpous.

Grass Alliance:

- Order 1. Graminaceæ.
 " 2. Cyperaceæ.

Restio Alliance:

- Order 3. Restiaceæ.
 " 4. Eriocaulonaceæ.
 " 5. Flagellariaceæ.

Spiderwort Alliance:

- Order 6. Xyridaceæ.
 " 7. Commelynaceæ.

Pontederia Alliance:

- Order 8. Philydraceæ.
 " 9. Pontederiaceæ.
 " 10. Rapateaceæ.

Lily Alliance:

- Order 11. Juncaceæ.
 " 12. Xerotideæ.
 " 13. Roxburghiaceæ.
 " 14. Asteliaceæ.
 " 15. Gilliesiaceæ.
 " 16. Conantheraceæ.
 " 17. Eriosperrmaceæ.
 " 18. Liliaceæ (Flowers often phosphorescent).
 " 19. Ophiopogonaceæ.
 " 20. Aspidistraceæ.

Arum Alliance:

- Order 21. Lemnaceæ.
 " 22. Araceæ.
 " 23. Typhaceæ.

Palm Alliance:

- Order 24. Pandanaceæ.
 " 25. Palmaceæ.

Subdivision II.—Ovary apocarpous; reduced to one carpel in some Naiadaceæ.

Pondweed Alliance:

- Order 26. Naiadaceæ.
 " 27. Alismaceæ.

fruit; their monocotyledons, however, fix their place among Endogens. See Lesson X.)

(Alismaceæ resemble Ranunculaceæ in flower and apocarpous

Triuris Alliance:

- Order 28. Triurideæ.*

DIVISION II.—*Ovary Adherent.*

(Free in some Bromeliaceæ and Hæmodoraceæ.)

No Subdivisions.

Frogbit Alliance:

- Order 29. Hydrocharideæ (closely allied to Pondweeds, thus making a continuous chain from the most simple (Najas) to the most complex (Hydrocharis) of Endogens. But in Hydrocharis the ovary is adherent and syncarpous).

Yam Alliance:

- Order 30. Dioscoreaceæ (leaves ribbed, with netted cross-veins; and fruit and habit of Smilax; but the ovary here is adherent).

Narcissus Alliance:

- Order 31. Vellosiaceæ.
 " 32. Hæmodoraceæ.
 " 33. Amaryllidaceæ.
 " 34. Iridaceæ.

Tacca Alliance :

- Order 35. Taccæcæ.
 " 36. Burmanniæcæ.

Cardamom Alliance :

- Order 39. Bromeliæcæ.
 " 40. Scitamineæ.

Orchis Alliance :

- Order 37. Apostasiæcæ.
 " 38. Orchidæcæ.

SUB-CLASS II.—ÉXOGENS (DICOTYLÉDONS).

- 3 Divisions { 1. Apétalæ.
 2. Monopétalæ.
 3. Polypétalæ.

- DIVISION I.—*Apétalæ*. 2 Subdivisions { 1. Ovary adherent.
 2. Ovary free.

Flowers achlamýdeous, or monochlamýdeous; rarely dichlamýdeous.

Subdivision I.—Ovary adherent when a perianth is present. Perianth more or less distinct.

Sandalwood Alliance :

(Allied also to Olax.)

- Order 1. Balanophoræcæ.
 " 2. Santalæcæ (sometimes
 dichlamýdeous).
 " 3. Loranthæcæ.

Oak Alliance :

- Order 4. Cupulíferæ.
 " 5. Juglandæcæ.

Aristolòchia Alliance :

- Order 6. Rafflesiæcæ.
 " 7. Aristolochiæcæ.

Subdivision II.—Ovary free, rarely adherent. Perianth usually distinct.

Nepénthes Alliance :

- Order 8. Nepenthæcæ.*

Nettle Alliance :

- Order 22. Urticæcæ.

Pepper Alliance :

- Order 9. Ceratophyllæcæ.
 " 10. Chloranthæcæ.
 " 11. Saururæcæ.
 " 12. Piperæcæ.

Dáphne Alliance :

- Order 23. Proteæcæ.
 " 24. Eleagnæcæ.
 " 25. Thymelæcæ.
 " 26. Hernandiæcæ.

Euphórbia Alliance :

- Order 13. Lacistemæcæ.
 " 14. Geissolomæcæ.
 " 15. Penææcæ.
 " 16. Euphorbiæcæ (some-
 times dichlamýde-
 ous; often phospho-
 rescent).

Laurel Alliance :

(Allied to Anonæcæ.)

- Order 27. Lauræcæ.

Áment Alliance :

- Order 17. Salicæcæ.
 " 18. Casuarinæcæ.
 " 19. Myricæcæ.
 " 20. Platanæcæ.
 " 21. Betulæcæ.

Goosefoot Alliance :

- Order 28. Cynocrambæcæ.
 " 29. Chenopodiæcæ.
 " 30. Amaranthæcæ.
 " 31. Polygonæcæ.
 " 32. Phytolaccæcæ.
 " 33. Nyctaginæcæ.

DIVISION II.—*Monopétalæ*. 2 Subdivisions { 1. Ovary free.
2. Ovary adherent.

Flowers usually dichlamydeous. Petals usually connate.

Subdivision I.—Ovary usually free. 2 Sections { 1. Flowers irregular.
2. Flowers regular.

Section I.—Flowers irregular, rarely regular.

Mint Alliance:

Order 34. Labiatae. Order 38. Gesneriaceae (ovary sometimes adherent.)

“ 35. Verbenaceae.

“ 39. Columelliaceae.

“ 40. Orobanchaceae.

Foxglove Alliance:

Order 36. Acanthaceae.

“ 41. Lentibulariaceae.

“ 37. Bignoniaceae.

“ 42. Scrophulariaceae.

Section II.—Flowers usually regular.

Nightshade Alliance:

Order 43. Solanaceae.

Ebony Alliance:

Order 54. Styracaceae (ovary sometimes adherent)

Polemonium Alliance:

Order 44. Borraginaceae.

“ 55. Cyrillaceae.

“ 45. Convolvulaceae.

“ 56. Ebenaceae.

“ 46. Polemoniaceae.

“ 57. Sapotaceae.

“ 47. Hydrophyllaceae.

Primrose Alliance:

Order 58. Myrsinaceae (ovary sometimes adherent).

Gentian Alliance:

Order 48. Gentianaceae.

“ 59. Primulaceae.

“ 49. Loganiaceae.

“ 60. Plumbaginaceae.

“ 50. Asclepiadaceae.

“ 61. Plantaginaceae.*

“ 51. Apocynaceae.

“ 52. Salvadoraceae.

“ 53. Oleaceae.

Heath Alliance:

Order 62. Lennoaceae.

“ 63. Diapensiaceae.

“ 64. Ericaceae.

Subdivision II.—Ovary usually adherent.

Campanula Alliance:

Order 65. Lobeliaceae.

Aster Alliance:

Order 69. Compósitæ (phosphorescent).

“ 66. Campanulaceae.

“ 67. Goodeniaceae (ovary sometimes free).

“ 70. Dipsacaceae.

“ 68. Stylidiaceae.

“ 71. Calyceraceae

“ 72. Valerianaceae.

Honeysuckle Alliance:

Order 73. Rubiaceae.

“ 74. Caprifoliaceae.

DIVISION III.—*Polypétalæ*. 3 Subdivisions { 1. Calycifloræ.
2. Discifloræ.
3. Thalamifloræ.

Flowers usually dichlamydeous; petals usually separate.

Subdivision I.—Calycifloræ.

Calyx usually conspicuous ; sepals usually connate.

Ovary frequently adherent. Petals 1-seriate, epigynous, or perigynous. Torus adnate to the base of the calyx, rarely raised into a gynophore. Stamens perigynous, usually inserted on or beneath the outer margin of the torus.

Umbel Alliance :

- Order 75. Cornaceæ.
 " 76. Araliaceæ.
 " 77. Umbelliferæ.

Fig-Marigold Alliance :

- Order 78. Ficoideæ.
 " 79. Cactaceæ.

Passionflower Alliance :

- Order 80. Datiscaceæ.
 " 81. Begoniaceæ.
 " 82. Cucurbitaceæ.
 " 83. Passifloraceæ.
 " 84. Turneraceæ.
 " 85. Loasaceæ.
 " 86. Samydeæ.

Myrtle Alliance :

- Order 87. Onagraceæ.
 " 88. Haloragaceæ.
 " 89. Lythraceæ.
 " 90. Melastomaceæ.
 " 91. Myrtaceæ.*
 " 92. Combretaceæ.
 " 93. Rhizophoraceæ.

Rose Alliance :

- Order 94. Bruniaceæ.
 " 95. Hamamelidaceæ.
 " 96. Droseraceæ.
 " 97. Crassulaceæ.
 " 98. Saxifragaceæ.
 " 99. Rosaceæ.
 " 100. Leguminosæ.
 " 101. Connaraceæ.

Subdivision II—Discifloræ.

Torus usually conspicuous as a Disk. Sepals connate, or separate.

Ovary usually free. Disk usually conspicuous as a ring or cushion, or spread over the base of the calyx-tube, or confluent with the base of the ovary, or broken up into glands. Stamens usually indefinite, inserted upon or at the inner or outer base of the disk.

Cashew Alliance :

- Order 102. Anacardiaceæ.
 " 103. Sabiaceæ.
 " 104. Sapindaceæ.

Staff-tree Alliance :

- Order 105. Vitaceæ.
 " 106. Rhamnaceæ.
 " 107. Stackhousiaceæ.
 " 108. Celastraceæ.

Olive Alliance :

- Order 109. Empetraceæ.
 " 110. Illici-næ (Aquifoliaceæ).
 " 111. Olacineæ.

Geranium Alliance :

- Order 112. Chailletiaceæ.
 " 113. Meliaceæ.
 " 114. Burseraceæ (Amyridaceæ).
 " 115. Ochnaceæ.
 " 116. Simarubaceæ.
 " 117. Rutaceæ.
 " 118. Geraniaceæ.
 " 119. Batideæ.*
 " 120. Zygophyllaceæ.
 " 121. Coriariaceæ.*
 " 122. Malpighiaceæ.
 " 123. Humiriaceæ.
 " 124. Linaceæ.

Subdivision III.—Thalamifloræ.

Torus usually a *Thalamus* (that is, with all its floral parts free and distinct, as it were in a common bridal-chamber), rarely changed into a disk or a gynophore. Stamens often indefinite. Petals 1-2- ∞ -seriate.

Mallow Alliance :

- Order 125. Tiliacææ.
 " 126. Sterculiacææ.
 " 127. Malvacææ.

Mangosteen Alliance :

- Order 128. Chlenacææ.
 " 129. Dipterocarpeæ.
 " 130. Camelliacææ.
 " 131. Guttiferæ.
 " 132. Hypericacææ.
 " 133. Elatinacææ.
 " 134. Podostemacææ.

Pink Alliance :

- Order 135. Tamariscinææ.
 " 136. Portulacacææ.
 " 137. Caryophyllacææ.
 " 138. Frankeniæcææ.

Milkwort Alliance :

- Order 139. Vochysiæcææ.
 " 140. Tremandræcææ.
 " 141. Polygalacææ.
 " 142. Pittosporæcææ.

Violet Alliance :

- Order 143. Bixacææ
 " 144. Canellacææ.
 " 145. Violacææ.
 " 146. Droseracææ.
 " 147. Cistacææ.
 " 148. Resedacææ.
 " 149. Moringacææ.
 " 150. Capparidacææ
 " 151. Cruciferæ.
 " 152. Fumariacææ.
 " 153. Papaveracææ.
 " 154. Sarraceniæcææ.

Crowfoot Alliance :

- Order 155. Nymphæacææ
 " 156. Lardizabalacææ.
 " 157. Berberidacææ.
 " 158. Menispermæcææ.
 " 159. Anonacææ.
 " 160. Myristicacææ.
 " 161. Monimiæcææ.
 " 162. Magnoliacææ.
 " 163. Calycanthacææ.
 " 164. Dilleniæcææ.
 " 165. Ranunculacææ.

SERIES I. CRYPTOGAMIA.—Flowers microscopic and rudimentary ; producing a spore without differentiation of parts.

Class I. THALLOGENS.

Seaweed Alliance : 1. Algæ ; 2. Fungi. 3. Lichens.

Ord. I. Algæ, Seaweeds.—Described, Lessons II., V., VI.

Two Divisions (Classification of Le Maout et Decaisne).

Div. 1.—PROTOPHYTA, FIRST PLANTS. 5 Tribes :

Tribe 1. Palmellacææ.—Internal cell-division. Cells globular or elliptic, solitary or in masses in a gelatinous matrix which is an outgrowth of the cell-wall. Several Genera.

1. *Protococcus nivâlis*, RED SNOW ; on snow, mts. ; Fig. 11, D.

P. viridis, green; in gutters, etc. 2. *Palmella cruenta*, deep red; on stone walls. 3. *Chroococcus rufescens*, russet; wet rocks, in springs; Fig. 11, A, B, C.

Tribe 2. **Volvocææ**.—Int. cell-division; active zöospores associated in a gelatinous matrix of various forms, in fresh water. Few genera. 1. *Völvöx globätor*, green; in ponds. Fig. 12.

Tribe 3. **Bacteriææ**. **MICROBES**.—Transverse Fission. Cells cylindric, rigid, very active; isolated or joined end to end, forming filaments; without chlorophyl; usually microscopic. Omnipresent. Several genera.

1. *Micrococcus* (perhaps near *Saccharomyces*, in Fungi); cells rounded. Several species; in smallpox, scarlet fever, measles, diphtheria, gout, blood-poisoning from Poison-Oak (*Rhus toxicodendron*). *M. prodigiösus*, BLOOD-RAIN; red, on spoilt meat, vegetables. *M. Pflügeri*, on fishes; phosphorescent, making luminous patches in the sea. 2. *Bacterium*, cells rod-like, rigid. Several species; in putrefaction, filth. 3. *Bacillus*, like 2, but more slender. Several species; in leprosy, hydrophobia, typhoid fever, malaria, consumption, catarrh, hog-cholera, hen-cholera. 4. *Cömma Bacillus*, cells curved like a comma; in Asiatic cholera. 5. *Léptothrix*, very slender. Several species; in decayed teeth, skin-diseases.

Tribe 4. **Nostocææ**.—Transverse Fission. Cells rounded, joined end to end, with one larger cell (*heterocyst*) at intervals, the whole forming a moniliform filament immersed in a gelatinous matrix. Fresh water, damp earth, stones, etc. Many genera; some are the gonidia of lichens. 1. *Nöstoc edüle*, fresh water; China. *N. cacicula*, Catoosa Springs, Ga. *N. commune*, FALLING-STARS, STAR-JELLY; appearing suddenly on lawns, etc., after rain. Common. One species fossil, in Tertiary.

Tribe 5. **Oscillatoriææ**.—Fission. Cells with chlorophyl; in filaments with oscillating movements; here and there a heterocyst. Several genera. 1. *Oscillatoriä*, several species, dark green; in water, wet earth. 2. *Trichodösmium Ehrenbèrgii*, brick-red filaments on the great oceans, and on the Red Sea, which gets its name from them. 3. *Rivuläria*, like 1, but with radiating filaments. Several species; wet places. 4. *Scytonëma*, filaments branching. Several species; habitat of 3.

Div. 2.—**ALGÆ VÈRÆ**, TRUE (higher) SEAWEEDES. Lessons V., VI. Fossil in Silurian, thence upward. 5 Tribes:

Tribe 1. **Conjugatææ**.—Fission; conjugation. 3 Sub-Tribes:

Sub-Tribe 1. **Diatomæææ** (*Bacillariæææ*).—Described, Lesson V. Many genera; common in fresh or salt water, damp earth. 1. *Navicula viridis*, frustules solitary, longer than broad; valves with a distinct middle line; Fig. 13, A. 2. *Grammatöphora marina*, frustules longer than broad, without middle line; plate-like, adherent; Fig. 14, A. 3. *Diatöma*, frustules longer than broad, coherent. *D. flocculösum*, ditches, 1-12" long. 4. *Bacilläria paradöwa*, only species; frustules stick-like, coherent by their sides, but slipping constantly back and forth. West Point; Gt Brit. 5. *Melosira sulcäta*, frustules cylindrical; valves adherent into a stout filament; Fig. 14, B. 6. *Actinöptychüs senärius*, valves shield-like, divided into light and dark compartments; Fig. 14, C; B and C fossils, in Tertiary, Richmond, Va., making, with many other species, a deposit 30 feet thick and several miles in extent.

A deposit near Monterey, Cal., is 50 feet thick, white and fine as chalk. A deposit in Bilin, Bohemia, is 14 feet thick. Its material was the first used as Tripoli, or Rotten-Stone.

Sub-Tribe 2. **Desmidiaceæ**.—Like Diatoms, but green and not silicious. Many genera; fresh water. 1. *Pediástrum*, cells in families in a flat, thalloid mass; many species. *P. granulátum*, zoöspore, Fig. 11, E. 2. *Closterium acútum*, Fig. 13, B, C, D. 3. *Desmidium*, many species.

Sub-Tribe 3. **Zygnemáceæ**.—Green; cells cylindric, making unbranched filaments elongating (as in Bacteria) by transverse fission of the cell; cells conjugating with cells of other (parallel) filaments. Felted masses in ditches and streams. 1. *Zygnema insigne*; 2. *Spirogýra longáta*; 3. *Mesocárpus scoláris*; all common.

Tribe 2. **Vaucheriáceæ**.—Internal cell-division (single zoöspore expelled from mother-cell). Fertilization; fs. ♂. Green; cell single, in simple or branched filaments, matted in fresh water, damp earth. 1. *Vaucheria séssilis*, Fig. 1, A, B, C, E. 2. *Caulérpa*, cell branched and anastomosing; sand, shaded rocks, deep water. 3. *Caulerpites cactoides*, fossil; Silurian. 4. *Halmeda*, cell similar to 2 and 3, Cactus-like; *H. Opúntia*; in sand and shells, tropical shores of Atlantic, Pacific; Mediterranean and Red Seas. 5. *Saprolégna*; 6. *Achlýa*; 7. *Pýthium*; genera resembling *Vaucheria* except that they are without chlorophyl, and are *saprophytes*,—parasites on dead flies, fish, etc., in water. For *Saprolégna fêrax*, see Lesson XXXII., 412.

Tribe 3. **Chlorospérmæ**. GREEN SEAWEEDS.—Reproduction of Tribe 2. Green; cells simple or branched, variously arranged; marine or fluviatile. Many genera. 1. *Cedogonium ciliátum*, filamentous; ponds. Zoöspore, Fig. 1, D, F. 2. *Acetabularia mediterránea*, small; cell radiately arranged on a tall pedicel; umbrella-like, handsome; Mediterranean. 3. *Bryopsis plumósa*, cell branching, small; marine, common. Fig. 15. 4. *Hydrodictyon utriculátum*, WATER-NET; cells forming a purse-like net. 5. *Conférva*, green filaments, swollen with gas-bubbles as if boiling, whence the name. Several species. 4 and 5 form the green scum on ponds. *Confervites*, fossil in Jurassic and Tertiary.

Tribe 4. **Melanospérmæ**. OLIVE SEAWEEDS.—Cell-division. Fertilization. Brown or olive; various in form; marine. 2 Sections:

Section 1. **Tangles**.—Cell-division; sori superficial. Many genera. 1. *Padina Pavònia*, PEACOCK LAVER, 7' high; temperate seas. Frontispiece, A. 2. *Dictyòta dichótoma*, British coast. Fig. 16, 2. 3. *Nereocýstis*; 4. *Macrocýstis*, SEA-BLADDER, several species; cord-like, 250° to 1700° long, a bladder at apex 7° long with leaf-like appendages; North Pacific. 5. *Alária esculénta*, BADDERLOCKS (BALDERLOCKS); 3° to 20° long; edible; eaten raw. British coast. Fig. 16, 1. 6. *Chórda filum*, DEAD-MAN'S-ROPE; cord-like, 20° to 50° long. British bays. Terror to swimmers. *Palæochórda mînor*, fossil, Lower Silurian. Fig. 83, A. 7. *Laminária*, SEA-OAR; long, oar-like. Many species; edible; common. *Laminarites*, fossil, Silurian. 8. *Lessònia fuscéscens*, SEA-WILLOW; 12° high, with branching drooping crown; making submarine forests. S. Pacific.

Section 2. **Varecks, Wracks**.—Fertilization; fs. ♂; ♂ and ♀ in separate conceptacles. 1. *Himanthália lórea*, SEA-THONG. Frond small, cup-shaped; conceptacles long, strap-shaped. West coast of

England. Fig. 16, 3. **2. Sargassum bacciferum**, GULFWEEED, SEA-LENTILS. Shrub-like; fronds lanceolate, serrate, imitating axiferous growth; conceptacles axillary; small grape-like vesicles near the frond-axils. Floating. See Lesson VI. Fossil in Tertiary. **3. Fucus**. Fronds forked, with or without vesicles; many species, common. *F. vesiculösus*, Fig. 17. *F. platycarpus*, antherozoids, Fig. 2, A. **4. Fucoides**, fossil, Silurian.

Tribe 5. Rhodospärmæ. RED SEAWEEDS, ROSE-TANGLES.—Fertilization; fls. ♂ or ♀ ♂. Fronds various in form; rarely green. Marine, rarely in fresh water. Many genera and species. **1. Corallina**, calcareous, coral-like; several living species; fossil in Silurian. **2. Rytiphloëa thuyoides**. Yew-like, 1' high; British coasts. Fig. 16, 4. **3. Clauëda elegans**. Beautiful. Frond forming a series of nets; each net 1' wide, 10' long, elegantly recurved. Australian seas. **4. Rhodymënia palmata**, DULSE. Frond flat, forked; edible. Common. **5. Chöndrus crispus**, CARRAGEEN MOSS, IRISH MOSS; frond forked, fan-shaped; edible; common. **Chondrites**, fossil, Miocene. **6. Callithamnion**, small, growing on various objects. Marine; frond of simple or branched tubes, red, handsome. Several species. Common. **7. Cerámium**, frond of simple or branched tubes. Several species. *C. rubrum*, red; common.

Ord. 2. Fungi, Moulds, Mildews, Mushrooms.—Described, Lesson VI. Internal cell-division. Fertilization. 6 Tribes:

Tribe 1. Arthrospöreæ (Hyphomycètes).—Spores joined end to end. **1. Penicillium glaucum**, COMMON MOULD. **2. Törula (Saccharomyces) cerevisiæ**, YEAST PLANT, Fig. 18.

Tribe 2. Trichospöreæ (Hyphomycètes).—Spores clustered on hyphæ. **1. Peronöspora infestans**, POTATO-ROT, Fig. 19.

Tribe 3. Cystospöreæ (Phycomycètes)—Spores in a bladder-like sporangium. **1. Mucor Mucödo**, FRUIT-MOULD, Fig. 20.

Tribe 4. Clinospöreæ (Coniomycètes)—Spores (dust-like) on a clinödium (couch). **1. Ustilägo**; **2. Puccinia**; the BUNT and SMUT of grains and grasses; several species of each.

Tribe 5. Thecaspöreæ (Ascomycètes).—Spores few (2 to 8), in thecæ or asci. 2 Sections:

Section 1. Thecæ lining a closed perithëcium. **1. Tuber**, TRUFFLE; many species; hypogæal; edible. Two or three American species. *T. melanösporum*, Fig. 21; Eur. **2. Sphaëria morbösa**, BLACK-KNOT on cherry-trees. Fossil species in Eocene and Miocene. **3. Cördiceps Robertsii**, grows from the head of a caterpillar, forming a horn; New Zealand. *C. militäris*, similar; scarlet; Gr. Brit. *C. purpurea*, ERGOT; on rye.

Section 2. Thecæ lining the upper surface of an open perithëcium, which is sometimes deeply pitted. **1. Cyttäria**, WASP'S-NEST; white; perithëcium convex, pitted. *C. Günnii*, *C. Hookëri*, on beech-trees; edible. Terra del Fuego. **2. Peziza**, BIRD'S-NEST; perithëcium cup-shaped. On ground in beech and pine woods; edible. Many handsome species. Several fossil species, Tertiary. **3. Morchélla**, MOREL; stipitate; perithëcium convex, pileate, with regular, shallow pits. On ground in woods; many edible species. Common. **4. Helvëlla**; stipitate; perithëcium pileate, convex, smooth. Many species edible; habitat of *Peziza*.

Tribe 6. Basidiospöreæ.—2 Sections:

Sec. 1. (Gasteromycètes).—Hyménium internal, enclosed in a *peridium*. 1. **Phýsarum**. 2. **Stemonitis**. 3. **Licea**. 4. **Tubulina**. 5. **Cribrária**. 6. **Arcýria**. 7. **Lycógala**. These are SLIME-MOULDS (*myxomycètes*); on dead logs, bark in tan-yards, etc.; all beautiful in color and construction. See Lesson VI. 8. **Bovista**, SMALL PUFF-BALL; edible; many species; on ground, fields, pastures. 9. **Lycopérdon**, LARGE PUFF-BALL, DEVIL'S SNUFF-BOX. Peridium double; outer p. rough with warts and spines. Many species; habitat of Bovista; edible; "*L. gigantèum* is the Southdown of mushrooms."—*Dr. Curtis*. 10. **Geáster**, EARTH-STAR. Peridium double; outer p. dividing in regular parts from crown to base, imitating a many-parted perianth with a puff-ball in its centre. Several species; on ground. 11. **Phállus**, STINKHORN. Stipitate; peridium double, mushroom-like, pileate, free at base; spores *diffluent* (melting into a fluid mass) at maturity, and escaping through a perforation at the apex of the peridium. Many species; handsome, but ill-scented.

Sec. 2. (Hymenomycètes).—Hyménium external on a receptacle. 1. **Clavária**. Club-shaped; stipe confluent with receptacle; hyménium on upper surface of receptacle. Many species; edible; various in form and color. On ground, woods, fields. **C. phalloïdes**, Fig. 22, 7. 2. **Hýdnum**. Stipitate, pileate; hyménium consists of spines projecting from the pileus. Many species, various in form; edible. In woods, on ground. Fossil in Tertiary. 3. **Bolétus**. Stipitate, pileate; hyménium lining separable tubes (pores). Many species; edible. On ground in woods. 4. **Polyporus**. Like 3, but tubes not separable. Many species; some edible. On ground, woods. **P. imbricatús**, in imbricate masses at foot of beech-trees; 2°–5° across. **P. híbridus**, DRY ROT in oak timber. **P. tuberáster** furnishes the *Piètra-Fungàja* (*It.*, FUNGUS-STONE) of commerce; its mycélium collects the earth into a solid ball, which for years yields abundant crops. **P. annòsus**, phosphorescent; in Welsh mines. Fossil species in Tertiary. **Polyporites**, fossil, Carboniferous. 5. **Merúlius láchrymans**, DRY-ROT in timber, especially in conifers. 6. **Cantharéllus**, CHANTARELLE. Stipitate, pileate; hyménium on under surface of pileus, which has veins instead of gills. **C. cibárius**, rich yellow, with fruity fragrance; edible. On ground in woods. 7. **Agáricus**, MUSHROOM. Stipitate, pileate; hyménium on gills on under surface of pileus. 1000 species, many edible; various in form, size, color, habitat. **A. Geòrgii**, SNOW-BALL; edible; Fig. 22, 4. **A. (Marásmius) oreàdes**, CHAMPIGNON, FAIRY RING MUSHROOM; edible; Fig. 22, 6. **A. campéstris**, PINK-GILL; edible; Fig. 22, 5. All in woods, pastures. **A. Gardnèri**, phosphorescent; on leaves of palm-trees, Brazil. **A. oleárius**, phosphorescent; at the base of olive-trees, Italy. **A. muscárius**, FLY AGARIC; stipe slender; pileus vermilion, studded with white or yellow warts; handsome, but poisonous. On ground in birch woods.

Ord. 3. **Lichènes**. LICHENS.—Described in Lesson VI. Reproduction of Fungi. 2 Tribes:

Tribe 1. **Lichinæcæ**.—Crustaceous, leathery. 1. **Verrucária**; warty. 2. **Calicium**, nail-like; on posts. 3. **Gráphis**, like writing; on trees. 4. **Cladònia**, shrub-like; **C. rangiferina**, REINDEER-MOSS, N. Europe; food for reindeer. 5. **Lecanòra tartárea**, CUTHBERT (CUDBEAR). Figs. 23, 27. **L. esculénta**, MANNA of the Israelites. See Lesson VI. 6. **Megalóspora affínis**, spore sprouting, Fig. 26.

7. *Parmelia parietina*, on walls; Fig. 25. 8. *Cetraria islandica*, ICELAND MOSS, edible; Fig. 24. 9. *Usnea*, TREE-HAIR; long gray tufts on trees, stones; many species. *U. barbata*, common. *U. Melacantha*, very long, handsome; S. Am.

Tribe 2. *Collemaceæ*.—Gelatinous; gonidia moniliform, resembling Nostoc. 1. *Myrangiium*. Few species, cosmop. On bark of living trees, especially ash. 2. *Collèma*, similar, several species. 3. *Lichina*, tufted, branched; on stones washed by the sea. Europe.

Class II. ACROGENS.

Moss Alliance: 1. *Hepaticæ*; 2. *Músci*; 3. *Characeæ*.

Ord. 1. *Hepaticæ*. LIVERWORTS.—Fertilization; fs. ♂ or ♀ ♂. Described, Lesson VII. 4 Tribes, all thalloid except 4th; gen., representing Tribes: 1. *Riccia*, no columella nor elaters. *R. glauca*, terrestr.; *R. natans*, aquatic. 2. *Anthoceros*; columella, elaters; capsule opening vertically. *A. laevis*, common; moist places. 3. *Marchantia*; elaters, no columella; fs. on erect branches. Several species, terrestr.; fossil in Tertiary (Eocene, Eur.). *M. polymorpha*, Figs. 27, 28, 29. 4. *Jungermannia*; thalloid fronds, or leafy moss-like stems. Elaters, no columella. On rocks, trees. Many other species. Fossil in Tertiary (Miocene).

Ord. 2. *Músci*. MOSSES.—Fertilization; fs. ♂ or ♀ ♂. Described, Lesson VII. 4 Tribes; rep. gen.:

Tribe 1. *Andraea*.—Lvs. golden-brown; caps. 4-valved. Several species. On rocks.

Tribe 2. *Phascum*.—Nearly stemless; caps. indehisc. Several species. Walls.

Tribe 3. *Sphagnum*.—Moss-like, but lvs. and stems colorless, transparent; caps. operculate; no peristome. Sev. spec. Bogs, swamps.

Tribe 4. *Bryaceæ*. TRUE (higher) MOSSES.—Tufted, usually bright green; caps. operculate, dehisc., with peristome. Many genera and species. Moist ground, rocks, trees. Several fossils in Tertiary. 1. *Hypnum dendroides*, Fig. 30. 2. *Polytrichum*, veil hairy. *P. commune*, antherozoids, Fig. 2, B. 3. *Bryum*. Caps. pendulous. Many fine species; walls, walks, marshes. *B. argenteum*, lvs. silvery-white. 4. *Splachnum*. Apophysis often large. *S. rubrum*, apophysis red, shaped like an umbrella; Europe. *S. luteum*, apophysis similar, but yellow; Europe and America; on dung.

Ord. 3. *Characeæ*. POLISHING RUSHES.—Fertilization; fs. ♂. Described, Lesson VII. 5 genera; many species:

1. *Tolypella nidifica*, America; sev. foreign spec. 2. *Nitella flexilis*, *gracilis*, *capillata*; three of 15 Am. species. 3. *Chara vulgaris*, Fig. 31; *C. fragilis*, Fig. 32. Common. 37 fossil species, in Jurassic and Tertiary of Europe; none in America.

Fern Alliance: 4. *Filices*; 5. *Equisetaceæ*; 6. *Marsileaceæ*; 7. *Lycopodiaceæ*.

Ord. 4. *Filices*. FERNS.—Many fossil gen. and spec.; see Lesson XIII. Parthenogenesis. Fertilization. Described, Lesson VII. 9 Tribes:

Tribe 1. *Marattiaceæ*.—Sporangia ringless; opening by a slit or pore; 4 gen.; 25 spec. 1. *Danaea*. Rhiz. large, woody; fronds pinnate (rarely simple), fleshy; fertile frond more or less contracted.

D. alata, *D. nodosa*, W. Ind., S. Am. 2. *Marattia*. Rhiz. large, globose, scaly; fronds broad, 2-3-pinnate, lf.-stalk fleshy. *M. fraxinea*, S. Af.; Pacific Islands. 3. *Angiopteris*. Rhiz. (or caudex) massive, 3° high. Lf.-stalk stout, fleshy, edible; fronds large. 2-pinnate. Few, but fine, species. E. Ind. and islands. 4. *Kaulfussia*, rhiz. thick, frond coarse, ternate, reticulate. Ind., Java.

Tribe 2. *Osmundaceæ*.—Ring partial, or reduced to a disk. 2 genera; 12 species. Temperate regions. 1. *Todea*. Caudex short, erect; fronds 2-pinnate. *T. bárbara* (*africana*), fronds thick; *T. leptopteris*, fronds pellucid-membranous; New Z., S. Af. 2. *Osmunda*, FLOWERING F. Caudex creeping; end producing a crown of showy fronds 1-2-pinnate, 2°-4° high; fertile frond contracted, paniculate. *O. regalis*, ROYAL F., fronds 2-pinnate, Fig. 33. *O. Claytoniana*, fronds pinnate, lanceolate. *O. cinnamomea*, CINNAMON F., similar to last; fruit bright cinnamon color. N. Am.

Tribe 3. *Lygodiaceæ*.—Ring replaced by a cap. 5 gen.; 60 spec.; warm regions, both worlds. 1. *Lygodium*, CLIMBING F. Frond compound, rachis slender, climbing; upper pinnæ fertile. *L. palmatum*, rachis 2°-4° high, pinnæ palmate; shady woods. *L. japonicum*, rachis 10°-12° high, pinnæ ovate; Japan. 2. *Hydroglossum*, similar to *L.*, but veins netted. Few species; Mexico, Pacific Isles, Madagascar. 3. *Schizæa*. Small, not climbing; fronds wiry, forked, with pinnæform fertile appendages. *S. flabellum*, fan-shaped; Brazil. *S. pusilla*, linear, New Jersey. 4. *Aneimia*. Not climbing. *A. Phyllitidis*, fronds 12'-18' high, lower pinnæ long-stalked, 3-4-pinnulate; fertile, flower-like; upper part pinnate. S. Am. *A. adiantifolia*, similar, sterile part of frond 2-3-pinnate. S. Florida. 5. *Mohria thurifraga*, only species; fronds 2-pinnate, with odor of incense. S. Af.

Tribe 4. *Gleicheniaceæ*.—Ring complete, nearly horizontal; 2 gen.; 30 spec.; Southern Hemisphere. 1. *Gleichenia*. Rhiz. creeping; frond dichotomously forked, rigid; ultimate segments pinnatifid. *G. Hermanni*, rhiz. aromatic, edible; S. Am. 2. *Platyzoma microphyllum*, only gen. and spec.; dwarf; fronds linear. Australia.

Tribe 5. *Ceratopteraceæ*.—Ring broad, nearly complete, obliquely vertical. Spores few, trigonal, elegantly marked with concentric lines. Aquatic. Only genus: *Ceratopteris* (*Parkeria*) *thalictroides*, WATER-RUE F.; frond much dissected, succulent; young shoots edible. Tropics, both hemispheres.

Tribe 6. *Hymenophyllaceæ*.—Ring on a plane nearly perpendicular to its point of attachment. Sporangia short-pedicelled on receptacles projecting from the ends of the free veins and included in a cup-shaped involucre. Rhiz. creeping, thread-like; fronds filmy-pellucid. 3 gen.; 200 spec.; tropics.

1. *Hymenophyllum*. FILM FERN.—Many species in hot, damp tropical forests of both hemispheres. *H. Tunbridgense*, fronds lanceolate, pinnate, pinnæ pinnatifid; Tunbridge Wells, Eng. 2. *Trichomanes*, BRISTLE F. Many species; habitat of *H.* *T. radicans* (*speciosum*), fronds 4'-8' high, lanceolate, pinnate, pinnæ 1-2-pinnatifid. On wet rocks, Tenn. and Ala.; Ireland; Madeira. 3. *Loxsoma*, not pellucid; fronds decomposed. Australia.

Tribe 7. *Cyatheaceæ*. TREE FERNS.—Ring complete, obliquely vertical. Sporangia sometimes short-pedicelled. Caudex erect;

fronds large, in a crown at top. 4 gen.; 151 spec.; tropics. 1. *Cyathæa*. Fronds 1-3-pinnate. Many fine species, tropics of both worlds. *C. arborea*. Frontispiece, B. Section of stem, Fig. 42. S. Am. 2. *Alsóphila excelsa*, 80° high; Norfolk Island. *A. Perrotetiana*, 30° high. W. Ind. 3. *Hemitelia speciosa*. W. Ind. 4. *Matonia pectinata*, only genus and species; no caudex. Rhiz. creeping, bearing a single frond on a tall ebony leaf-stalk; frond fan-shaped, dichotomous, each leaf pinnate-pinnatifid. Tropics.

Tribe 8. *Polypodiaceæ*.—Ring incomplete, vertical. Sporangia pedicelled. Sori often *indusiate*. 50 genera; more than 1000 species. 1. *Dicksonia antarctica*, caudex tall, crowned with 2-pinnate fronds 6°-9° long. New Z. *D. punctilobula*, SWEET F. Rhiz. creeping; fronds scattered, lanceolate 2-pinnate, 2°-3° high, fragrant. N. C. and Tenn., N.; moist shades. 2. *Cibotium*. Rhiz. decumbent, shaggy with fine hairs; fronds of *Dicksonia*. *C. Barometz* (*glaucescens*), AGNUS SCYTHICUS, SCYTHIAN LAMB, BYSSUS. West Asia. See Lesson VII. *C. glaucum*, *C. Chamissoi*, *C. Menziesii*, PULD FERNs. Sandwich Islands. See Lesson VII. 3. *Davallia*. Rhiz. creeping above ground, scaly; fronds pinnately decomposed, rarely pinnate. *D. aculeata*, scandent, bramble-like; S. E. Asia. *D. canariensis*, HARE'S-FOOT F.; rhiz. creeping, resembling a hare's foot; fronds few, triangular, 15' in size, 3-4-pinnate. Canaries. 4. *Woodisia*. Small, tufted; frond lanceolate, pinnate. *W. Iloensis*, 4'-8' high; *W. obtusa*, 6'-18' high. N. C., northward, mts. 5. *Oncoclea sensibilis*. Sterile frond pinnate, triangular, 1°-2° high; fertile contracted, flower-like. Damp places, U. S. 6. *Struthiopteris*, OSTRICH FERN. Caudex erect; fronds erect in a crown; sterile lanceolate, pinnate-pinnatifid, 2°-5° high, in an outer series; fertile in the centre, much shorter, pinnate, pinnæ contracted, moniliform. *S. germanica*, Northern U. S. 1 species in Eur.; 1 in Asia. 7. *Cystopteris*, BLADDER F.; indusium inflated. *C. fragilis*, fronds delicate, 4'-8' long, oblong-ovate, 2-pinnate. Rocky shades, N., U. S. *C. bulbifera*, fronds lanceolate, 1°-3° high, 2-pinnate, bulbiferous beneath. Wet places, N. C., N. 8. *Cyrtodium*. Indusium peltate; veins netted, venules curved. *C. falcatum*, fronds evergreen; pinnate, lanceolate, 1°-2° high, end pinna large, rhomboid. Japan. 9. *Polystichum*. Indusium of 8; veins free. *P. acrostichoides*, fronds evergreen, lanceolate, pinnate, bristly-serrulate, 1°-2° high, in crowns. Rocky woods, U. S. 10. *Aspidium*. SHIELD F. Indusium of 8 and 9; but veins compoundly reticulate. Strong-growing, usually pinnate ferns. 12 species, in Asia, S. Am., W. Ind. None in U. S. *A. singaporiænum* has simple fronds. Singapore.

11. *Lastræa*. Indusium reniform; veins free. 2 Sections:

1. *Fronde evergreen, in a crown.*

L. marginale; fronds 2-pinnate, ovate-oblong, 1°-3° high. Rocky grounds, U. S. *L. Filix-mas*, MALE F.; fronds 2-pinnate, lanceolate, 3° high. Eur.; adv. in Canada; found in Tennessee. *L. spinulosa*, fronds oblong-ovate, 2-pinnate, 1°-3° high, spinulose. N., U. S. *L. cristata*, fronds lanceolate, pinnate, 1°-2° high, pinnæ pinnatifid, serrate. Wet woods, U. S. *L. Goldiana*, fronds broad ovate, 2°-4° high, pinnate, pinnæ pinnatifid. N., U. S. *L. Sieboldii*, frond thick, 1° high, with 5-9 large pinnæ, end pinna largest. Japan.

2. *Fronds scattered, deciduous.*

L. noveboracensis, fronds lanceolate, 10'-18' long, hairy. *L. Thelypteris*, similar, but smoother. Both in bogs, U. S.

12. Nephrodium.—Indusium of 11; but veins anastomosing; and fronds in a crown, evergreen. *N. mólle*, fronds pinnate, ovate-oblong, 1°-2° high, whole plant downy. Tropics. *N. patens*, similar, but less hairy. Shady grounds, Florida, W. **13. Camptosorus**, sori curved; veins reticulate. *C. rhizophyllum*, WALKING F.; frond 4'-12' long, cordate at base, tapering to a long point, rooting at apex. Damp rocks, rare, U. S. **14. Athyrium**, sori lunate; veins free. *A. Filix-fœmina*, LADY F.; fronds lanceolate, 2-3-pinnate, delicate, 2°-5° high, in a crown. Moist woods; cosmopolitan; common throughout Tennessee. **15. Scolopéndrium**, HART'S-TONGUE, CENTIPEDE F. Sori linear, double; veins free. *S. vulgare*, frond simple, oblong-lanceolate, 6'-18' long. Gt. Brit., Can., U. S., north. Fig. 35. Cultivated forms are curled, furcate, etc.

16. Asplénium.—Sori linear, usually single, sometimes solitary. Veins free. 2 Sections:

1. *Sori few.*

A. bulbiferum, fronds lanceolate, 1°-3° long, 2-3-pinnate, bulbiferous above. New Z. *A. myriophyllum*, fronds 1°-2° high, 2-3-pinnate, translucent. Limestone caves, Florida. *A. Belangèri*, fronds 1°-2° high, lanceolate, 2-pinnate, coriaceous. Malacca, Java. *A. thelypteroides*, fronds 1°-3° high, broad lanceolate, pinnate, pinnæ deeply pinnatifid. Common in woods. *A. furcatum*, fronds 8'-15' high, ovate-lanceolate, pinnate, pinnæ cut almost to midrib. Trop. Am., S. Af. *A. Rûta-murària*, WALL-RUE F., fronds 2-3-pinnate, 1'-4' long; ovate, thick, dentate at top. Cliffs, Vermont, S. and W.

2. *Sori numerous (except in A. Trichomanes).*

A. angustifolium, fronds pinnate, long-lanceolate, 1°-3° high. Woods, U. S. *A. flabellifolium*, fronds pinnate, 4'-15' high, pinnæ flabelliform, crenate. Australia. *A. ebèneum*, fronds pinnate, linear-lanceolate, 8'-15' long, on a dark shining stalk; pinnæ linear-oblong, finely serrate, auricled at base. Common, U. S. *A. Trichomanes*, fronds pinnate linear, 4'-8' long, stalk and rachis black, shining. Tufted, in crevices of rocks. Common. *A. pinnatifidum*, fronds pinnatifid below, tapering to a long, entire point; 3'-6' long. S. Penn., W. and S. *A. Nidus*, BIRD'S-NEST F.; fronds broad, lanceolate, simple, entire, 2°-4° long, in a crown around an erect rhizome. E. Ind. **17. Doodia.** Sori slightly lunate; veins reticulate. Fronds small. *D. áspera*, fronds 9'-15' long, broad-lanceolate, deeply pinnatifid; stalk black, rough. *D. caudata*, frond 9'-15' long, linear-lanceolate, pinnate; lower pinnæ triangular, distant; stalk black. Both from Australia, New Z. **18. Woodwardia**, CHAIN F. Sori linear, immersed, forming chains; veins reticulate. *W. angustifolia*, frond lanceolate, 6'-10' long, pinnatifid; fertile segments narrow. Swamps, N. and S. *W. virginica*, fronds 2° high, ovate, pinnate, pinnæ deeply pinnatifid. Fertile and sterile fronds alike. Habitat of last. **19. Platyloma (Pellaëa)**, CLIFF BRAKE. Small. Sori marginal, veins free. *P. atropurpurea*, frond 6'-12' long, lanceolate, 2-pinnate; tufted. On

rocks. *P. rotundifolia*, New Z. *P. hastata*, S. Af., small ferns, introduced. 20. *Doryopteris*, sori marginal. *D. pedata*, frond pedate, 2'-6' long, veins reticulate. W. Ind., S. Am. 21. *Pteris*. Sori marginal. Veins free. *P. aquilina*, COMMON BRACKEN, fronds 2-3-pinnate, triangular, 1°-5° high, rough. Common. Duct, Fig. 220, C. *P. quadriaurita*, frond pinnate, with lobed branches below; striped. E. and W. Ind. *P. crètica*, 1°-2° high, handsome; *P. longifolia*, pinnate, oblanceolate; both native to Florida and other tropical regions.

22. *Adiantum*.—Sori marginal. *A. pedatum*, BIRDFOOT MAIDEN-HAIR, frond 2-forked, pinnate, delicate; common. *A. hispidulum*, similar, Australia. *A. Capillus-Veneris*, TRUE MAIDEN-HAIR (VENUS MAIDEN-HAIR). Frond 6'-18' high, ovate-lanceolate, 2-4-pinnate, pinnules exquisitely ganze-like and delicate on fine black shining hair-like stalks; the loveliest of the ferns; on shaded dripping rocks, and at the mouth of wells. Tropical and temperate regions of both worlds; finest specimens found at Cumberland Falls, Kentucky. Fig. 34. *A. æthiopicum*, similar, Af.; *A. cuneatum*, larger, S. Am. *A. macrophyllum*, frond large with few large pinnæ, W. Ind.

23. *Nothochlaena nivea*, N. *flavens*; small; and 24. *Gymnogramma calomélanos*, *G. sulphurea*, *G. triangulâris*, larger; fronds 2-3-pinnate, dusted beneath with white or yellow powder, are the GOLD- and SILVER-FERNS of tropical Am.

25. *Phegopteris*, BEECH F. Sori medial, frond triangular; veins free. *P. Dryopteris*, frond 4'-6' wide, with 3 stalked divisions 1-2-pinnate. Common N. *P. hexagonoptera*, larger than last, frond broader than long. 2-pinnatifid. Common N. and S. *P. polypodioides*, frond 4'-9' long, longer than broad, 2-pinnatifid. N., U. S.

26. *Phlebodium aureum*, frond stalked, broad ovate, pinnately parted, large, showy; veins netted; Florida, W. Ind. 27. *Nipholobolus Lingua*, frond 4'-8' long, lanceolate, entire, netted. Japan.

28. *Campyloneurum*. Veins parallel, netted, veinlets arched. *C. Phyllitidis*, frond simple, linear-lanceolate, 1°-2° long, 1'-2' wide, shining. Trop. Am. *C. magnificum*, fronds large, pinnate, pinnæ 18' long, 4' broad. Showy. Venezuela. 29. *Polypodium*, veins free, sori globose, naked. An extensive genus, cosmopolitan. *P. incanum*, fronds 2'-8' high, lanceolate, pinnatifid, scurfy beneath. Shades, S.; often on trees. *P. vulgare*, similar, but larger, not incanous; evergreen. Rocks. Common. 30. *Platycerium*, STAGHORN F. Sori in amorphous patches; fronds ribbed, netted, furcate, lobed, or lacinate. Showy; natives of Australia and tropical Asia and Af. *P. alcicorne*, fertile frond articulate, 1° high, 2-3-furcate; whitish beneath. *P. Walllichii*, *P. biforme*, are fine species. 31. *Acróstichum*. Sori in a dense mass; veins netted. *A. aureum* (only species), tall-growing, 8°-10° high, with a thick rhizome and bold pinnate evergreen fronds, the upper pinnæ fertile. Marshes near the sea; Florida, W. Ind., S. Am., Australia, Pacific Isles, E. Ind., Madagascar, S. and W. Africa.

Tribe 9. *Ophioglossaceæ*.—Sporangia ringless, globular, opening transversely by 2 valves. Fertile frond or portion of frond contracted, flower-like. Sterile frond net-veined, succulent, not circinate in veneration. Short rhizome (or crown) with fleshy roots. Spores triangular, making this tribe the connecting link with *Lycopodiaceæ* through *Phylloglossum*. 3 genera:

1. **Ophioglóssum**, ADDER'S TONGUE. Fertile frond spicate; sporangia in a longitudinal series on its two opposite margins. 3 gen.; 20 species. *O. vulgátum*, 2'-10' high; sterile branch of frond ovate, elliptical, entire, 1'-2' long, sessile near middle of stalk, from which rises the short spicate fertile portion. Wet meadows. Common, cosmopolitan. *O. pëndulum*, sterile part of frond ribbon-like, much longer than the spike. Pendulous, on trees; S. Africa.

2. **Botrychium**. Fertile branch of frond paniculate. Rhiz. erect, fleshy. Cosmop. *B. Lunària*, MOONWORT. Small, fleshy; sterile branch pinnate. Europe. Prothallus, Fig. 36. *B. ternátum*, fleshy, 3'-10' high; sterile part of frond triangular, ternately compound. Grassy shades, U. S. *B. virginicum*, herbaceous, tender, 6'-18' high, sterile part of frond broad, triangular, ternate, divisions 2-3-pinnate; fertile long-stalked. Rich soil in woods, S. States. 3. **Helminthósthachys zeylánica (dulcis)**, only species. Rhizome horizontal. Sterile branch of frond trifoliately digitate, pedate; sterile portion a simple spike with pedicelled tufts of spore-cases arranged in whorls, each whorl terminated with a crest-like appendage. Young shoots edible. Ceylon, Ind., E. Archipelago.

Ord. 5. **Equisetáceæ**. HORSETAILS.—Parthenogenesis. Fertilization. Fls. ♀ ♂ or ♀. Described, Lesson VIII. 1 genus; 25 species; all containing silica. Cosmopolitan, but not found in Australia and New Z. Moist places. *Equisetum Telmateia*, Fig. 37. *E. hyemale*, SCOURING RUSH, 2°-4° high. *E. arvense*, 8°-20° high. *E. giganteum*, TREE HORSETAIL, 30° high. Caraccas, S. Am. *Equisetites*, fossil, Carboniferous.

Ord. 6. **Marsileáceæ (Rhizocarpáceæ)**.—Parthenogenesis. Fertilization. Fls. ♀ ♂. Described, Lesson VIII. Fossil in Secondary and Tertiary. 4 genera; 50 species. 2 Tribes:

Tribe 1. **Salviniáceæ**—Small, ann., floating in pools or lakes; lvs. simple, edges reflexed in veneration. 2 gen.; 8 or 10 species: 1. *Salvinia natans*, only species. Sporocarps, Fig. 39. Warm countries, common; rare in U. S. 2. *Azólla*, branching, lvs. imbricate. Several species. *A. caroliniana*, N. Y. to Ill., and S. States.

Tribe 2. **Marsileæ**.—Small, perennial, lvs. circinate in veneration. In marshes or inundated places. 2 gen.; about 40 species. Temperate regions, both worlds. 1. *Marsilea salvatrix (macropus)*, NARDOO. Lvs. quadrifoliate, petiolate. Sporocarps edible. Specific name from the fact that the fruit saved a party of explorers from starvation. Fig. 38. Australia. *M. vestita*, similar, lvs. hairy; Western U. S. *M. quadrifolia*, larger, S. W., U. S. 2. *Pilularia*, PILLWORT. Lvs. (or leaf-stalks) quill-shaped; fr. pill-like. Few species; in Tasmania, N. Af., Eur. *P. globularia*, Gt. Brit.

Ord. 7. **Lycopodiáceæ**. CLUB-MOSSES.—Parthenogenesis. Fertilization. Fls. ♂ and ♀. Described, Lesson VIII. Perennial. Magnificent fossils. See Lesson XIII. 6 gen.; near 350 spec.; 2 Tribes:

Tribe 1. **Isoèteæ**, QUILLWORTS.—♂ ♀. Small, acaulescent, aquatic; rhiz. globose, rough, with horny processes (phyllopodés). Lvs. grass-like. 1 genus, *Isoetes*, 12 species, cosmop.; nearly all aquatic; 8 or 10 in U. S. 1. *lacustris*, mt. lakes, N. Eng. and Mid. States. 1. *melanópoda*, shallow water, wet fields, Western U. S. 1. *Hystrix*, not aquatic; sandy places, Channel Islands. 1. *malinverniana*, 2° long, in deep water; Eur.

Tribe 2. Lycopodiææ.—Described, Lesson VIII. 5 genera. Terrestrial, except 2 and 3. 1. *Phylloglossum*. Lvs. subulate; fr. spicate, resembling *Ophioglossum*. Sev. spec.; marshes, New Z. 2. *Tmesipteris*, only gen., 1 spec.; pendulous on tree-ferns, from Pacific Isles to Cal. 3. *Psilotum triquetrum*, only gen. and spec.; on trees, but erect; Brazil, Centr. Am., Southern U. S. 4. *Lycopodium*, CLUB-MOSS. 50 spec., cosmop., terrestrial. *L. clavatum*, stems creeping, with short ascending branches. Dry woods, N., U. S. Fig. 40. *L. carolinianum*, stems and branches creeping. Wet grounds, N. J., S. *L. dendroideum*, GROUND PINE; rhiz. Stems upright, 6'-9' high. Moist woods, U. S. Many other species in U. S. *Lepidodendron*, fossil in Devonian, Fig. 84. 60 or more allied species in Carboniferous. *Sigillaria*, fossil in Carboniferous, Fig. 85. 5. *Selaginella* (*Lycopodium* of florists), spores colored, handsome; foliage-spray flat, often with metallic shades. Many fine foreign species. *S. lepidophylla*, RESURRECTION ROSE, see Lesson VIII. Texas, Mex., Cal. *S. apus*, stems 2'-4' high, branching, delicate; wet meadows, S. *S. Martensii*, spore sprouting, Fig. 41.

SERIES II. PHANEROGAMIA.—Flowers visible and developed, producing a *Seed* with differentiated parts called Radicle, Cotyledon, and Plumule, equivalent to Root, Leaf, and Stem. ("The radicle is not a root, but an axis of growth; the root descends from its base, the plumule rises from its apex."—*Hooker*.) It is more properly called *Tigellus*, *Tigella* (Fr. *tige*, stem).

Class I. GYMNOSPÉRMÆ (GYMNOGENS).

Pine Alliance.—1. *Cycadæææ*. 2. *Coniferææ*. 3. *Gnetæææ*.

Ord. 1. Cycadæææ, Cycads.—Fls. ♂ ♀, terminal. Described, Lesson IX. Low evergreen long-lived *Trees*, or *Shrubs*; without resin. Stem simple, crowned with large palm-like leaves 1-2-3-pinnate and often circinate in veneration. Pith abundant, surrounded with zones of wood, each zone the result of several years' growth and not annual as in exogenous Angiospermæ. Wood "composed of wood-fibres and punctate, rayed, or reticulate vessels arranged in radiating lines separated by medullary rays, and enveloped in a thick layer of cortical parenchyma."—*L. and D.* Sd. drupe-like, large, often edible. Fossil in Carboniferous, thence upward. See Lesson XIII. 8 genera. Tropics, both worlds.

1. *Cycas*.—Stem 5°-20° high, ♀ stouter. Lvs. pinnate. Several species; Australia, Polynesia, Asia. *C. revoluta*, miscalled SAGO PALM; pith starchy, edible; Japan. ♀ tree, Frontispiece, C; lf., ♀ fl., Fig. 43. 2. *Encephalartos*, CAFFIR BREAD. Stem 15°-30° (?) high. Lvs. pinnate, thick, spiny. ♀ cone used as food by the Caffirs. Sev. spec.; S. Af. 3. *Zamia*. Stem low, stout, sometimes epiphytal. Lvs. pinnate, spiny at the joints. Pith edible. Sev. spec.; Bahamas, W. Ind., trop. Am., S. Af. *Z. integrifolia*, COMPTIE, COONTIE, S. Fla. 4. *Macrozamia*. Stem 15°-20° high. Lvs. pinnate, rachis twisted. Fls. in spikes; ♀ spike with but 2 fls. (ovules). Australia, swamps near the sea. 5. *Ceratozamia*, HORNED ZAMIA. Stem short, globular. ♀ cone consists of scales, each scale having a disk-like top with 2 diverging horns. *C. longifolia*, pollen-grain, Fig. 47, B. Mex-

ico. **6. Dion edule.** Stem stout, woolly; lvs. pinnate, pinnæ sword-shaped, sharp. ♀ cone as large as a child's head, woolly. Sds. large, edible. Mexico. **7. Stangéria paradóxa.** Stem short, napiform; lvs. coarse, pinnate. Natal, S. Af. **8. Bowénia spectábilis** (only species). Stem thick, short, crowned with 1 or 2 large lvs.; petiole terete, erect; blade broad, spreading, bipinnatisect. S. Af.

Ord. 2. Coniferæ. PINES.—Fls. ♂ ♀ or ♂. Fossil in Devonian, thence upward. 4 Tribes:

Tribe 1. Yews.—Described, Lesson IX. Not resinous. Fls. ♂ ♀; axillary. Branches scattered, rarely whorled. **1. Salisbùria adiantifòlia**, GINKOO, MAIDENHAIR YEW. Lvs. fern-like, fan-shaped, fascicled, deciduous; fr. drupe-like, large, edible. Tree 50° high, with spreading branches. Hardy. Japan; sacred, and planted near the temples. Fig. 44. **2. Podocàrpus.** Lvs. large, linear, or ovate; no vein but the midrib. Fr. drupe-like, on a thick fleshy foot or stalk, whence the name. **P. macrophýllus**, large stout tree, with large scattered lvs.; wood valuable in cabinet-work; **P. latifòlia**, not so large; lvs. opp., lanceolate, evergreen. Both native to Japan. **3. Torrèya.** Lvs. evergreen, needle-shaped, 1'–2' long, 2-ranked. Fr. nutmeg-like, perisperm ruminant. **T. taxifòlia**, STINKING YEW; handsome tree, 20°–50° high, but ill-scented. Florida. **T. nucifera**, Japan; **T. califòrnica**, California; NUTMEG YEWs; sds. yield oil. **4. Táxus.** Lvs. evergreen, needle-shaped, dark green, 1' long, 2-ranked. Fr. berry-like, with a red aril. **T. baccàta**, YEW. Low tree with short spreading branches. Eur. Var. *fastigiàta*, IRISH YEW; branches appressed, making the tree columnar; var. *canadénsis*, GROUND HEMLOCK; stems spreading over the ground. N. U. S. **5. Dacrydium cuprèssinum**, 100° high; **D. taxifòlium**, 200° high; fine trees; **D. laxifòlium**, low shrub; all of New Z.

Tribe 2. Cypresses.—Fls. ♂; rarely ♀ ♂. Resinous, fragrant trees or shrubs. Branches scattered. Lvs. usually evergreen; linear, subulate or scale-like; solitary, opp., or whorled. Described, Lesson IX.

A. Galbule scales decussate or whorled.

1. Juniperus, JUNIPER. Fls. ♀ ♂; ♂ axillary or terminal; ♀ axillary; galbule berry-like. Lvs. subulate, evergreen, opp. or whorled. **J. virginiana**, VIRGINIA JUNIPER, RED CEDAR. Tree large or of middle size; sometimes shrub. Branches horizontal. Wood red, valuable. **J. Sabina**, SAVIN, low, spreading. Native of S. Europe. Introduced in Am. **2. Thùja.** ARBOR-VITÆ. Fls. ♂, terminal; galbule oblong, soft, dehiscent. Lvs. evergreen, scale-shaped. **T. occidentális.** Tree of moderate size; planted in hedges. N. U. S. Many nursery varieties. **T. (Biòta) orientális.** Small tree. China. Var. *àurea* has gold-tinted foliage. **T. (Thujópsis) dolabràta**, foliage spray flat, white underneath. Japan. **3. Cállitris.** Fls. ♂, terminal; galbule valvular, dehiscent. Low evergreen trees of Africa and Australia. Branches jointed, with scales at the joints. **C. quadriválvis.** Stout tree with straggling branches; galbules with 4 valve-like scales; wood mahogany color, used in mosques. Resin is the varnish *Gum Sándarach*; powdered it is the *Pounce* of commerce. Barbary. **4. Cuprèssus.** CYPRESS. Fls. ♂, ♂ terminal; ♀ lateral; galbule globular, woody, dehiscent. Lvs. evergreen, small, subulate,

imb., 4-ranked. **C. (Retinóspora, Chamæcýparis) pistifera.** Galbules like peas. Shrub, Japan. **C. (Retinóspora) obtusa,** HINOKI, TREE-OF-THE-SUN, 80°-100° high, Japan. **C. Lawsoniána,** galbules $\frac{1}{4}$ ' wide. A fine tree with thick flat spray. Cal. **C. thujoides,** WHITE CEDAR. Galbules $\frac{1}{2}$ ' wide. Foliage-spray slender, glaucous green, evergreen. Tree 80° to 100° high. Wood white, valuable. Low grounds, N. J. to Fla., W. **C. sempervirens,** classical CYPRESS of antiquity. Galbules 1' in diam. Tree 50°-70° high, with fastigate branches; in appearance like a Lombardy Poplar. Wood (probably the Gopher-wood of the Bible) hard, fragrant, of a fine red hue, durable, valuable. Made into mummy-cases by the Egyptians. Figs. 45, 47, A. Var. *horizontalis*, WILD CYPRESS. Has spreading branches; wood finely mottled like the skin of a tiger or panther. Sonorous, and used in making musical instruments, tables, etc. It is the *Citron-wood* of the Romans. Both natives of Cyprus and other islands of Gr. Archipelago; naturalized throughout S. Eur., E. Asia, N. Af. **C. pëndula, funëbris,** WEEPING C. Branches pendulous. N. China.

B. Galbule scales spiral.

5. Sequóia (Wellingtonia). REDWOOD, BIG TREES. Evergreen. **S. gigantëa.** Galbules 1'-2' long. Tree 300° high, 50° in circumference. "Three Graces," Fig. 97; Sierra Nevada, Cal. **S. sempervirens.** Galbules smaller. Tree 100°-150° high. Coast, Cal. **6. Taxodium.** Lvs. decid. Fls. ♂. Galbule 1' long. **T. distichum,** SOUTHERN CYPRESS. Lvs. 2-ranked. Large tree, 125° high, 30°-40° in circumf., hollow at base. Rts. produce conical hollow protuberances ("knees") 2°-3° high, used by negroes as bee-hives. Swamps, Southern U. S. **7. Cryptomëria.** Fls. ♂. Galbule small, terminal. Lvs. crowded, spreading, evergreen. **C. japonica,** lofty tree. Japan.

Tribe 3. Pines.—Resinous, fragrant. Branches whorled. Fls. ♂. Cones with spiral scales, which are usually persistent. Described, Lesson IX. **1. Cëdrus.** CEDAR. Lvs. short, needle-shaped, rigid, evergreen; in fascicles of 12-20 lvs. Cones abrupt-ovate, erect, lateral, maturing autumn of second year; scales thin, deciduous. **C. Libani,** CEDAR-OF-LEBANON. Cones 3°-5° long. Majestic tree of E. Asia and N. Af., 50°-80° high, with spreading branches and dark foliage. Old trees flat-headed. Wood red. Emb., Fig. 47, D. **C. Deodàra.** DEODAR. Lvs. and cones of last, but larger. Tree 150° high, 30° in circumference, with spreading branches. Wood yellow. Himàlayas.

2. Làrix. LARCH. Lvs. of Cedrus, but soft, deciduous. Cones small, lateral, scales persistent. **L. europæa.** Cones 1' long. Tree 80°-100° high, with spreading branches. **L. americana,** TAMARACK, HACKMATACK. Cones $\frac{1}{2}$ '- $\frac{3}{4}$ ' long. Tree as tall as last, but more slender. Canada, N. U. S.

3. Picea. FIR. Lvs. short, linear, flat, solitary. Cones upright, lateral, maturing autumn of same year; scales deciduous. **P. pectinàta,** SILVER F. Cones 6'-8' long, 2' broad. Tree 160°-180° high, 8° diam.; branches horizontal. Lvs. white beneath. Central Eur., W. Asia. **P. Píchta,** SIBERIAN SILVER F. Foliage similar to last, but thicker set. Cones 3' long; tree smaller. Altai Mts.; Siberia.

P. grandis, GREAT SILVER F. Foliage like last. Cones obtuse, 3'-4' long, 1'-2' broad. Tree 170°-200° high. Oregon, Cal. *P. (Abies) cephalonica*, CEPHALONIAN SILVER F. Lvs prickly-pointed, spreading. Tree 60° high. Cephalonia. *P. balsamea*, BALSAM F. Lvs. crowded; cones 2'-4' long. Tree 30° high. Wet grounds, North. U. S. *P. Fràseri*, SOUTHERN BALSAM F. Similar to last; cone 1' long. Alleghenies.

4. *Abies*. HEMLOCK. SPRUCE. Lvs. linear, flat, or needle-shaped, solitary, spreading. Cones terminal, nodding, scales persistent; maturing autumn of same year. *A. (Tsùga) Douglàsii*, DOUGLAS HEMLOCK. Cone 2'-3' long. Tall tree, Rocky Mts. to Pacific. *A. (Tsùga) canadensis*, COMMON HEMLOCK. Cones $\frac{1}{2}$ '- $\frac{2}{3}$ ' long. Large tree, N. U. S. *A. Menziesii*, MENZIES SPRUCE. Cones 3' long, soft. Fine tree, Rocky Mts., W. *A. álba*, WHITE SPRUCE. Cones 2' long. Tree 50° high; foliage pale. Can. to Car. and Wis. *A. nìgra*, BLACK SPRUCE. Cones 1' long. Tree 70° high; foliage dark. Can., N. U. S. *A. excélsa*, NORWAY SPRUCE. Cones 7'-8' long. Tree 120°-180° high; foliage dark. N. Europe. Fig. 46.

5. *Pinus*. PINE. Lvs. linear, needle-shaped, long, evergreen, fasciculate, 2, 3, or 5 in a fascicle. Cones maturing autumn of second year. 70 species.

A. Fascicle with 5 lvs. Cones terminal, pendulous (except in *Cembra*), deciduous after shedding their sds.

P. Lambertiana, SUGAR P. Cones 12'-20' long. Lvs. 2'-5' long. Tree 150°-200° high, 8°-20° in diam. Cal., Oregon. *P. excélsa*, BHÔTAN P. Cones 10'-12' long. Lvs. 6'-8' long. Tree 90°-100° high. Pollen, Fig. 4. Ind. *P. Stròbus*, WHITE P. Cones 5'-6' long. Lvs. pale, 3'-4' long. Tree 100°-180° high. Wood white. Canada to Va. *P. Cembra*, SWISS STONE P. Cones 3' long, erect; sds. large, edible. Lvs. 4' long. Tree 50° high, wood citron-scented, valuable. Alps, N. to Siberia, S. to Italy and France.

B. Fascicle with 3, rarely 4 or 5 lvs. Cones lateral, persistent after shedding sds.; scales hooked.

P. Coulteri, COULTER'S P. Lvs. in 3's, 4's, or 5's, 9' long. Cones oblong, solitary, 12'-15' long, 6' in diam.; scale-hooks large. Tree 80°-100° high. California, mts. *P. Sabiniàna*. Lvs. in 3's or 4's, 11'-14' long. Cones ovate, 11' long, 18' in circumference, in whorled clusters of 3-9 around the stem, persisting several years; scale-hooks large. Tree 110°-140° high. Coast mts., Cal. *P. longifolia*, INDIAN P. Lvs. in 3's, 9'-18' long, pendulous. Cones ovate, 5'-9' long. Tree 100°-120° high. Nepal, mts. *P. austràlis*, SOUTHERN P., PITCH P., YELLOW P., S. Lvs. in 3's, 12'-15' long, beautiful brilliant green. Cones 7'-10' long, 4' thick; hooks short; sd. edible. Tree 70°-100° high; wood yellow, resinous, valuable; yielding most of the pitch and turpentine of commerce. Barrens, N. Car., south to Florida. *P. ponderòsa*. Lvs. in 3's, 7'-14' long. Cones 3' long, clustered. Wood very heavy. Northwest coast of N. America. *P. seròtina*, POND P. Lvs. 4'-8' long. Cones oval, 2'-3' long, in pairs. Tree 35°-40° high. N. Car., S. *P. rìgida*. Lvs. in 3's, 3'-5' long. Cones ovate, 2'-3' long, clustered. Tree 12°-40° high in New Eng.;

70°-80° in New Jersey and Maryland. *P. Taeda*, LOBLOLLY P. Lvs. in 3's, 6'-10' long. Cones 3'-5' long, solitary. Tree 80° high, clear of branches to height of 50°; head spreading. Va. to Florida.

C. Fascicle with 2 lvs., rarely 3; cones as in last section (except in *P. resinosa*).

P. brütia, CALABRIAN P. Lvs. in 2's, rarely 3's, 6'-9' long, slender, wavy. Cones 2'-3' long, ovate, in clusters of 20, or more, around the stem. Handsome tree, 50°-60° high. Calabria. *P. mitis*, SOFT-LEAVED P. Lvs. in 2's, rarely 3's, 3'-5' long. Cones ovate, 2' long, solitary. Tree 50°-60° high. Wood yellow, resinous. New Eng. to Ga., west to Ky. and Tenn. *P. Pinea*, STONE P., ITALIAN P. Lvs. in 2's, 5'-8' long. Cones ovate, 5'-6' long, solitary, ripening the third year; sd. edible. See Lesson IX. Tree 80°-100° high; 60° clear of branches. Mediterranean States of Europe, Asia, coast of Barbary. *P. Pinaster*, STAR P. Lvs. in 2's, 8'-12' long. Cones slender, 4'-6' long, in starry whorls of 3-8, rarely solitary. Tree 40°-60° high. Both shores of Mediterranean, W. to China. *P. austriaca*, BLACK P. Lvs. in 2's, 2'-5' long, dark green. Cones conical, 2'-3' long, horizontal, solitary. Tree 50° high. Wood resinous, valuable. Austria. *P. Laricio*, CORSICAN P. Lvs. in 2's, 4'-8' long. Cones 2'-4' long, conical, in pairs or clusters of 3 and 4. Tree 80°-100° high; 140°-150° high in Corsica, its native habitat. Corsica, and other parts of S. Eur. *P. pungens*, PRICKLY P. Lvs. in 2's, 2' long. Cones 3' long, ovate, clustered; scale with a strong hook. Tree 40°-50° high. Mts., Penn. to S. Car. *P. inops*, SCRUB P. Lvs. in 2's, 2'-3' long. Cones ovate, 2'-3' long, solitary. Tree 30°-40° high, straggling. New J., S. and W. *P. Banksiana*, GRAY SCRUB P. Lvs. in 2's, 1' long. Cones curved, 2' long, gray, in pairs. Straggling tree, 5°-20° high. Nova Scotia, Canada, Maine. *P. sylvestris*, SCOTCH P. Lvs. 2'-4' long, twisted, light blue-green. Cones conical, 2'-3' long, ripening in 18 months. Tree 60°-100° high; wood valuable. Native to most parts of Europe. Ovule and emb., Fig. 47. *P. resinosa*, RED P. Lvs. in 2's, 5'-6' long. Cones ovate, without hooks, 2' long at the apex of the branch; deciduous after shedding the sds. Tree 50°-80° high. N. Eng. to Wisconsin.

Tribe 4. Araucariaceæ.—Fine trees; wood valuable. Lvs. evergreen, small, flat, often broad, imbricate or spirally arranged. Cones large, terminal. Branches verticillate, spreading. Fls. ♀♂. 1. *Araucária imbricatá*, lvs. small, ovate-lanceolate, imbricate. Cones globular, as large as a man's head. Female tree 150° high; male tree 40° high. Mts., Chili. *A. excelsa*. Female tree 170°-230° high, free from branches to the height of 100°. Norfolk Island, New Caledonia. 2. *Dammara australis*, DAMMAR or KAURI (COWRIE) PINE. Lvs. alt. or opp., linear-oblong or elliptic, box-like. Cones large, turbinate, stalked, erect. Female tree 150°-200° high; producing a brittle resin resembling copal. New Z. *D. orientális*, AMBOYNA DAMMAR. Female tree 100° high; yields the fine, transparent resin called *Dammara*. Moluccas. Fossil conifers of Devonian closely related to Araucariaceæ. *Amber*, the fossil gum of a conifer (Fig. 86), abounds in North Prussia; found in America at Amboy, New Jersey: Cape Sable, Maryland; Gay Head, Martha's Vineyard.

Ord. 3. Gnetaceæ.—Joint-Firs. Fls. ♂ ♀ and ♂. Described, Lesson IX. 3 genera. 1. *Gnétum*, JOINT-FIR. Stems jointed, lvs. smooth, entire, exstipulate. Trees and creeping shrubs. 6 species, native to tropical Asia, and Guiana. Sds. edible. 2. *Éphedra*, SEA-GRAPE, described. 25 species, temperate sandy regions, both hemispheres. *E. distachya*, 2°-4° high. Fr. a succulent cone, edible. Mediterranean coast of France and Spain; plains of S. Russia. Fig. 48. *E. altissima*, climbing shrub, 15°-20° high. Barbary. *E. anti-syphilitica*, 2° high; W. Texas, to Cal. and Nevada. *E. trifurcata*, undershrub, New Mex., Arizona. Fossils in Tertiary, Eur. 3. *Welwitschia mirabilis*, only known genus and species. Described. Figs. 49, 50. Sandy Mossamedes country, W. Af.

Class II. ANGIOSPERMÆ.

Sub-Class I.—Endogens (Monocotylédons), 2 Divisions.

Division 1.—Ovary free. 2 Subdivisions. 1. Ovary simple or syncarpous (rarely apocarpous). 2. Ovary apocarpous.

Subdivision 1.—Ovary simple or syncarpous.

Grass Alliance, Glumiferae.—Embryo outside (extruded from) the perisperm, or sometimes barely included. Ova. 1-celled, 1-ovuled. Sta. 3-2-1, rarely 6-4. Perianth 0. 1. **Graminaceæ.** 2. **Cyperaceæ.** (Most of the foreign species named are naturalized in the U. S.)

Ord. 1. Graminaceæ, GRASSES.—Described, Lesson X. The most useful of all the Orders. 300 gen.; 4000 species; 13 Tribes:

Tribe 1. Triticeæ.—Infl. spicate. 1. *Secale cereale*, RYE; native of Crimea. ☉. 2. *Triticum repens*, COUCH-GRASS, a pest of fields. ♀. *T. vulgare*, WHEAT. ☉. Sd. sprouting, Fig. 6, C; fl., Fig. 52, B; starch gr., Fig. 239, B. Originating through 3. *Aegilops triticoides*, from *A. ovata*, both wild in S. Eur. and Asia. See Lesson XXXIV. 4. *Hordeum*, glumes bristle-like. *H. vulgare*, *H. distichum*, BARLEY; *H. pusillum*, WILD B. Several other wild species. Eur., Asia. 5. *Lolium*, RAY- or RYE-GRASS, several valuable species. *L. temulentum*, DARNEL, a pest in fields. ☉. Eur. 6. *Elymus*, LYME-GRASS, 49 species, of wide range; temperate to arctic zone.

Tribe 2. Festuceæ.—Infl. in branched or spicate panicles, rarely in racemes or spikes. 1. *Bambusa*, BAMBOO. Sta. 6, rarely 3. 33 species; warm countries, both hemispheres. *B. arundinacea*, tree 60° high; joints produce *Tabashèer* (Lesson XXXII.). S. China, Ind. *B. guada*, tree 60°-100° high; internodes filled with pure cool water. Mts. of Quindu, S. Am. 2. *Arundinaria*, TREE CANE. Sta. 3. ♀. Warm climates, many species. *A. macrosperma*, 10°-15° high, river-banks, Va., Ky., southward. 3. *Uniola*, SPIKE-GRASS, SEA-OAT. Many ornamental species, N. and S. Am. 4. *Festuca*, FESCUE. 200 species, cosmopolitan; many valuable for pasturage. 5. *Bromus*, BROME, CHESS, or CHEAT. 141 species, extensive range. *B. mollis*, SOFT BROME, DOWNY CHESS, lvs. downy; good pasture-grass. Eur. 6. *Dactylis*, ORCHARD-GRASS. 29 species, widely distributed. *D. glomerata*, COCK'S-FOOT GRASS, panicles 3-branched, imitating a bird's foot. Eur. Pollen-gr., Fig. 52, C. 7. *Poa*, MEADOW-GRASS. 192 species, cosmopolitan, many valuable. *P. pratensis*, BLUE-GRASS, Penn., Ky., North west. ♀. 8. *Melica*, MELICK. Many species, temperate regions. 9. *Briza*, QUAKING-GRASS; spikelets large, cordate,

drooping, on slender pedicels; panicle diffuse. 30 species, ornamental; chiefly S. American.

Tribe 3. Avènææ.—Infl. paniculate, rarely racemose or spicate. 1. *Hólcus*. Species chiefly European. *H. lanátus*, SOFT-GRASS, VELVET-GRASS; very downy. Eur. 2. *Avèna satíva*, OAT, gr. Section, Fig. 6; fls., Fig. 52; fl. plan, Fig. 64. Eur. 3. *Arrhenathèrum avenáccum*, OAT-GRASS, WILD OAT, Fig. 51. Eur.

Tribe 4. Pappophòrææ.—Infl. in globose spikes, or a panicle. 1. *Pappophòrum*. 27 species. N. Holl., Af., E. Ind. 2. *Echínaria*. 2 species. Af., Syria, Spain.

Tribe 5. Chloridææ.—Infl. in unilateral digitate or paniculate spikes. 1. *Chlóris*. 69 species, ornamental. Warm climates. 2. *Cýnodon*. 14 species. *C. Dáctylon*, BERMUDA-GRASS. Eur.

Tribe 6. Arundinææ.—Infl. a branched or spicate panicle. 1. *Phragmites*, WATER-REED. 18 species. W. Eur. to Japan. 2. *Arúndo*, CLASSICAL REED of Scripture and of the Iliad. *A. Dónax*, PROVENCE CANE. 10°–20° high. Mediterranean States. 3. *Gynèrium*. ♀ ♂. Infl. with silvery white hairs. 6 species; 5 in S. Am., 1 in New Z. Ornamental. *G. argéteum*, PAMPAS-GRASS. Lvs. several feet long, linear, recurved, tufted. Culms (sometimes 50 from one plant) 10°–12° high, terminating each in a large feathery panicle. ♀. Hardy. S. Am.

Tribe 7. Stipeææ.—Infl. paniculate. Outer palea coriaceous, embracing the sd. 1. *Stipa*, FEATHER-GRASS. Awn twisted, or tortuous, often plumose. 104 species, ornamental; finest in warm temperate regions. 2. *Aristida*, TRIPLE-AWNED GRASS. 3-awned. 150 species, widely distributed in sandy regions, except Europe, which has but one, *A. cæruléscentis*, Spain and Sicily. One is the MESQUITE (*Mézkeet*, *Múskeet*) GRASS of Texas, so called because it associates with the mesquite-tree. 3. *Uráchne* (*Piptathèrum*, *Oryzòpsis*), MOUNTAIN RICE. Few species, chiefly in S. Am., N. Af. *O. melanocárpa*, rocky woods; *O. asperifólia*, hill-sides; *O. canadénsis*, rocky hills; in Northern U. S., Can.

Tribe 8. Agrostidææ.—Infl. a branched or spicate panicle. 1. *Agróstis*, BENT GRASS. Panicle large, light, spreading. 171 species. Cosmopolitan; all beautiful, many useful. *A. vulgáris*, RED-TOP, HERD'S-GRASS; *A. canína*, DOO-BENT; *A. álba*, WHITE BENT; Eur. *A. pulchélla*, QUITO-GRASS, panicles very large and light; ornamental. Quito. *A. scábra*, HAIR-GRASS, FOUNTAIN-GRASS, panicles large, light, with whorled capillary branches; resembling a fountain-jet; handsome. Exsiccated places, U.S. Common. 2. *Polypógon*, BEARD-GRASS, awn long. 24 species, ornamental. W. France to Central Asia. 3. *Vilfa* (*Sporóbolus*), DROPSEED-GRASS, RUSH-GRASS. 123 species. N. and S. Am., New Holland; ornamental. 4. *Lagùrus ovátus*, only species, infl. soft, white, silky, with protruding awns. S. Eur., Asia. 5. *Cinna*. Stamen 1. *C. arundinácea*, SWEET-REED GRASS. 3°–5° high, panicle nodding. Can., U.S., N.

Tribe 9. Phleineææ.—Infl. a spicate panicle or spike. 1. *Phléum*. 17 species, N. Eur. *P. praténse*, TIMOTHY. ♀. 2. *Alopecúrus*, FOX-TAIL. Several species; Eur.

Tribe 10. Phalaridææ.—Infl. a spicate panicle or spike; palea hardened after flowering. 1. *Cóix*. ♂. *C. Láchryma*, JOB'S-TEARS; culm 1°–2° high; fr. large, round, shining, resembling tear-drops. E.

Ind., Japan. **2. Zæa.** ♂. 5 species, S. Am. *Z. Mays*, MAIZE, INDIAN CORN. Culm 5°-12° high. ♂ infl. the *tassel*; ♀ infl. the *ear*, of which each grain is a fl. consisting of the ovary only (its pistil the silk), with minute scales at its base; the *shucks* are the involucre. **3. Phálaris**, RIBBON-GRASS, GARDENER'S GARTERS, CANARY-GRASS. Lvs. often variegated; culms tall, leafy. 20 species, ornamental; chiefly from Central Asia. **4. Anthoxánthum odorátum**, SWEET VERNAL GRASS. Fragrance of Tonka Bean. Eur.

Tribe 11. Orýzææ.—Infl. a racemose panicle. Sta. 6, sometimes 3 or 4, rarely 1. **1. Microlaëna stipoides**, only species; sta. 4. N. Holland. **2. Orýza.** Sta. 6. 14 species, warm climates. *O. sativa*, RICE, a marsh grain; native to Asia and perhaps S. Am.; supplies food for a greater number of human beings than any other known plant. **3. Zizánia (Hydropýrum)**, INDIAN RICE. Gr. used as food by Indians. 5 species. N. Am.

Tribe 12. Paniceææ.—Infl. a spicate, branched or digitate panicle; paleæ usually cartilaginous. **1. Pánicum**, PANIC-GRASS. 850 species, widely distributed; several gigantic, forming the field-crops of the Amazon. **P. (Digitária) sanguinále**, CRAB-GRASS; culm 1°-2° long. Eur. **2. Cénchrus**, HEDGEHOG GRASS, BUR-GRASS; spikelet enclosed in a globular, spiny involucre. 30 species, in warm climates; many ornamental. **C. tribuloïdes**, a pest in sandy soil; coasts, Great Lakes, and larger rivers of N. Am. **3. Pennisétum**. Involucre of Cenchrus, but with finer spines, or bristles. 87 species; ornamental. Sub-tropical, of wide range. **4. Stréphem guianense**, GUIANA-GRASS. Lvs. sleep at night. Guiana.

Tribe 13. Andropogoneææ.—Infl. a spicate, branched or digitate panicle, rarely a spicate raceme. Paleæ rarely cartilaginous. **1. Sorghum vulgare**. Culm 6°-10° high; infl. in panicles; INDIAN MILLET, DURRA; var. *cérnuum*, GUINEA CORN; all cultivated for the grain; var. *saccharátum*, CHINESE SUGAR-CANE, IMPHEE, SWEET SORGHUM, cultivated for the syrup; and BROOM-CORN, for the panicles, which are made into brooms. ☉. Af. and Ind. **2. Sáccharum**. Infl. in large, loose, beautiful panicles; glumes enveloped in long, silky hairs. 62 species. E. and W. Ind., China, Af., South Sea Islands, S. Am. **S. officinàrum**, SUGAR-CANE, the great staple of commerce; culm 8°-20° high. Native of India, where it has been cultivated from time immemorial. Many ornamental species; several N. American, described as *Eriánthus*, or WOOLLY-BEARD GRASS; 4°-6° high. **3. Andropògon**, BEARD-GRASS. Culm 1°-5° high; rts. aromatic. Infl. of clustered or digitate spikes; rachis and ♂ fls. with short, silky hairs. 458 species, warmer parts of the globe; all ornamental, many useful, their rts. being woven into mats, screens, etc. **A. Schœnánthus**, LEMON-GRASS, lvs. lemon-scented. Ind. **A. argenteus**, SILVER-BEARD GRASS. Handsome. Del., South. **A. scopàrius**, BROOM-SEDGE GRASS. Common. **A. Cálamus**, SWEET CANE and CALAMUS of the Bible. **A. muricátus**, rts. furnish the *Vetivert*, or *Kus-kus*, perfume. Ind. **4. Imperàta (Eulália) japónica**, ZEBRA-GRASS; lvs. transversely striped; culm 6° high, leafy; infl. feathery, resembling curled ostrich-plumes. Japan.

Ord. 2. Cyperáceæ. SEDGES.—Emb. extruded (or barely included) at base of perisperm. Infl. usually surrounded by long involucral leaves, as in *Papyrus* (Fig. 53). 120 genera, 2000 species, of

little economic value. 6 Tribes, of which only typical genera are given here.

Tribe 1. Caricineæ.—1. *Carex*, SEDGE. ♂ or ♂ ♀ ♀; ♀ with a perigynium. Culm triangular. 1000 species. *C. riparia*. ♂; 3°–5° high, borders of streams and ponds. Eur. Fl., Fig. 54, A. *C. bullata*, ♂; ♂ spikes 2–3, on a long peduncle; ♀ spikes 1–2, oblong or cylindrical, stout, on a short peduncle; perigynia turgid, shining. Culm 2° high. Swamps, N. Eng., south to Fla. and W.

Tribe 2. Sclerieæ.—Fls. diclinous. 1. *Scleria*, NUT-RUSH. ♂. Akaine bony. 149 species, 1°–3° high, in or near southern tropics; several in U. S.

Tribe 3. Rhynchosporæ.—Fls. ♂ ♀ ♀. Perianth of 6–10 bristles, or 0. Akaine often beaked with the base of the style. 1. *Rhynchospora*, BEAK-RUSH. Spicate paniced or clustered. 121 species. N. and S. Am. 2. *Cladium*, TWIG-RUSH. 21 species, chiefly in N. Holland. *C. mariscoides*, 1°–2° high; spikes in cymose hds: Akaine, Fig. 54, B. Bogs, N. Eng. to Del., Ill., northward. 3. *Dichromena latifolia*, STAR-SEDGE, 1°–2° high. Infl. a terminal hd. with long involucral radiating lvs. whitened at base. Ponds, N. Car. to Fla.

Tribe 4. Hypolytræ.—Fls. ♀, in hds. or cymose panicles. 1. *Hypolytrum*. Species native of Brazil, W. and E. Ind. 2. *Kyllingia*. Fls. in hds. 50 species. S. Af., Australia, Brazil, U. S. *K. pumila*, 2'–9' high; Ohio to Fla. *K. (Lipocarpa) maculata*, 2'–8' high, lvs. spotted. Ga., Fla.

Tribe 5. Scirpæ.—Fls. ♀. Akaine usually beaked. Perianth of scaly or hairy bristles, or 0. 1. *Scirpus*, BULRUSH. Stem triquetrous, or striate, or terete. Spikes sol. or capitate. Most of the once numerous species have been distributed to other genera by Steudel. Of those retained, 14 are British, several N. American. *S. lacustris*, COMMON BULRUSH, 5°–8° high. Lakes, ponds, Eur.; nat. in U. S. and Can. 2. *Eriophorum*, COTTON-GRASS. Bristles of perianth numerous, elongating into a soft white wool. Several species, ornamental. Eur.

Tribe 6. Cyperææ.—Fls. ♀. Perianth of hispid bristles, or 0. Style deciduous. Spikes sol. or clustered. 1. *Cyperus*. 673 species, warm parts of the world. *C. longus*, GÁLINGALE; Eur. *C. esculentus*, CHÛFA, GRASSNUT-SEDGE, rts. bearing tubers, edible. Eur. *C. Hydra*, COCO-GRASS, rts. bearing fine small tubers; a pest of fields and gardens. S. States. 2. *Papyrus antiquorum* (*Cyperus Papyrus*), PAPER-REED. Stems 8°–10° high, leafless except at top, where the lvs. are long, involucrate, surrounding the umbelled spikes of fls. Fig. 53. See Lesson X. Mediterranean States.

Réstio Alliance.—Fls. ♀ or diclinous. Perianth-segments 1-2-seriate. Emb. extruded. Ova. usually 3-celled. Fr. usually a capsule. Perianth glumaceous, 4-6-merous. Sta. 1-3, free, or connate in a cup. Styles 1-3. 3. **Restiææ.** 4. **Eriocaulonææ.** 5. **Flagellariææ.**

Ord. 3. Restiææ. ROPE-GRASSES.—Lvs. long, grass-like. Herbs or Undershrubs; rhiz. creeping. Infl. spiked, racemed, or paniced. Fr. a caps. follicle, nut. 24 genera; many species. S. Af., Australia, tropical Asia. 1. *Réstio*, rush-like, leafless. Fls. diclinous. Many species. *R. tectorum*, used to thatch houses. Australia.

Ord. 4. Eriocaulonææ. PIPEWORTS.—Similar to Restiææ. Fls. diclinous. Infl. capitate on a tall scape; hd. often white with

the fringes of the fls. Small marsh *plants*. 10 genera, over 220 species, in S. Am., N. Am., Australia, N. Holl., Asia, Gt. Brit. 1. *Eriocaulon*, 100 species. 2. *Pæpalánthus*. 3. *Lachnocaulon*. These three in U. S., chiefly S.

Ord. 5. Flagellariaceæ. WHIP-GRASSES.—Fls. ♂. Sepals 3; petals 5, larger, colored, but glumaceous. Infl. paniculate. Sta. 6, free. Styles 3. Fr. a berry. Lvs. lanceolate, terminating in a whip-like spiral tendril. *Herbs*, reedy or sarmentose. 2 genera: 1. *Flagellária*. 2. *Joinvillea*. Tropical Asia, Australia, New Caledonia.

Spiderwort Alliance.—Emb. extruded. Fls. ♂. Perianth of 6 segments, 2-seriate, inner segments petaloid, colored. Sta. 2-6, some of them often abortive. Styles usually 3-fid. Fr. a caps. 6. *Xyridaceæ*. 7. *Commelynaceæ*.

Ord. 6. Xyridaceæ. YELLOW-EYED GRASSES.—Infl. a small spicate hd. of imbricate 1-flowered scarious bracts terminal on a tall scape. Sta. 3, staminodes 3. Petals yellow. Lvs. radical. Sedge-like plants, often in marshes. 2 genera. 1. *Xyris*, 50 species, usually tropical; in both hemispheres, but abundant in S. Am. Several species in U. S. 2. *Abólboda*, 6 or 7 species, S. Am.

Ord. 7. Commelynaceæ. SPIDERWORTS.—Emb. sunk in a pit of the perisperm, but still extruded. Infl. with leafy bracts or spathaceous involucre. Sta. 6, some of them abortive (or 3 in *Mayaca*). Succulent *Herbs*, with simple sheathing lvs.; ann. with fibrous rts., perenn. with rhizome. 16 genera; 260 species. New Holl., E. and W. Ind., Af., N. and S. Am. 1. *Commelyna*. Petals 3, blue or purple; 1 minute or 0. Numerous species, several in U. S., from S. New York, S. and W. 2. *Tradescántia*, SPIDERWORT, WANDERING JEW. Fls. blue, purple, pink, white. Stems and hairs jointed. Lvs. sometimes variegated. Several species; 3 in U. S.; N. Y., S. and W. *T. virginica*. Fls. blue; cyclosis in hairs, Fig. 242. Allied genus *Mayaca* (*Syena*). Emb. half immersed in perisperm, but still extruded. Sta. 3, anthers 1-celled; fl. sol., white, pink, violet. Lvs. linear, flaccid. Small moss-like marsh or aquatic *Herbs*. 3 or 4 species. Va. to Brazil. *M. Michauxii*, only one in U. S.

Pontederia Alliance.—Emb. included and immersed in perisperm. Perianth of 6 segments, 2-seriate. Sta. 6-3. Style single. Fr. a capsule or utricle. 8. *Philydraceæ*. 9. *Pontederiaceæ*. 10. *Rapateaceæ*.

Ord. 8. Philydraceæ. WATERWORTS.—Perianth of 2 yellow marcescent segments. Sta. 3; 2 sterile, petaloid. Infl. spicate or racemose. Fr. a caps. Lvs. ensiform. Marsh *Herbs*. 2 genera. 1. *Philydrum*, N. Holland, China. 2. *Hetaëria*, Australia.

Ord. 9. Pontederiaceæ. PICKEREL-WEEDS.—Perianth 6-parted, irreg., white, blue, or violet. Sta. 6-3. Infl. spicate or paniculate. Caps. or Utricle enveloped in the persistent (fleshy) base of the perianth. Lvs. oval, orbicular, cordate, sagittate, rarely linear. Aquatic or marsh *Herbs*, with rhiz., or rooting stem. 6 gen.; 30 spec. N. and S. Am., E. Ind., Af. 1. *Pontederia*. Stem 1-leaved, with a spike of blue fls. *P. cordata*, 1°-2° high, lf. large, cordate, sagittate. Muddy shores, Can., U. S. *P. lancifolia*, 2°-2½° high, lvs. lance-oblong or linear. Pools, Ga., S. C. 2. *Leptánthus* (*Schöllera*) *graminea*, WATER STAR. Lvs. linear, translucent. Submerged, except the scl., yellow fls. Streams, U. S.

Ord. 10. Rapateaceæ.—Perianth reg.; 3 inner segments petaloid, long-clawed, yellow or pink. Infl. capitate, spathaceous. Sta. 6, anthers with terminal pores or a glandular appendage. Lvs. ensiform. Tall marsh *Herbs*. 3 genera. Brazil. 1. *Schœnocéphalum*. 2. *Spathanthus*. 3. *Rapatea*.

Lily Alliance.—Emb. included, immersed in copious perisperm. Fls. usually ♂. Perianth 6-merous, 2-seriate (4-merous in Roxbúrgia, sometimes 8-merous in *Aspidistra*). Sta. 6 (4 in Roxbúrgia, sometimes 8 in *Aspidistra*). Perianth petaloid, except in *Juncaceæ*. Fr. a capsule or herry:

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|---------------------------|-----------------------------|
| 11. <i>Juncaceæ</i> . | 16. <i>Conantheraceæ</i> . |
| 12. <i>Xerotideæ</i> . | 17. <i>Eriosperrmaceæ</i> . |
| 13. <i>Roxburgiaceæ</i> . | 18. <i>Liliaceæ</i> . |
| 14. <i>Asteliaceæ</i> . | 19. <i>Ophiopogonaceæ</i> . |
| 15. <i>Gilliesiaceæ</i> . | 20. <i>Aspidistraceæ</i> . |

Ord. 11. Juncaceæ. RUSHES.—Fls. usually coriaceous, green, yellow, or brown. Infl. a cyme, spike, or head, rarely sol. Stigmas 3-1. Fr. a caps. Lvs. hollow, flat, or grooved, ensiform. Stem cylindrical, spongy, sometimes chambered with medullary septa. *Herbs*, ann. or perenn., with creeping rhiz. 18 genera, 200 species, temperate and arctic. 1. *Juncus*, COMMON RUSH. Characters of Order. Many species, cosmopolitan. Many in U. S. 2. *Luzula*, WOOD-RUSH. Many species. *L. sylvatica*, lvs. flat; stem leafy, 2° high; cymose panicles spreading. Eur. Fig. 55. Several species in U. S.

Ord. 12. Xerotideæ. XEROTE RUSHES.—Fls. ♂ or ♂ ♀. Lvs. grass-like. Several genera. *Herbs* or *Trees*. 1. *Xerotes*. Fls. ♂ ♀; caps. berry-like. *Herbs*. Australia. 2. *Xanthorrhœa*, GRASS-TREE, BLACK BOY. Fls. ♂; infl. spicate. Stem stout, palm-like, crowned with long, grass-like lvs.; scape rising from the centre, 15°-20° long, terminated by the dense flower-spike. Living to the age of 4000 years. Several species, Australia. *X. hastilis*, Fig. 96. 3. *Narthécium ossifragum* (*Abama ossifraga*), LANCASHIRE ASPHODEL. *Herb*, fls. yellow. Bogs, W. Eur., pine-barrens of N. J. 4. *Dasylyrion*. Stem short, crowded with drooping lvs., each lf. tipped with a brush-like tuft of fibres. Fls. in axil. panicles. Mexico.

Ord. 13. Roxburgiaceæ.—Fls. ♂, 4-merous, sol. Stigma sessile; caps. 1-celled; sds. ∞, on long funiculi. Lvs. simple, netted with cross-venules. *Half-shrubby* twining or creeping *plants*. 2 gen.: 1. *Roxbúrgia*. Fls. large, green, handsome, but fetid. 4 species, tall, *half-shrubby* twiners, rhiz. edible. Ind., Malaysia. 2. *Croömia pauciflora*. Only Am. spec. Fls. small, whitish, few, axile. Sds. ribbed lengthwise, fringed along the raphé and funiculus. Lvs. lance-ovate, cordate. Rhiz. creeping, perenn., stem annual, 1° high, with 6 lvs. at top, pedately arranged; fls. in their axils. S. Ga., Fla.

Ord. 14. Asteliaceæ.—Fls. ♂ ♀, or ♂ ♂ ♀, 6-merous. Perianth sub-coriaceous, silky outside. Infl. a raceme or panicle, rarely sub-sol. Fr. a baccate or fleshy caps., 3-valved. Lvs. grass-like, velvety. *Herbs*, tufted, perenn., often epiphytal on old trees. Islands of S. Ocean. Few genera. 1. *Astelia alpina*, fls. large, brown, paniculate. Lvs. edible, with nutty flavor. Sand-hills, Tasmania.

Ord. 15. Gilliesiaceæ.—Fls. ♂, small. Perianth greenish. Infl. umbellate, with double, colored involucre. Stamens epipetalous. Fr.

capsular. Lvs. radical, linear. Bulbous *Herbs*. 2 genera, 6 species. Chili. 1. *Gillièsia*. Perianth with 3 bilabiate segments; sta. at its base, united into a cup; 3 posterior sterile. 2. *Mièrsia*. Perianth urceolate, 6-toothed; stamens minute, on its throat.

Ord. 16. *Conantheraceæ*.—Fls. ♂, 6-merous. Perianth petaloid, blue. Sta. 6, epipetalous, anthers connivent into a cone, opening by a pore at top. Infl. a scape, paniced. Ova. adherent at base. Fr. capsular. Lvs. linear. Stemless *Herbs*. Peru, Chili. 1. *Conanthera*. 2. *Cumingia*. 3. *Zephyra*.

Ord. 17. *Eriosphermaceæ*.—Fls. ♂, raceme or paniced. Fr. capsular; sds. covered with long, silky hairs. Lvs. rounded, with projecting reticulate veins. Stemless *Herbs*, with tuberous scarlet roots. *Eriosphermum*. Only gen.; sev. spec. S. Af.

Ord. 18. *Liliaceæ*.—Fls. usually ♂, sometimes ♂ ♀, or ♂ ♂ ♀. Perianth never glumaceous. Lvs. simple, entire. Large and varied Order. 4 Sub-Orders: 1. *Melanthaceæ*. 2. *Smilacææ*. 3. *Asparagææ*. 4. *Liliaceæ*.

Sub-Ord. 1. *Melanthaceæ*.—Fls. ♂, rarely ♂ ♀ ♀. Styles (or stigmas) free. 3 Tribes:

Tribe 1. *Methoniceæ*.—Perianth tubular, white, yellow, or red. Sta. epipetalous. Fr. capsular, loculicidal. Sds. with fleshy testa, white or red. Rt. a fleshy tuber. *Pl.* *Herbs* with erect or climbing stems. 3 genera. 1. *Littônia*. 2. *Sandersônia*, Natal. 3. *Methonica* (*Gloriosa*). Stem climbing, branching; lvs. lance-acuminate or ending in a tendril. Fls. sol., yellow or crimson. Several fine species. Ind., tropical Af.

Tribe 2. *Colchicææ*, MEADOW-SAFFRONS.—Stemless. Fls. 6-merous, colored, from a subt. bulb, in autumn; lvs. following spring. 1. *Colchicum*, perianth tubular. 2. *Bulbocodium*, perianth of 6 stalked sagittate segments. 3. *Merendera*, perianth with a crest bearing the anthers. Several species of each. S. Eur., Abyssinia.

Tribe 3. *Veratreeæ*.—Fls. often ♂ ♂ ♀. Colored. Segments distinct, rarely coherent at base. Ova. sometimes half-adh. Stem or scape leafy. Many gen. 1. *Xerophyllum asphodeloides*. St. 3°-5° high; fls. ♂, large, white, in a dense raceme. Sands, N. J. to Car. 2. *Chamælririum luteum*, DEVIL'S-BIT, BLAZING-STAR. Rhiz. præmorse. Stem 1°-3° high. Fls. ♂ ♀. Yellowish-white, in a nodding, spike-like raceme. Low grounds, Can., U. S. 3. *Veratrum*. Fls. ♂ ♀ ♀. Rts. fibrous, furnishing the poison *Veratrin*. Fls. green, yellowish, whitish, or brown, paniculate. Many species, some very ornamental. Cosmop. 4. *Asagraea officinalis*. Fls. ♂; sds. are the *Sebadilla* (*Cevadilla*), which also furnish *Veratrin*. Mexico. 5. *Melanthium*. Fls. ♂ ♂ ♀, petals clawed, white, yellow, or pink. Fr. 3 inflated carpels, separate when ripe. Sds. winged. Several species in S. Af.; one American species, *M. virginicum*, BUNCH-FLOWER. Stem 3°-5° high, fls. paniced, yellow. Moist grounds, Wis. to N. Y. and Fla. 6. *Uvularia*, BELLWORT. Styles united at base. Stem low, furcate, bearing 1-2 small, yellowish, bell-shaped fls. in the fork. Many species; N. Am.; some in the mts. of India.

Sub-Ord. 2. *Smilacææ*. SARSAPARILLAS.—Fr. a berry. 2 Tribes:

Tribe 1. *Parideææ*.—Fls. ♂, terminal. Styles or sessile stigmas free. Stem from a perenn. root-stock; simple, naked, crowned with a whorl of net-veined lvs. around a single flower (or an umbel in

Medæola). 1. *Pâris quadrifolia*, HERB PARIS; stem 1° high; lvs. and green flower 4-merous. Eur. 2. *Trillium*, WAKE-ROBIN. Lvs. and fls. 3-merous. Fls. brown, white, or striped; stem 6'–1° high. 17 species. Am.; Ga. to Arctic regions. 3. *Medæola virginica*, INDIAN CUCUMBER. Only species. Stem 1°–3° high; lvs. in 2 whorls; fls. yellowish-green, few, umbelled. Rhiz. with taste of cucumber. U. S.

Tribe 2. Convallariææ.—Fls. ♂ or ♂ ♀ ♀; axillary. Styles united; stigmas free. Perennial, often climbing *Herbs* or *Undershrubs*, with rhizome. Many genera. 1. *Smilax*, SARSAPARILLA. Species, more than 100; tropical and temperate regions. Stem climbing, often prickly; lvs. petiolate, with strong ribs and cross-venules, cordate, ovate, or lanceolate. Fls. small, axillary, clustered, rarely sol., often fragrant. Rts. bitter, medicinal. Berries small, black or red. Many fine N. Am. species; especially the following: *S. lanceolata*, lvs. lanceolate, berries red (black when fully ripe), stem climbing to the height of 40°, Va. to Fla.; *S. laurifolia*, unarmed, lvs. oblong-linear, evergreen, fls. fragrant, berries black, stem climbing 50°–60°, N. J. to Ga.; *S. rotundifolia*, GREENBRIER, lvs. round-ovate, berries black, stem armed, climbing 40°, Penn., W.; and *S. Wâlteri*, low, berries coral-red, N. J., South. 2. *Lapageria rosea*, similar to *Smilax*, but fls. large, red; berries grape-like, edible; Chili. 3. *Philesia buxifolia*, PEPÏNA; box-leaved small shrub, with large red fls.; Valdivia to Straits of Magellan. 3. *Ruscus*, BUTCHER'S BROOM, described, Lesson XV. *R. aculeatus*, Fig. 103. Several species. S. Eur. 4. *Polygonatum*, SOLOMON'S SEAL, stem naked below, bearing at top nerved lvs. and axillary nodding green or white fls. Sev. spec. Eur., Am. 5. *Convallaria majâlis*, only species, LILY-OF-THE-VALLEY. Stemless. Scape enveloped in the sheathing petioles of 2 oblong lvs., and bearing a 1-sided raceme of small, white, fragrant fls. Fig. 138.

Sub-Ord. 3. Asparagææ.—Fls. ♂, rarely diclinous; small. Style simple, stigma 3-lobed. Fr. a berry; sds. with black, crustaceous testa. *Herbs*, *Shrubs*, or *Trees*. Lvs. various. 1. *Dracaena Draco*, only species, DRAGON'S-BLOOD TREE, palm-like stem exuding a blood-red resin; lvs. lance-linear, long, crowning the stem, from the centre of which rises an immense panicle of small yellowish fls., succeeded by small red berries. Trees branching in old age, and the longest-lived known plants. The famous tree in Orotava, Teneriffe, blown down in 1867, was older than the Pyramids; it was 70° high, and 79° in circumference near the base. 2. *Dracænopsis*, 3. *Cordylina*, 4. *Calodrâcon*, 5. *Charlwoodia*, are similar genera, some with colored foliage. St. Helena, tropical Africa, Madagascar, Mascarene Islands, Malaysia. *Cordylina* also in S. Am. 6. *Asparagus*, fls. and fr. of *Dracæna*; stem leafless, with leaf-like capillary branches or expansions. Many ornamental Asiatic species, some creeping. *A. officinâlis*, the common vegetable, native of Eur. and Asia. 7. *Myrsiphyllum*, leaf-like expansions, as in *Asparagus*, but broader, as in *Ruscus*; stem twining, fls. fragrant, berries green. Several species. S. Af.

Sub-Ord. 4. Liliæææ.—Fls. ♂, 6-merous. Style simple, stigmas 3, more or less distinct. Fr. a capsule, rarely a berry. Perennial *Herbs*, rarely annual. 4 Tribes:

Tribe 1. Hyacinthineææ.—Stamens on the torus or on the perianth-tube. Fr. capsular. Sds. globose or angular; testa crustaceous,

black. Small *Herbs*, with bulbs, or fibrous-fascicled rts. Many genera.

Bulbs.

1. *Ornithogalum umbellatum*, STAR-OF-BETHLEHEM. Scape umbellate, fls. small, white, green outside. Syria. Sev. species. S. Eur., S. Af., W. Asia. 2. *Hyacinthus orientalis*, HYACINTH. Scape and rather small racemose fls. fleshy; fragrant. Bagdad. Many cultivated varieties. 3. *Allium*, pungent. Lvs. grassy or fistular. Scape umbelled; fls. usually small. *A. cernuum*, lvs. grass-like; umbel hd.-like, nodding; fls. pink, handsome. Va., Ky., N. W. Several other wild spec. *A. Cæpa*, ONION, fls. white (bulb, Fig. 94); *A. Schoenoprasum*, CHIVE, fls. pink; *A. Ascalonicum*, ESCHALLÓT (SHALLÓT), fls. purple; these with fistulose lvs.; *A. Porrum*, LEEK, fls. white, with pink stripes; *A. sativum*, GARLIC, fls. purple; *A. Mòly*, GOLDEN GARLIC, fls. large, yellow, these with flat lvs. All from E. Eur., Asia, Af. *A. mágicum*, *Mòly* of Homer. 4. *Scilla*, SQUILL, WILD HYACINTH. Scape racemose, fls. blue, hyacinth-like. Many lovely wild species, Eur.; one in Am., *S. Fraseri*. Ohio, W. and S.-W. States. 5. *Urginea* (*Scilla*) *maritima*, SQUILL of pharmacy. Several spec.; Mediterranean States. 6. *Muscári*, GRAPE HYACINTH, fls. racemose, grape-like, deep blue. Sev. spec. *M. comòsum*, FEATHERED HYACINTH, fls. a paniced mass of abortive pedicles, bright blue. Medit. States. 7. *Lachenàlia*, lvs. lorate, often spotted, scape with a raceme of pendulous vari-colored fls., yellow the chief tint. Sev. spec., S. Af.

Rts. fascicled, fleshy.

8. *Anthèricum Liliástrum*, ST. BRUNO'S LILY. Scape $1\frac{1}{2}^{\circ}$ high, with a few large white fragrant fls., each segment or petal with one green dot. S. Eur. Other spec., S. Af., N. Holl.

Tribe 2. *Aloineæ*.—Stamens as in *Hyacinthineæ*. Fr. capsular, rarely a berry (*Sansevièra*). Sds. compressed or angular or winged. Testa membranous, pale; or crustaceous, black. Rts. fibrous-fascicled, often swollen. Stems often frutescent or arborescent.

1. *Lomatophýllum*, arborescent, stem crowned with long spiny-serrate lvs. and axil., paniced fls. Sds. with black crustaceous testa. Isle of Bourbon. 2. *Aloe*, arborescent, crowned with fleshy, spiny lvs. (which yield the medicine Aloes) and spiny spikes of fls. *A. dichótoma*, QUIVER-TREE, often 90° high, 12° in circumference, 400° round the extremity of the crown of lvs. Cape of Good Hope. Made into quivers by natives. Many spec. S. Af., E. and W. Ind. 3. *Sansevièra*, BOWSTRING HEMP. Stemless. Scape spicate, fls. yellowish-green. Fr. a berry. Lvs. fleshy, lanceolate, 4° long; leaf-fibre made into bowstrings. Sev. spec. Guinea, Ind. 4. *Tritoma* (*Kniphófia*), REDHOT-POKER (vile name, but expressive). Stemless. Lvs. long, grass-like. Scape 4° – 5° high, bearing a spike of large scarlet or yellow fls. Fr. capsular. Sev. spec. Cape of Good Hope. 5. *Asphódelus*, ASPHODEL. Sacred to the dead among the ancient Greeks. Stemless, lvs. long; scape with racemes of large white fls. Many species. S. Eur. *A. álbis*, KING'S SPEAR, Fig. 56.

Tribe 3. *Hemerocallideæ*.—Stamens on perianth. Fr. capsular. Sds. more or less compressed; testa membranous, usually pale. Tu-

berous or fibrous rts.; no bulb except in 2 last. **1. Hemerocallis**, DAY-LILY. Lvs. grass-like; scape with a few large yellow fls. Sev. spec. Common. E. Eur., Asia. **2. Phormium tenax**, only species, NEW ZEALAND FLAX. Lvs. sword-shaped, 6° long; scape 16° high, with branching spikes of orange-red fls. Lvs. yield the fibre which gives the English name. New Z. **3. Agapanthus**. Lvs. linear. Scape with a large 2-bracted umbel of large blue fls. Sev. spec. S. Af. **4. Polianthes**, TUBEROSE. Ova. half-adh. Lvs. linear. Flower-stalk few-leaved, 2°-4° high, bearing a spike of fragrant white fls. E. Ind. Many double varieties. Fls. phosphorescent. **5. Fünkia**, JAPAN DAY-LILY. Lvs. large, ovate or cordate, petiolate, ribbed with cross-venules. Scape racemose, fls. large, blue or white. Sds. winged; sev. spec.; Japan, China. **6. Brodiaëa**. Bulb. Sev. spec.; scape with umbels of large blue or red fls.; 3 stamens abortive. West N. Am. to Cal. **7. Tritelëia**. Bulb. Scape with umbels of white or blue fls., rarely sol. Stamens all perfect. West N. Am., Chili. Sev. species.

Tribe 4. Tulipacææ.—Perianth segments distinct or coherent at base. Stamens hypogynous or perigynous. Fr. capsule, rarely a berry. Sds. usually compressed. Testa pale brown, spongy or hard. Bulbs; or rarely arborescent, with fascicled rts. **1. Yucca**. Fls. often ♂ & ♀. Stem arborescent, 1°-20° high, crowned with rigid pungent-pointed sword-shaped lvs. and a compound panicle of large white or whitish fls. Leaf-fibre used as hemp and flax. Many fine species. N. and S. Am. **Y. filamentosa**, ADAM'S NEEDLE, BEAR-GRASS, EVE'S THREAD. Leaf-margin bearing long threads. Stem 1°-2° high. E. Va., Ky., South. **Y. gloriosa**, coasts S. States. **Y. aloifolia**, SPANISH DAGGER, DAGGER-TREE. Stem 8°-20° high. Lvs. serrulate. S. Am., Mex., Tex.

Bulbs. Fls. often phosphorescent.

2. Calochortus. Lvs. rigid, ensiform. Stem leafy, with a raceme of large showy fls. with the 3 outer divisions linear and calycine, the 3 inner large, bearded, richly colored, maculate. Few species, Mex., Cal., N. W. Am. **3. Cycloböthra**, similar, but with all the segments bearded. Sev. spec., Mex. and Cal.; some umbellate, resembling **4. Fritillaria**, fl. divisions equal. **F. Meleagris**, GUINEA-HEN FL. Leafy stem 1° high, fl. sol., terminal, chequered with blue, purple, white. S. Eur. **F. imperialis**, CROWN IMPERIAL, leafy stem, 2°-3° high, large nodding orange-crimson fls. in an umbel under a terminal tuft of lvs.; segments of fl. each with a round gland at base. Asia. **5. Lilium**, LILY. Stem leafy, bearing several large flowers with recurving divisions. Species considerable, mainly in northern hemisphere. **L. candidum**, COMMON WHITE L., ANNUNCIATION L. Palestine, "the lilies of the field." Ova., Fig. 5; lf., vert. sec., Fig. 232. **L. Märtagon**, TURK'S-CAP, fls. spotted, S. E. Eur.; **L. tigrinum**, TIGER L., China, Japan. Many fine foreign species, white and colored. Native: Orange-red, spotted. **L. carolinianum**, st. 3° high, S.; **L. superbum**, 7° high, paniculate, Can., Mid. and W. States; **L. philadelphicum**, 2° high, fls. few, N. and W.; not spotted. **L. Catesbaei**, 2° high, fl. sol., red, S. **6. Erythronium**. Lvs. 2, tongue-like, maculate, at base of scape, which bears 1 large nodding fl. **E. Dëns-canis**, DOG-TOOTH VIOLET (misnomer). Fls. purple. Eur. **E. americana**, fls. yellow. U. S. **7. Tulipa**, TULIP. Stem 1-2-leaved, bearing 1 large erect fl.,

with divisions slightly incurved, never spreading. Many fine species, colors rich, varied. Eur., Asia.

Ord. 19. Ophiopogonacææ.—Fls. ♀, 6-merous. Ova. half-adh. Stemless, tufted *Herbs* with grass-like lvs. Scape with racemose small fls. Sds. with fleshy testa. 2 gen.: 1. *Ophiopogon*, SERPENT'S BEARD. 2. *Peliosánthes*, fls. with a corona. Ind., Japan.

Ord. 20. Aspidistracææ.—Fls. ♀. Ova. free. Perianth 6-8-fid; sta. 6-8, on perianth; stigma radiate. Fls. sol. or spiked, dull purple or green. Fr. a berry. 3 gen.: 1. *Aspidistra*. 2. *Tupistra*. 3. *Rohdea japonica*, spike of white fls. succeeded by showy berries. Japan.

The 2 remaining Alliances in this subdivision (*Arum*, *Palm*) are called *Spadiciferæ*—*Spadix-bearing*.

Arum Alliance.—Fls. small, ♀ or diclinous, on a spadix or spike (except in Lemnaceæ). Perianth divisions distinct, 2-seriate, or 0. Fr. a berry, 1-∞-seeded. Perisperm fleshy or floury: 21. **Lemnaceæ.**

22. **Araceæ.** 23. **Typhaceæ.**

Ord. 21. Lemnaceæ. DUCKMEATS.—Fls. ♀. Perianth 0. Sta. 1-2. Ova. 1-celled. *Herbs*, consisting of minute green scales on stagnant water. Several genera; cosmop. 1. *Lémna*. Several species. 2. *Wólfia*. Eur., S. Am. *W. brasiliensis*. Can. to Ill.

Ord. 22. Araceæ. ARADS.—Fls. small, ♂ or diclinous. Sta. few or many. Perianth 0, or 4-5-6-8-merous. Spadix often colored. Fr. a berry. Perisperm copious, disappearing at germination (0 in *Symplocarpus*). Lvs. usually large, with cross-venules. *Herbs*, stemless, with erect or scandent stems. 2 Tribes.

Tribe 1. Araceæ.—Fls. ♂ (♂ ♀ in *Arisaëma*), achlamydeous. ♀ on lower, ♂ on upper part of spadix. 1. *Pistia*. Spadix adnate to spatha. Aquatic; tropical ponds; floating. *P. Stratiôtes*, WATER-LETTUCE. S. C. to Fla. and La., W. Ind. 2. *Cryptocoryne*. Spadix included and jointed to spatha by its top. Marshes, Asia.

A. Spadix free (rarely adnate), terminated by a naked appendage.

Herbs with thick or tuberous rhizome; often acrid.

3. *Arisaëma*. Fls. ♂ ♀. Sev. spec. Asia, America. *A. Dracón-tium*, GREEN-DRAOON. Lf. sol., with 11 pedate divisions; spadix with long, tapering appendage, protruding, snake-like. Low grounds. N. Am. *A. triphýllum*, JACK-IN-THE-PULPIT, INDIAN TURNIP. Lvs. trifoliolate. Tubers acrid. U. S. 4. *Dracunculus vulgaris*, (*Arum Dracunculus*). Handsome pedate lvs. and spotted stems. S. Eur. 5. *Arum*. Several spec. Eur., Asia. *A. maculatum*, CUCKOO-PINT, LORDS-AND-LADIES, FRIAR'S COWL. Lvs. ovate-sagittate, maculate, spatha green, spadix purple. Berries clustered, bright red. Fig. 57. Gt. Brit. 6. *Caládium*. Lvs. large, sagittate, peltate, often variegated. Many tropical species, both worlds. 7. *Peltandra virginica*. Lvs. sagittate, long-petioled; spatha green; berries green, enclosed in base of spatha; edible. Shallow water. Mass. to Can. 8. *Colocásia*. Several species, tropics of both worlds. *C. antiquorum*. Lvs. ovate-sagittate, 2°-5° long; rhiz. furnishes *Arrow-root*. Asia, Af.

B. Spadix without naked appendage.

9. *Richàrdia africàna*, TRUMPET LILY (miscalled Calla Lily). Lvs. large, hastate, long-petioled; spatha white, fragrant; spadix yellow. Cape of Good Hope. 10. *Aglaonëma*, similar. Ind.

Tribe 2. Callææ.—Fls. ♂ or ♀. Lvs. various. *Herbs*, rarely aquatic, sometimes climbing. 2 Sections:

A. Perianth 0.

1. Cálía. Marsh plants, creeping or floating. Lvs. entire, cordate; spatha colored. Sev. spec. Northern Eur. and Am. *C. palústris*, berries red; small plant; wet bogs, N. Eng. to Penn. and W. **2. Monstéra.** Climbing; lvs. often perforated with holes. Berries succulent, fused together; edible. Species tropical American. *M. deliciosa*, Mex., has luscious fruits, with pineapple flavor.

B. Fls. with perianth.

3. Póthos. Climbing; stems cord-like, attaching themselves to trees by adventitious rts. Lvs. petiolate, of various forms,—entire or palmately lobed, often perforated. Fls. ♂, 6-merous; spatha at length reflexed. Sev. spec.; cultivated for the foliage. Ind., China, Madagascar, N. Holl. **4. Anthúrium** (Póthos), **TAIL-FLOWER.** Similar to Pothos (but ov. pend., anat.). Spadix long, tail-like. Central and trop. Am.; sev. spec.; usually epiphytal in the forks of trees, and climbing by adventitious rts. *A. Scherzerianum*, **FLAMINGO PLANT.** Spadix twisted, spatha large, scarlet, on a tall peduncle; Costa Rica. *A. ornatum*, spadix purple, spatha white. *A. Lindenii*, lvs. satiny, exquisitely tinted. **5. Lásia.** Creeping, spiny. Lvs. pinnately divided; spadix sessile. Sev. spec. Ind. **6. Symplocárus foétidus**, only species, **SKUNK CABBAGE.** Stemless. Fls. ♂, 4-merous. Spadix globular. Spatha hooded, nearly sessile, with purple stripes. Berries embedded in the enlarged spatha. Lvs. large, ovate, tufted, appearing after the fetid fls. Swamps, etc., Can., N. Eng., Mid. and W. States. **7. Oróntium**, **GOLDEN CLUB.** Stemless. Fls. ♂, 4- and 6-merous, yellow, covering the conical, long-stalked, yellow spadix. Berries dry. Spatha 0. Lvs. elliptic or lanceolate, long-stalked. Species, N. American aquatics. *O. aquaticum*, inundated spots, U. S. **8. Gymnóstachys ánceps**, only species. Fls. ♂, 4-merous. Stemless, rhiz. thick. Lvs. grassy. Scape with a terminal cluster of spadices, each with a short, leafy, keeled spatha. Berries succulent, blue. E. Australia. **9. Ácorus.** Fls. ♂, 6-merous, green. Rhiz. long, jointed, cane-like. Lvs. long, lanceolate. Flower-stalk a leaf like the others, with a sessile spadix issuing from one edge half-way above base of leaf. Aromatic. Northern hemisphere; ponds, wet places. *A. Calamus*, **CALAMUS FLAG**; lvs. 2°–3° long. *A. gramineus*, much smaller.

Ord. 23. Typhææ. **CAT-TAILS.**—Fls. ♂ on same spadix, ♀ at top. Perianth 0, or of scales or bristles. Stamens ∞. Ova. 1-celled, 1-2-seeded. Fr. dry or drupaceous. Perisperm floury or fleshy. Lvs. linear, long, entire. Rhiz. creeping. Tall, reed-like aquatic or marsh *Herbs*. 2. 2 genera, cosmop. **1. Týpha**, **CAT-TAIL**, **REED-MACE**, **MASSETTE.** Stem 3°–5° tall, terminated by the cylindric spadix. Lvs. 3°–4° long. Cosmopolitan. *T. latifolia*, fls. continuous; *T. angustifolia*, of more slender habit, with a space between the ♂ and ♀ fls. Ponds, pools, Eur., Can., U. S. **2. Spargánium**, **BUR-REED.** Fls. in dense heads at intervals along the spadix. Some species small, floating. Cosmopolitan. *S. eurycarpum*, 3°–5° high, rooted. *S. simplex*, *S. minimum*, smaller, sometimes floating. U. S.

Palm Alliance. Fls. diclinous. Perianth 6-merous, 2-seriate (4-merous in *Cyclánthus*), or 0. Stamens ∞ . Spadix simple or branched. Spatha various, or 0. Fr. a 1- rarely 2- or ∞ -seeded drupe or berry. Large *Herbs*, *Shrubs*, or *Trees*; with flabellate or pinnately divided, rarely simple, lvs. **24. Pandanáceæ.** **25. Palmáceæ.**

Ord. 24. Pandanáceæ.—Fls. small. Perianth 0, except in *Cyclánthus*. Stamens ∞ , sometimes grouped. Fr. a 1-seeded drupe or ∞ -seeded berry. Perisperm copious; fleshy, cartilaginous, or horny. Large *Herbs*, *Shrubs*, or *Trees*. 1, **Pandánu**, SCREW-PINE. ♂ ♀. Branching trees or large shrubs; lvs. ensiform, prickly, in screw-like spirals crowning the stems. ♂ spadix branched; flowers fragrant; spatha phosphorescent (see Lesson XXXII., 405). ♀ spadix simple; ova. 1-celled, 1-seeded. Fr. of closely-cohering clusters of fibrous drupes; endocarp bony. 30 species, often with large aerial roots. Asia, Pacific and Indian islands, W. Af., N. Australia.

2, **Freycinétia**, only genus; sev. spec. Malaysia, Pacific Islands. Fls. ♂ ♀ ♂. Perianth 0. Spatha yellow or red. Spadix globose or oblong. Fr. a berry, ∞ -seeded. Lvs. narrow, spiny. Large *Herbs* or *Trees*, erect or climbing. 3, **Cyclánthus**. Fls. ♂; spadix cylindrical-oblong, the 2 sexes in alternate spiral bands around it; fragrant. Spatha 4-leaved. Stem contracted, lvs. fan-shaped, 2-cleft. Sev. spec. S. Am. 4, **Carludóvica**. Fls. ♂, disposed in spiral squares on a cylindrical-oblong spadix; spatha 2-leaved. ♀ perianth of 4 scales, each with 4 long tail-like staminodes; stigma cross-like. Lvs. stiff, plaited, deeply 2-5-fid. Stems often climbing; aerial rts. rope-like. **C. palmáta**, a stemless species, with lvs. 4° in diam., on stalks 6°–14° long; lvs. furnish the fine straw for Panama hats. All the species tropical Am. 5, **Nipa frúticans**, only spec. Fls. ♂, on a branched spadix; ♂ with 3 sepals, 3 petals, 3 stamens, in the lateral branches; ♀ without perianth, in the terminal hd. of the spadix. Spatha polyphyllous. Ova. with 3 distinct carpels. Fr. a head of drupes; sds. germinating in it. Trunk thick, short, spongy; crowned with pinnatisect lvs. 20° long. Coasts in Indian seas. Fossil in Tertiary at the mouth of the Thames. Allied genus, 6, **Phytélephas macrocarpa**, IVORY-NUT PALM. ♂ ♀. Perianth divisions 2-seriate, unequal. ♂ fls. with many fragrant stamens, on a fleshy simple spadix 4° long, spatha 4-5-leaved. ♀ fls. 6 or 7, white, on a very short spadix, spatha 1-leaved. Drupes 6 or 7, aggregated in a hd., each drupe with 6–9 large sds., the Ivory Nuts of commerce. ♀ trunk creeping; ♂ erect; crowned with long pinnatifid lvs. Northern parts of S. Am.

Ord. 25. Palmáceæ.—Fls. small, diclinous, rarely ♀ (*Còrypha*, *Sàhal*). Infl. axillary. Perianth of 6 2-seriate segments. Sta. 6, rarely 3 or multiples of 3. Ova. 3, rarely 1-celled, or of 3 separate carpels. Styles short, free, or connate. Fr. various, 1-3-celled. Sds. large. Emb. minute, peripheric. Perisperm fleshy or horny (central portion milky in *Cocoa-nut*). Spadix usually branched. Spatha herbaceous or woody, 1-leaved (2-leaved in *Wettinia*), or of several bracts. Lvs. various, folded in veneration. Perennial woody plants, with short or tall stems, crowned with leaves. Primary rt. decaying early; replaced by adventitious rts. which pierce the bowl-shaped base of the stem and remain more or less above ground, often raising and supporting the stem ("like the shrouds of a ship."—*Hooker*). Tropical, both hemispheres; preferring (except *Phœnix*) moist regions.

The most useful Order next to the Grasses. Many gen.; 1000 species, all helpful to man. 5 Tribes.

Tribe 1. Coccoineæ.—Fls. ♂ or ♀. Spadix enclosed in the spathe. Fr. a drupe; sarcocarp fibrous or oily; endocarp woody, marked with 3 scars, of which 1 corresponds to the emb.; sd. oily or milky. Lvs. pinnate, large. Trees. Many genera.

1. **Elæis**, OIL-PALM. ♂ ♀. Drupe with yellow, oily sarcocarp. 2 species. *E. guineénsis*, OIL-PALM; trunk thick, 30° high. Drupes 1½' long, in dense hds. 2° long and 2½° in circumf.; Guinea. Am. species creeping. 2. **Attælea**. Drupes in large clusters, 3-celled, 3-seeded. Sev. spec.; valuable. Trop. Am. *A. funifera*, COQUILLANUT P. Sds. 4' long, hard, brown; used in turnery. Leaf-stalk furnishes strong fibre. Brazil. 3. **Astrocaryum**, STAR-SEED P. Fls. ♂. Sarcocarp opening into 6 stellate parts,—hence the generic name. Stemless, or lofty trees. Whole plant spiny, especially the handsome spathe. Trop. S. Am. 4. **Cocos**. Fls. ♂. Drupe large; sarcocarp fibrous, endocarp bony, 1-seeded. 12 species, all handsome trees with large lvs. *C. nucifera*, COCOA-NUT P.; trunk 2° in diam., 60°–100° high. Lvs. 18°–20° long, feathery, curving. Tropics, both worlds.

Tribe 2. Coryphineæ.—Fls. ♂ ♀ or ♀. Spatha rarely perfect. Fr. a berry. Lvs. palmate-flabellate, rarely pinnate. Trees, or stemless.

1. **Phœnix**. ♂ ♀. Lvs. pinnate, feathery. Berry 1-seeded. 12 species, low or tall trees, of S. E. Af., N. Af., and tropical Asia. *P. dactylifera*, DATE-PALM, DESERT-PALM. 60°–125° high. Mediterranean States. The "palm of victory." Frontispiece, D. 2. **Sabal**. Fls. ♀, white. Lvs. flabellate, plaited. Berry dark green. 8 or 9 species. W. Ind. and Southern U. S. *S. Palmétto*, PALMETTO. Only tree of the genus; wood valuable. S. Car., Fla., W. Ind. 3. **Chamaerops**. Fls. ♂ or diclinous. Lvs. flabellate. 12 species, N. Asia, Af., Am., S. Eur.; dwarf or low trees, never more than 30° high. Fr. an olive-like 1-seeded berry. *C. serrulata*, SAW-PALMETTO; *C. Hystrix*, BLUE PALMETTO, both called LATANIER by the Creoles. Gulf States. 4. **Còrypha**. Fls. ♀. Fr. a 1-seeded berry. Lvs. flabellate, plaited; 5 species, nearly all tall trees; trop. Asia. *C. umbraculifera*, TALI-POT PALM, 70° high, crowned with gigantic prickly-stalked lvs.; each lf., when fully expanded, forming a fan 13° in diameter with a fringe of double points. Carried as fans before persons of rank. Ceylon, Malabar.

Tribe 3. Borassineæ.—Fls. usually ♂ ♀. Fr. a drupe, rarely a berry. Spathas woody or fibrous, sometimes imperfect. Lvs. palmate-flabellate or pinnate. Trees.

1. **Latània**. ♂ ♀. Drupe 3-seeded, size of a small apple, edible. Lvs. palmate-flabellate. *L. Commersonii*, 30° high, Bourbon, Mauritius. 2. **Hyphaene**. ♂ ♀. Drupe 1-seeded, size of an orange, with smooth, brown, polished skin and mealy sarcocarp. Lvs. palmate-flabellate. Stem branching when old. *H. thebaïca*, DOUM P., GINGERBREAD P., 30° high; drupes in long clusters, each cluster with 1-2-hundred drupes; sarcocarp with taste of gingerbread, edible. Egypt, Nubia, Abyssinia, Arabia. 3. **Lodoicea seychellàrum**, only spec., DOUBLE COCOA-NUT P., SEA COCOA-NUT P., SOLOMON'S COCOA-NUT P. ♂ ♀. ♂ trees 100° high; ♀ tree shorter. Lvs. palmate-flabellate, 20° long, 12° wide, crowning the top. Fr. a thick fibrous husk,

containing 1, 2, or 3 immense nuts, resembling cocoa-nuts, but each divided half-way down into 2 lobes, thus seeming double. Trees bloom at the age of 30 years; ♂ fls. in spadices 5° long; ♀ fls. on a long, zigzag spadix, maturing 5-11 nuts averaging 40 lbs. each. Fruit requires 10 years to mature; its perisperm, jelly-like for the first five years, is horny when ripe. The root-system, with stem-bowl, etc., is surprisingly developed, giving the tree great play amidst gales. Found only in the Seychelle Islands, which were not discovered by Europeans until 1743. The nuts, found floating at sea centuries before, had given rise to a thousand legends, and fabulous virtues were ascribed to them. Lvs. are manufactured into exquisitely fine baskets, etc., and for this traffic the trees are likely to become extinct. 4. **Borássus.** ♂ ♀. Drupe as large as a child's head, 3-seeded, edible. Lvs. palmate-flabellate, immense. 2 species: *B. flabelliformis*, PALMYRA P., TODDY P.; trop. Asia; 60°-100° high; Palm-wine (Toddy) furnished by the spatha (though obtained from other genera); *B. æthiopicum*, Central Af.; trunk bulging at the middle of its height.

Tribe 4. Calámææ.—Fls. usually declinous. Fr. a berry with imb. scales. Lvs. pinnate, or palmate-flabellate, with a hooked appendage. Sarmentose or arborescent.

1. **Ságus**, SAGO P. Lvs. pinnate. Infl. terminal. Trees, monocarpic; flowering at the age of 15-20 years, requiring 3 years to ripen their fruit, then dying. Sago is furnished by the pith, the trees being feiled just before flowering. *S. laëvis*, 30°-50° high, lvs. smooth; *S. Rumphii*, smaller; lvs. spiny; Moluccas. 2. **Calamus**, RATTAN P.; usually climbing. Lvs. pinnate, often ending in a long appendage, armed with hooks, by which the stems climb; stems reed-like, jointed, often 250° long; manufactured into canes, chair-bottoms, etc. 80 species, a few low shrubs or small trees. Malaysia, Ind., 2 in Australia, 1 in Af. **C. Rotáng**, is the typical RATTAN. Ind.

Tribe 5. Arcinéæ.—♂ or ♀. Spatha ∞-leaved, rarely 1-leaved, very rarely 0. Fr. deeply 3-lobed, berry or drupe. Lvs. pinnate, pinnatifid, or 2-pinnate. Trees or shrubs.

1. **Caryóta.** Lvs. 2-pinnate, pinnules the shape of a scalene triangle, broad and jagged at top. Monocarpic, like Ságus, but longer-lived. Infl. axillary. Spadices branching, drooping, like horsetails; lowest flowering first. Fr. a berry. 9 species, handsome trees, E. Ind. and Islands. *C. urens*, 60° high; lvs. 20° long, 12° broad; spadices 10°-18° long. 2. **Oreodóxa.** Lvs. pinnate. 6 species, all fine trees, W. Ind., trop. Am.; *O. olerácea*, CABBAGE P., 100°-170° high; leaf-bud cabbage-like in form; delicious, but the young trees die after it is cut. Woody leaf-stalks made into cradles by negroes. Spatha double, woody. W. Ind. 3. **Saguérus.** Lvs. pinnate. Infl. like horsetails. Few species, tallest 40° high. Ind. Archipelago. *S. saccharifer*, ARENGA P., TODDY P.; spatha yields Toddy, made into sugar. 4. **Ceróxylon.** Lvs. pinnate, 20° long. Fr. a berry. 3 species, all noble trees of great height, S. Am.; *C. andicola*, WAX P.; stem bulging towards the top; exuding a valuable wax. New Granada, elevated regions almost to snow-line. 5. **Iriártea.** Lvs. pinnate, large; pinnæ trapezoid, jagged on one side; spatha ∞-leaved. Fr. a drupe, 1-seeded. 5 species, 60°-100° high, elevated on a conical mass of spiny adventitious rts. Peru, Brazil. 6. **Wettinia.** ♂ ♀. Lvs. pinnatisect, segments truncate and erose at apex. Infl. axillary.

Spatha 2-leaved. Fr. a dry 1-seeded berry. Stem 30°-40° high, on stilt-like, spiny adventitious roots. 2 species: *W. angusta*, *W. maynensis*; eastern slope of Andes, 3500' above sea-level. 7. *Arëca*. Lvs. pinnate. Fls. ♂; spatha double. Fr. a 1-seeded drupe, with fibrous rind; sd. with ruminated perisperm. 2 species. *A. Catechu*, **BETEL-NUT** P. Drupe red, as large as a hen's egg. Sd. as large as a nutmeg; cut into small bits, which are rolled up with lime in leaves of Betel Pepper and chewed as tobacco. Fls. very fragrant. Warmer parts of Asia. *A. Dicksoni*, wild in Malabar; sds. used in the same way.

Subdivision 2.—Ova. apocarpous; reduced to 1 carpel in some Naiadaceæ. Flowers rarely on a spadix.

Pondweed Alliance.—Fls. ♂ or diclinous. Perianth of 3-4-6 segments, or 0. Stamens 1-6. Perisperm 0. Emb. often curved or hooked. Aquatics; submerged or floating: 26. Naiadaceæ. 27. Alismaceæ.

Ord. 26. Naiadaceæ. PONDWEEDS.—Herbs, ann. or perenn. Fr. a berry or utricle. 1. *Najas*. ♂ ♀. Perianth 0. ♂ fl. of 1 stamen; ♀ fl. of 1 ovary with 2-4 stigmas. Fr. a nut. Emb. a macropod. 8 species, both worlds; all submerged, small; lvs. narrow, opp., or whorled. 2. *Zostera*. Fls. of *Najas*; pollen confervoid (see Lesson XXIII., 271). Lvs. ribbon-like, colored. 2 species, marine, cosmop. *Z. marina*, **SEAWRACK, GRASS-WRACK**; lvs. several ft. long, $\frac{1}{4}$ wide. Social; shallow water, sea-coasts. 3. *Ouvirandra*. Sepals 2-3. Sta. 6. Ovaries 3-4. Scape with a 2-5-furcate spike. Rts. tuberculate, lvs. submerged. 5 species. Ind., Af. *O. fenestralis*, **LATTICE-LEAF, WATER-YAM**. Lf. 1° long, 3' wide, latticed. Spike 2-furcate. Rhiz. edible. Madagascar. Fig. 231. 4. *Potamogeton*. Fls. ♂, 4-merous. Emb. variously curved. Lvs. various. Many spec., submerged or floating. Cosmop., in ponds, canals, etc. *P. perfoliatum*, **PONDWEED**; fls. purple, lvs. orbicular, ovate, or lanceolate. Emb. curved. Fig. 190, A.

Ord. 27. Alismaceæ. WATER-PLANTAINS.—Fls. ♂ or diclinous; parts distinct and free. Perianth segments 2-seriate; 3 sepals, 3 petals; stamens 6-∞, ovaries 3-∞. 1. *Triglochin*, **ARROW-GRASS**. Fls. ♀, greenish, racemed. Emb. straight. Lvs. cylindric, fleshy. Several spec.; marshes, salt or fresh. N. Y. to Wis., N. 2. *Alisma*. Fls. ♀, petals white, lilac, or rose-colored; small. Several spec., cosmop. *A. Plantago*, **WATER-PLANTAIN**; lvs. ribbed, large, jointed. Compound panicle 1°-2° long. Shallow water. 3. *Sagittaria*, **ARROW-HEAD**. Fls. of *Alisma*, but ♂, ♂ ♀ or ♂ ♀ ♀, with stamens and ovaries ∞. Lvs. various, sometimes sagittate. Fls. usually whorled in 3s on a tall scape, ♂ fls. at top. 15 species, trop. and temp. regions, both worlds. Several in U. S. 4. *Limnócharis*. Fls. ♀. Lvs. cordate, small; petals yellow, large; fls. proliferous. Few spec.; pools, S. Am. 5. *Bütomus*. Fls. ♀. Petals colored. Stamens and ovaries some multiple of 3. Ovules with dissepimental placentation. Lvs. linear. The most highly differentiated of Endogens; see Lesson X., 88, 91. *B. umbellatus*, **FLOWERING RUSH**. Lvs. 2°-3° long, sometimes striped. Scape 5°-7° high, bearing an umbel of rose-colored fls. Handsome. Borders of brooks, ponds, lakes, Eur., Asia. Fls., Fig. 58; carpel, trans. sec., Fig. 179, C.

Ord. 28. Triurideæ.—Affinities obscure. Fls. ♂ or ♂ ♀; 2-

merous or 3-merous. Style lateral or basal; sd. minute; emb. obscure; perisperm dense. Minute, slender, leafless, white, discolored herbs, on mossy banks and dead lvs., tropical forests of Asia and Am. 4 gen.: 1. *Sciaphila*, Asia. 2. *Soridium*. 3. *Héxuris* (perianth lobes 6-tailed). 4. *Triuris*, 3-tailed, America.

Division 2.—Ovary adherent (free in some Bromeliaceæ and Hæmodoraceæ). No subdivisions.

Ord. 29. **Hydrocharideæ.** FROGBITS.—(Closely allied to Pondweed Alliance; thus making a continuous chain from the most simple (Najas) to the most complex (Hydrócharis) of Endogens. But in Hydrócharis the ovary is adherent and syncarpous.) Fls. ♂ ♀, rarely ♀. Perianth of 6 segments, 2-seriate, inner series petaloid. Stamens and stigmas 3, or a multiple of 3. Fr. submerged, fleshy, 1-celled, ∞-seeded; testa elegantly clothed with cylindric cells. Perisperm 0. Aquatic Herbs, submerged or floating; rhiz. edible. 3 Tribes; types only given here. 1. *Hydrócharis Morsus-ranæ*, FROGBIT. ♂ ♀. Fls. white, sol., pedicelled; lvs. ensiform, petiolate. Elegant little floating plants; ditches, ponds, backwaters. Eur. 2. *Vallisnèria spiràlis*, EEL-GRASS. ♂ ♀. Described, Lesson XXXIII., 418; Fig. 244. 3. *Anácharis canadense*. Polygamo-dicæious; lvs. linear, opp., or whorled on the elongated branching stems. Submerged; habit of *Vallisnèria*. Common, U. S.; naturalized in Gt. Brit., and there troublesome.

Ord. 30. **Dioscoreaceæ.** YAMS.—♂ ♀. Fls. racemed. Perennial Herbs or Undershrubs, stem twining; resembling *Smilax* in fls., fr., and lf.; but with herbaceous perianth; ova. adh., fr. a caps., rarely a berry, and lvs. sometimes opp. Perisperm copious, dense. Rhiz. or root thick, fleshy, edible; deeply subterranean; sometimes epigeal (*Testudinària*). 7 gen., 160 spec., chiefly in southern tropical regions.

1. *Testudinària*, rhiz. epigeal. 2 species, Cape of Good Hope. *T. elephántipes*, ELEPHANT-FOOT, HOTTENTOT-BREAD, TORTOISE-PLANT; rhiz. huge, with cracked bark, resembling the foot of an elephant, or the back of a tortoise; bearing many stems. 40° high. Ornamental. Fr. capsular. 2. *Dioscòrea*, YAM. Lvs. usually alt., sometimes opp.; fr. capsular, 3-celled. 150 species, Am., Asia, 12 in Af., 4 in Australia; producing the *Yams* of commerce,—white, pink, purple, or black, according to species, and often weighing 40 lbs. *D. sativa*, E. Ind., cultivated in S. States; lvs. opp., 9-13-nerved, handsome; badly drawn in Fig. 89. *D. Batàtas (japónica)*, CHINESE Y.; rts. deeply subterranean, edible; lvs. opp., with bulbs in the axils. Ornamental. *D. villòsa*, WILD Y.; rhiz. knotty. Common, S. States. 3. *Rayàna (Rajàna)*, similar, but caps. 1-celled. West Ind. 4. *Tàmus*; similar, but fr. a berry. 2 spec.; *T. commùnis*, BLACK BRYONY, Gt. Brit.; *T. crètica*, lvs. 3-lobed; Greece and Archipelago.

Narcissus Alliance.—Fls. ♂. Perianth reg. or irreg., segments 2-seriate. Ova. 3-celled. Fr. a caps., sometimes a berry. Perisperm copious, fleshy, or horny. 31. **Velloziaceæ.** 32. **Hæmodoraceæ.** 33. **Amaryllidaceæ.** 34. **Iridaceæ.**

Ord. 31. **Velloziaceæ.**—Fls. ♂, 6-merous, reg., large, sol. on a scape, handsome. Fr. a caps.; emb. extruded. Lvs. long, linear. Stem resinous, dichotomously branched, 2°-12° high, lvs. crowning the branches. 2 gen.: 1. *Vellòzia*, fls. white, blue, violet. Sev. spec., chiefly in Brazil, but found in Madagascar, Arabia, Abyssinia.

2. *Barbacenia*, fls. purple or red. 12 spec., some very showy. Hot mt. regions of Brazil; Guiana.

Ord. 32. *Hæmodoracæ*. BLOODROOTS.—Fls. ♂, 6-merous; woolly, or scurfy, white or yellow; panicled or corymbed. Fr. a caps.; sds. strophiolate. Emb. barely included. Rts. fibrous-fascicled, sometimes red. Lvs. ensiform. 8 or 10 gen. ♀. Chiefly in S. hemisphere.

1. *Hæmodorum paniculatum*, BLOODROOT; rts. edible. S. Af. 2. *Lophiola (Conostylis)*, CREST-FLOWER. *Ova. adh. only at base*. Scape cymose-panicled; fls. yellowish. *L. aurea*, N. J. to Va. 3. *Lachnanthes tinctoria*, RED-ROOT. Rt. red; stem leafy, with a cyme of woolly, yellowish fls. Rhode Island, N. J., S.

Ord. 33. *Amaryllidacæ*.—Fls. ♀, 6-merous, reg. or irreg., sol., umbellate or spiked; perianth often with a crown in the throat; stamens 6, on an epigynous disk, or on the perianth throat or crown. Fr. a capsule or berry. Emb. included. Perennial *Herbs*, usually stemless, bulbous, with fibrous roots; rarely caulescent, long-lived, with fascicled roots. Lvs. ensiform or linear. 2 Sections:

A. *Caulescent. Rts. fascicled.*

1. *Fourcroya*. Stem massive, 10°–40° high, crowned with long leaves and producing an immense panicle of large fls. Monocarpic. See Lesson XV., 162. Many spec. S. Am., W. Ind., Mex., Madagascar. 2. *Agave*. Lvs. radical, massive, fleshy, spiny-toothed. Scape large, tall, terminating in a panicle with horizontal branches, or in a simple spike of fls. Monocarpic. Several species. U. S., Mex., S. A. *A. americana*, CENTURY PLANT, AMERICAN ALOE, gigantic; Fig. 115. Lf.-fibre made into ropes. Mex., S. A. *A. virginica*, much smaller, shorter-lived. Va., Ill., and S. 3. *Doryanthes excelsa*. Radical lvs. broadly ensiform, tufted, spreading; stem 20° high, with shorter lvs., and terminated by a large compound hd. of large crimson fls. emerging from immense crimson bracts. N. Holl. 4. *Bomarea Salsilla*, stem twining, with smooth lvs. and umbels of purple fls. $\frac{1}{2}$ inch long, with an eye-like spot on each of the 3 inner segments. Sev. spec.; all of S. Am., W. Ind., Mex. 5. *Alstrœmeria*, LILY-OF-THE-INCAS; similar, but weak and straggling; fls. richly colored, spotted. Sev. spec. S. Am.

B. *Acaulescent. Bulb; scape and lvs. issuing from it.*

Perianth with a corona, to which the stamens are adnate by their filaments. 1. *Narcissus*. Stamens included in corona. Many species. Old World. *N. poeticus*, POET'S N.; 1-flowered. *N. biflorus*, PRIMROSE-PERLESS; 2-flowered. *N. Tazzetta*, fls. numerous in an umbel. Boll, fl. plan, Fig. 202, A, B. *N. Jonquilla*, JONQUIL; fls. 2–5, small, fragrant. *N. Pseudo-Narcissus*, DAFFODIL; 1-flowered, fl. large, often double. 2. *Pancratium*. Corona 12-toothed, conspicuous; filaments projecting; fls. large, white, handsome, fragrant, umbelled on a tall scape; perianth tube slender; divisions long, narrow. Sds. with corm-like testa. Many species. Syria, Arabia, S. Eur., N. Af., Southern U. S. *P. maritimum*, *P. rotatum*, *P. coronarium*. S. States. 3. *Eucharis*. Lvs. broadly elliptic, long-stalked. Corona large, bell-shaped, the 6 stamens on its margin each with a lateral tooth at base.

Fls. large, white, fragrant, nodding in an umbel on a tall scape. Few species. S. Am.

Perianth without a corona; stamens on perianth, or on an epigynous disk. 1. *Hæmáanthus*, BLOOD-FLOWER. Fr. a berry. Lvs. few, sheathing at base. Scape short, terminating in an umbel of many crowded red or white flowers, usually with a many-leaved spatha, of which the leaflets are erect, colored, and much longer than the flowers. Few species. Trop. and S. Af. *H. multiflorus*, Fig. 59. 2. *Crinum*. Perianth tube long, slender; divisions long, narrow, spreading; stamens long. Scape with few or many large flowers in an umbelled head. Lvs. lorate. Numerous species, Asia, Australia, S. Af., trop. Am. *C. amabile*, bulb huge, epigeal, pyramidal; lvs. erect, 3°-6° long, 3'-6' wide in the centre. Scape 3°-4° high, bearing an umbel of 20-30 fragrant, rosy fls.; tube of perianth 6' long, lanceolate divisions 6' long. Sumatra. *C. americanum*, bulb globular, scape 2° high, with 2-4 large fragrant fls., of which the perianth divisions are white, shorter than the green tube. Banks of streams, and swamps, Texas. 3. *Amaryllis*. Perianth tube short, ribbed; 3 petaline filaments inserted at base of the segments; 3 sepaline ones on mouth of tube. Scape with an umbel of many large-stalked fls.; blooming in autumn before the lvs. *A. Belladonna*, BELLADONNA LILY. Scape 1½° high; fls. large, rose pencilled with red. Cape of Good Hope. Most of the fine species formerly included here are now distributed in 4. *Brunsvigia*, purple, S. Af.; 5. *Hippeastrum*, KNIGHT'S-STAR LILY, crimson, scarlet, orange, with a green or white central star, S. Asia and W. Ind.; 6. *Sprekélia*, ST. JAMES LILY, red, S. Am.; 7. *Oporáanthus*, yellow, small, S. Eur.; 8. *Vallóta*, purple. 9. *Zephyrántes*. Dwarf, with 1-2 large, delicate, pink or white fls. on a scape; lvs. and fls. in spring. Several species. N. and S. Am., W. Ind. *Z. Atamásco*, ATAMÁSICO LILY, Va., S. and W.; low grounds. 10. *Nerine*. Filaments of stamens cohering by their dilated bases. Scape with an umbel of large scarlet, rose, or pale-pink fls., appearing before the lvs. Several species. S. Af. *N. sarniënsis*, GUERNSEY LILY, fls. pale rose. Wild on the island of Guernsey, where the bulbs were drifted ashore with the fragments of a lost ship. 11. *Leucòjum*, SNOWFLAKE. Stamens on an epigynous disk at the base of the 6-parted perianth. Scape spathaceous, with 1-7 small white fls. on nodding pedicels. Few species. Eur. 12. *Galánthus*, SNOWDROP; stamens similar to last; scape with a solitary nodding small white fl., inner segments shorter than outer. Few species. Eur. 13. *Hypòxys*. Bulb (or Corm) solid. Stamens as in 11 and 12. Perianth 6-parted nearly to ovary, spreading. Few species. Cape of Good Hope. 2 in America. *H. erécta*, STAR-GRASS. Scape 3'-8' high, with a few yellow fls. ½ inch broad. Meadows, Can. and U. S. *H. filifòlia*, 2-flowered, fls. larger. Sands, Ga., Fla.

Ord. 34. *Iridáceæ*. IRIDS.—Fls. ♂, 6-merous, 2-seriate. Stigmas 3. Sta. 3. Fr. a 3-celled capsule. Emb. included. Perennial *Herbs*, with tuberous or bulbous rhizome, rarely with fibrous roots. Lvs. equitant; ensiform or linear. 5 Sections:

A. Spatha 2-valved. Stigmas linear (except *Crocus*). Filaments of stamens free. 1. *Crocus*. Fls. and linear lvs. from the corm. Perianth with long tube; stigmas dilated. Many fine species. Old World. *C. vérnus*, SPRING CROCUS, white, violet, purple, or with

mixed colors; its varieties are *C. luteus*, *C. Susiânus*, YELLOW-CROCUS. *C. sativus*, SAFFRON-CROCUS, autumnal; violet, purple, fragrant. The long orange-red stigmas are the *Saffron* of commerce. **2. Ixia.** Bulb tuberous. Stem with spikes of large showy fls.; perianth tube slender, border 6-parted, wheel-like. Sev. spec. Cape of Good Hope. **1. viridiflora**, fls. sea-green, with black markings.

B. Spatha 2-valved. Stigmas simple or involute-filiform. Filaments connate throughout. **1. Hydrotaënia Meleâgris**, only spec. Bulbous. A small horn between each of the 2-branched stigmas. Perianth bell-shaped, purple, spotted, its inner segments clawed, and marked with a glittering, crystal-like, triangular zone. Scape tall; fls. umbelled, nodding on long pedicles. Mex. **2. Nemástylis (Nemóstylis) celestina**, only spec. Bulbous. Stigmas branching, thread-like, fls. blue, handsome; stem 2° high. Pine barrens, S. **3. Sisyrinchium**, HOG-SNOUT GRASS. Rt. fibrous. Stigmas simple. The 2-leaved spatha resembles a hog's snout. Species in New World, N. Holland, 1 in Ireland. Fls. small, lvs. grass-like. **S. bermudiâna**, BLUE-EYED GRASS. Stems 2-winged, 1° high, with purple or white wheel-shaped fls., umbelled and nodding. U. S. **4. Tigridia pavonia**, TIGER FLOWER, PEACOCK LILY. Bulbous. Stem 2° high, with a few showy fls. 5'-6' wide, yellow or red, the centre dark and spotted with crimson or purple. Mexico. **5. Schizóstylis coccinea**, only species. Tuberous. Stems 3° high, bearing a spike of crimson fls. 2' wide; tube narrow, lobes wide-spread. S. Af.

C. Spatha 2-∞-valved. Stigmas dilated. Filaments connate at base. **1. Pardanthus sinënsis**, BLACKBERRY LILY. Rhizome with leafy branching stem 3°-4° high, bearing orange-yellow fls. mottled with red or purple; perianth 6-parted, rotate, 2½' wide. Capsule-valves deciduous, exposing the fleshy blackberry-like sds. China. Other species, Ind., Japan.

D. Spatha ∞-valved. Stigmas petaloid. Filaments connate at base, or free. **1. Iris**, FLAQ, FLOWER-DE-LUCE, FLEUR-DE-LIS. Rhizome fleshy, prostrate; rarely bulb; lvs. ensiform; stem 1-several-flowered, low or tall; colors various. Perianth tube short, or prolonged and adnate to style; limb 6-parted, outer divisions reflexed, and usually bearded at base. Many species, all beautiful. S. Eur., N. Asia, N. Af., N. Am. **1. florentina**, Florentine FLOWER-DE-LUCE (badge of the city of Florence, Italy). Stem with several large white fragrant fls. Rhiz. violet-scented; the *Orris-root* of pharmacy. **1. germanica**, taller, fls. large, violet color, scentless; fl. plan, Fig. 63, B; lf. stomata, Fig. 233; st., vert. sec., Fig. 223. **1. Pseudâcorus**, fls. yellow, beardless. S. Eur. **1. përsica**, dwarf; bulb-like tuber; nearly stemless; fl. sol., beardless, blue mottled with purple, fragrant. Persia. Wild Am. species, rhizome creeping, fls. beardless: **1. vërna**, DWARF I., fls. blue. Va., Ky., S. **1. cristâta**, larger, fls. crested. Alleghenies. **1. virginica**, fls. blue. Mass. to N. J. **1. versicolor**, larger, fls. blue, variegated. Can., U. S. **1. hexâgona**, fls. deep blue, variegated, crested. S., near coast. **1. cùprea**, fls. copper-color. S. and W. **1. tripëtala**, inner divisions minute, fls. blue variegated with yellow and purple. S., swamps. **2. Xiphion**, like Iris, but bulbous. Many fine species. Medit. States, Abyssinia. **3. Moraëa**. Many handsome species; near Iris, but stigmas bifid or multifid. Fls. brilliantly colored, fragrant. S. Af.

E. Spatha 2-valved. Stigmas filiform. Filaments free, unequal
1. Gladiolus, SWORD-FLAG. Corm fleshy; stem erect, tall, bearing a spike of showy, irregular fls. Many fine species. S. Af., Medit. States. **G. psittacinus**, tall; fls. large, yellow and scarlet; var. *Gandavensis*, in gardens, Cape of Good Hope; **G. cardinalis**, fls. scarlet, Cape; **G. blándus**, fls. rose and white, Cape; **G. byzantinus**, **G. comminis**, fls. white or rose, S. Eur. **2. Tritonia.** **3. Sparaxis, Watsonia**, fine Cape species, once included in Ixia.

Tacca Alliance.—Fls. ♂, reg.; perianth 6-lobed. Stamens 5 or 6, on perianth tube, anthers separate. Ova. 1-3-celled; fr. a capsule or berry. Sds. minute, perisperm 0; or large, with perisperm. *Herbs*, ann. or perenn. **35. Taccaceæ.** **36. Burmanniaceæ.**

Ord. 35. Taccaceæ.—Perennial, stemless. Rhiz. tuberous, edible; lvs. broad; entire, or palmisect, pinnatifid. Scape crowned with an involucre umbel of long, pedicelled, drooping fls., mixed with long, abortive pedicels. Fr. a berry. Emb. minute, included in perisperm. 2 gen.: **1. Tacca**, fls. green or brown. 7 species. Trop. Am., Af., Indian and Pacific islands. Scapes furnish a fine straw, wrought into hats, crowns, etc., by the Tahitians. **2. Ataccia**, lvs. entire. Few species. Ind., Malaysia. **A. cristata** (miscalled *Tacca integrifolia*). Scape, involucre, and fls. purple; perianth tube 6-angled; limb reflexed.

Ord. 36. Burmanniaceæ.—Ann. or perenn.; stem weak; often parasitic, discolored, rarely green and leafy. Scape with a cyme of 2-∞-bracteate fls., various in color. Fr. capsular. Sds. minute, ∞, with loose testa; emb. an undivided, cellular mass, seemingly formed of the tigellus. Perisperm 0. **1. Stenomeris.** Green, sarmentose, lvs. resembling Smilax. Fls. 6-merous. **2. Thismia.** Discolored, small, leafless. Fls. 6-merous, 5 of the lobes tailed; stamens often monadelphous. Fls. few, racemose, variegated yellow-red. Tenasserim coast. **3. Burmannia**, similar, but sta. 3, and 3 outer perianth divisions winged. 7 species. Asia, Af., Am. **B. biflora**, fls. light blue. Swamps, Va. to Fla. and La. **B. capitata**, fls. white. S. Car., Ga. **4. Apteria setacea**, similar, but purple fls. campanulate, wingless, racemed. Moist shades, Fla. and La.

Orchis Alliance.—Fls. ♂, very irreg.; perianth of 6, rarely 3, segments. Stamens 1, 2, or 3, gynandrous. Fr. capsular. Sds. numerous, very minute; testa lax; emb. undivided, fleshy. Perisperm 0. Perennial herbaceous plants. **37. Apostasiaceæ.** **38. Orchidaceæ.**

Ord. 37. Apostasiaceæ.—Fls. orchidaceous, but with ovary always 3-celled, and stamens with short filaments gynandrous only at base. Sds. minute, scobiform. 2 genera: **1. Apostasia**, lvs. grassy; fls. small, yellow, fragrant, nodding, in terminal panicles. Forests of Malacca, Burmah, Assam. **2. Neowiedia**, resembling a minute dwarf palm; fls. in spikes. Borneo.

Ord. 38. Orchidaceæ. ORCHIDS.—Fls. described, Lessons XXI., XXIII. Ova. 1-celled, except in *Selenipedium*. Terrestrial, epiphytal, or parasitic herbaceous plants, sometimes in marshes; rhiz. creeping, or with fasciated fibrous rts., often tubercular; lvs. often connate at base, forming a pseudo-bulb. Lvs. various in form. Very many genera, in all climates, but flourishing best in moist, hot tropics. 8 Tribes, distinctions in pollen, anthers, and habits.

Tribe 1. Cyripediæ.—**1. Selenipedium.** Lip saccate. Ova. 3-

celled. 10 species; formerly included in 2. *Cypripedium*, VENUS' SLIPPER. Very numerous species, cosmopolitan, in all climates; usually yellow, sometimes white or pink or purple; one, *C. guttatum* (Russia), blood-stained. *C. Calceolus* (*Calceolus Marianus*), OUR LADY'S SLIPPER; yellow, large. Gt. Brit. *C. pubescens*, MOCCASIN FLOWER; large, yellow, sol. Can. to Wis., S. to Ga. *C. candidum*, large, white, sol. Penn., N. and W. *C. spectabile*, stem 2° high, with 2-3 large fls., labellum white, purple-striped. Swamps, Can. to Ky. 3. *Uropedium Lindenii*, labellum flat, petals long-tailed. New Granada, 8500° above the sea.

Tribe 2. *Neotticæ*.—1. *Spiranthes*, LADY'S TRACES; fibrous rts., like corset-laces. 50 species. Lvs. grass-like; fls. in a spirally-twisted spike. Rt. tuberous in some species. Sev. spec. in Can. and U. S. 2. *Goodyera repens*, *G. pubescens*, RATTLESNAKE PLANTAIN. Lvs. ovate, mottled with white; fls. white or greenish. Can. to Car.; Gt. Brit. 3. *Listera*. Stem 2-leaved, with a raceme of small green fls. Few species. Eur., N. Asia, N. Am. 4. *Neottia*, like *Listera*, but leafless. 4 species: 3 in N. Asia; 1 Gt. Brit.: *N. Nidus-avis*, BIRD'S-NEST ORCHIS.

Tribe 3. *Vanilleæ*.—1. *Vanilla*. Climbing. Lvs. oblong-cordate, succulent, fls. thick, fleshy, dull-colored; capsule linear, fleshy; the Vanilla-pod of commerce. Sev. spec. Mex., W. Ind., trop. Asia. 2. *Cyrtosia Lindleyana*; similar, but leafless, with flat capsule; fls. bright yellow. Sikkim. 3. *Erythrorchis*, stems dull red, leafless, climbing to a great height. Burmah and adjacent islands. *E. scandens*, stems 50°-100° long, with racemes of yellow fls., the lip tinged with pale blue.

Tribe 4. *Arethuseæ*. 1. *Arethusa bulbosa*, only species. Scape 6'-10' high, from a bulb; terminated by a sol. bright pink flower 2' long, with bearded lip. Bogs, Can. to Va., W. to Wis. 2. *Pogonia*. Similar to *Arethusa*, but fls. often racemose and of various colors. 20 species, Am., Asia. 4 species in U. S. *P. ophioglossoides*, fl. large, sol., nodding, purple. Can., N. Eng., to Car., Ky. *P. divaricata*, stem 2° high, 2-leaved; fl. large, sol.; petals pink, sepals purple, lip green, with purple veins. Swamps, Va. to Fla. and La. 3. *Calopogon*, lip as in last. 4 species, all small, lvs. grass-like. *C. pulchellus*, scape 1° high, with 2-6 pink-purple fls. 1' broad at top. Bogs, U. S. and Can.

Tribe 5. *Ophrydæ*.—1. *Habenaria*. Many species, most numerous in Ind., Af.; found in Eur.; more numerous in Am. Fls. spurred; green, rose, yellow; more frequently white, fragrant; lip often fringed; ovary usually twisted. *H. chlorantha*, fls. white, long-spurred, fragrant, in a spike. Gt. Brit. 20 species in U. S., all in bogs or low grounds. *H. fimbriata*, FRINGED ORCHIS; Penn., N. E.; *H. psychodes*, smaller; both fringed, purple, spiked. *H. Bigelovii*, larger, purple, racemed. Can. to Penn. *H. ciliaris*, fls. yellow, fringed, spicate. Can., U. S. *H. nivea*, fls. white, spicate, not fringed; ovary not twisted. Del., S. *H. viridis*, fls. green, not fringed. N. *H. orbiculata*, lvs. orbicular, scape 1°-2° high, with a raceme of large, greenish-white fls. N. 2. *Orchis*. Many species, Eur., temperate Asia, few in N. Am. Fls. spurred. *O. mascula*, MALE O.; tuberous, with showy pink or flesh-colored fls. in a loose spike, Gt. Brit. *O. Mörrio*, tubers (as also those of *O. mascula*) made into *Salep*; Fig.

152; pollinia, Fig. 171; cell, Fig. 217, D. *O. spectabilis*, fls. pink-purple, lip white; spicate. Woods, N. U. S. 3. *Ophrys*. Spurless; lip usually convex. Numerous species in Mediterranean States. Few in Gt. Brit.; among these are *O. apifera*, BEE O.; lip resembling a bee; *O. muscifera*, FLY O.; fl. resembling a fly. Both in dry pastures, southeastern counties.

Tribe 6. Vandææ.—Largest and finest Tribe. Most epiphytal. 1. *Peristèria*. Pseudo-bulbs; large plicate lvs.; radical ∞ -flowered scapes with handsome globular fleshy fls. 4 species. *P. elata*, EL SPÍRITU SÁNTO, HOLY GHOST FLOWER, DOVE ORCHIS. Terrestrial. Lvs. 3° – $3\frac{1}{2}^{\circ}$ long, 6' wide; flower-stalk 4° – 6° high, $\frac{1}{3}$ of its length occupied by a spike of cream-white, fragrant fls., each fl. $1\frac{1}{2}'$ across. Single fl., Fig. 153, A. Panama. 2. *Angraecum*. Fl. spurred. Epiphytal on trees. Trop. Af. and its islands, W. Ind. *A. sesquipedale*, fl. dark crimson, more than 1° long, including its spur. Madagascar. Many leafless species. 3. *Oncidium*. Epiphytal. 200 species, tropical Am. Varied, but sepals always spreading. *O. Papilio*, BUTTERFLY ORCHID. Stemless; fls. single, richly colored, at the end of long stalks; resembling a butterfly. Trinidad, Venezuela. *O. altissimum*, fls. yellow, with brown spots; raceme 13° long. W. Ind. *O. corynèphorum*, fls. with crimson and white lip, on a twining scape 20° long. Peru. 4. *Brassia*. Many species, varied, but lateral sepals very long; fls. more or less yellow, racemed. Near *Oncidium*. Trop. Am. 5. *Cycnòches*, SWAN ORCHIS. Terrestrial; fls. swan-like. Several species, all with variable fls. Trop. Am. *C. ventricòsum*, fls. greenish white, racemed. Single fl., Fig. 153, A. 6. *Vanda*. Epiphytal; splendid genus, about 20 species. Trop. Asia. Lvs. often 2° long. Fls. large, elegantly colored, in erect or pendulous racemes. 7. *Comparètia*. Epiphytal; fine genus, 4 species, with pseudo-bulbs, coriaceous lvs., and graceful racemes of long-spurred fls., rose, purple, or scarlet. Trop. Am. *C. coccinea*, DANCING ORCHIS. See Lesson XXI., 238. 8. *Phalænòpsis amabilis*, INDIAN BUTTERFLY. Epiphyte, stemless. Fls. large, racemed on a long stalk; petals and sepals pure white; lip smaller, with 2 long, twisted tendrils, imitating antennæ; fls. resembling a flock of butterflies. Several other handsome species, all of Ind. Archipelago.

Tribe 7. Epidéndrææ.—Usually epiphytes. 1. *Epidéndrum*. 300 species, varied, but nearly all epiphytal, showy. Trop. Am. *E. nemorale*, fls. large, rose, in panicles; *E. vitellinum*, fls. deep orange color; both Mexican. *E. conòpseum*, small, with racemed greenish-purple fls.; epiphytal on Magnolia. S. Car., S. and W. 2. *Cattlèya*, epiphytal. Many fine species, Centr. Am., Brazil, on trees, rocks. Fls. 6' across, rose, sometimes yellow, two or more in the axil of 2 fleshy lvs. from a pseudo-bulb. *C. Schilleriana*, fls. yellow, with crimson spots. 3. *Laèlia*, close to *Cattlèya*; epiphytal; fls. showy, few or many on scapes. Several species, Brazil, Mex.

Tribe 8. Malaxidææ.—Epiphytes, rarely terrestr. 1. *Corallorhiza*, rhiz. branched, coral-like. Leafless, brown. Sepals and petals nearly equal. Spur short. On roots of trees. Few species. N. Am., Eur., N. Asia. *C. odontorhiza*, fls. in a spike; small, brown-green, lip white. Can., to Car. and Ky. 4 others in U. S. 2. *Aplèctrum hyemale*, only species, PUTTY-ROOT, ADAM AND EVE. Tubers with a putty-like mucilage. Terrestrial. Scape and dull fls. in summer;

large oval plaited lvs. in winter. Rich woods, Alleghenies, N. 3. **Bolbophyllum**. 100 species, tropics of both worlds. Small, on trees or overrunning the ground among mosses; fls. resemble *Dendrobium*; but usually small; in racemes, heads, or spikes. **B. saltatorium**, DANCING ORCHID; fls. racemed. See Lesson XXI., 238. 4. **Dendrobium**. Epiphytal. 200 species, 80 cultivated for their beauty. Varied in size and habit. Flower as in *Bolbophyllum*; lip fringed or crimped; often so transformed as to look like a ballet-dancer. Fls. often large, variously colored; sol., or in racemes or clusters; often fragrant. 5. **Liparis**. Species about equally terrestrial or epiphytal; one or two in N. Am., Eur., the majority in Ind., Java. Fls. small; with free lateral sepals and entire lip. *L. liliifolia*, 2-leaved; scape 6' high, with about 20 purple-lipped fls. in a raceme. Damp woods, Can. to Car., W. to Wis. *L. Læselii*, yellow. Moist fields, Can., N. Eng., to Penn. and Wis. 6. **Malaxis paludosa**, only species, near *Liparis*, but different in pollen-masses. Small, bulb epigeal from a rhizome; lvs. 3 or 4; fls. small, greenish yellow, racemed. Bogs, N. Eur., N. Asia. 7. **Masdevallia**. Epiphytal, small. Rhiz. creeping, lvs. broad. Fls. sol. on radical stalks; sepals connate into a tube, their apices drawn out into long tails; petals free, minute, concealed, with the lip, within the sepal-tube. Fls. of rich and varied colors, large, handsome. S. Am.

Ginger Alliance.—Fls. ♂, very irreg. (reg. in *Bromeliaceæ*). Perianth of 5-6, rarely 3, segments. Stamens 6; 1-5 antheriferous (all antheriferous in *Bromeliaceæ*), the rest petaloid. Ova. usually 3-celled (often free in *Bromeliaceæ*). Fr. a berry or capsule. Perisperm floury. Emb. distinct. 39. *Bromeliaceæ*. 40. *Scitamineæ*.

Ord. 39. Bromeliaceæ. PINAS.—Fls. ♂, reg., or nearly so. Perianth 6-partite, 2-seriate, inner series petaloid. Stamens 6, perfect; free or connate; more or less adh. to perianth. Ova. adh., semi-adh., or often free. Stigmas 3, various in form, sometimes petaloid. Fr. a berry or caps.; sds. ∞. Emb. extruded; straight or hooked. Woody, perennial *Plants*, usually stemless, with rhizome; usually epiphytes. Lvs. sheathing, stiff, channelled, often dentate or spiny; lf.-fibre made into twine, or manufactured into cloth. Fls. showy, each with a scarious or colored bract (except *Æchmæa*), spiked, racemed, or paniced. 28 known genera; 176 species. Tropics of Am., distributed thence to Old World.

1. **Tillandsia**. Epiphytal on trees. Southern U. S., trop. Am., W. Ind. Ova. free. Fr. capsular; sds. plumose. Fls. bracteate, scattered; sepals spirally twisted; petals convolute into a tube below. Stems long or short. Lvs. scurfy, often with dilated base, holding pure water. Many species. *T. utriculata*. Stem 2°-3° high. Lvs. dilated, holding water; fls. with pale blue petals. Texas, tropical Am., W. Ind. *T. usneoides*, TREE-BEARD, LONG-MOSS, SPANISH MOSS. Stem long, branching, filiform; used for mattresses; lvs. linear; petals green, recurved. S. States, trop. Am., W. Ind. 2. **Guzmânia**. Ova., fls., fr., sd., as in *Tillandsia*, but petals quite rolled into a tube, and anthers connivent into a tube. Sev. spec.; trop. Am. Stemless. *G. tricolor*, lvs. dark green, with transverse brown bands underneath. Fls. bracteate, concealed by the scarlet bracts, in a flat, spatula-like spike. 3. **Æchmæa**. Ova. adh. Fr. a berry. Usually epiphytal on trees in dense forests, trop. Am. Sev. spec. Stemless. Lvs. ensiform or ligulate. Fls.

ebracteate; scape spicate-panicled with ∞ fls. *Æ. discolor*, lvs. purple underneath. Panicle scarlet-stemmed, longer than lvs.; fls. with calyx coral-red; petals purple, twisted. 4. *Billbergia*. Ova. adh. Fr. a berry. Epiphytal on trees, trop. Am. Sev. spec. Lvs. harsh, rigid. Fls. elegant, bluish-red or yellow, in light panicles, fragrant. Plants hung on balconies, etc., in trop. gardens. 5. *Bromélia*. Ova. adh. Fr. succulent, often with refreshing juice. Many spec. Trop. Am. Stem short, with densely-packed, rigid, spiny, channelled lvs. Fls. spicate; petals convolute, erect, or spreading. Sev. spec. with very handsome fls. *B. pigna*, lvs. furnish the fine fibre of which *Pena* or *Pineapple muslin* is made. Philippine Islands. *B. Pinguin* (*Penguin*) is planted as a hedge in W. Ind.; its fruit used in fevers; its lf.-fibre made into hammocks. 6. *Ananássa*. Ova. adh. Fr. succulent. Plant biennial. Lvs. aloe-like, but thinner; spiny. Fls. bracteate, spicate on a short stem; spike ending in a crown of small spiny lvs. *A. sativa*, PINEAPPLE. Fr. consisting of the whole inflorescence. See Lesson XXVIII., 358, Fig. 212. Lvs. furnish a fine valuable fibre. Brazil.

Ord. 40. *Scitamineæ*. PLEASANT-MEATS.—Fls. ♂, very irreg. Perianth 6-partite. Stamens 6; 1 or 5 antheriferous, the rest petaloid. Ova. adh., 3-celled (rarely 1-2-celled). Fr. a capsule, fleshy or dry, indehiscent or dehiscent. Emb. straight or bent; perforating the perisperm. Lvs. (usually large) with distinct petiole and blade; blade with parallel veins running from midrib to margin. 3 Sub-Orders: 1. *Musáceæ*; 2. *Zingiberáceæ*; 3. *Cannáceæ*.

Sub-Ord. 1. *Musáceæ*. BANANAS.—Perianth 2-seriate; outer anterior segment usually very large, often carinate. Stamens 5, anthers 2-celled, connective appendaged; 1 staminode petaloid. Fr. 3-celled, fleshy. Sds. umbilicate, numerous, except in *Helicônia*. Emb. straight. *Herbs*, often gigantic. Rhizome sending up shoots which form spurious stems enveloped by persistent bases of petioles. Lvs. alt., usually very large. Fls. colored, in the axil of a colored spatha. 5 gen.; about 20 species. Tropics, both worlds.

1. *Ravenala madagascariensis* (*Urania speciosa*), TRAVELLER'S TREE. Palm-like stem built up of the sheaths of petioles; lvs. immense, diverging on opposite sides of the upper part of the stem, and storing up quantities of delicious water in their cup-like sheaths. Fls. closely crowded in the axils of large spathas, which are 2-rowed on terminal flower-stalks. Fr. a woody capsule; sds. with a fine ultramarine blue aril. Madagascar. 2. *Phenacospérum*. Similar to *Ravenala*, but smaller; and sds. with a funiculus which breaks up into tow, concealing them. Trop. Am. 3. *Strelitzia*. Lvs. long-petioled, large, glaucous, from a contracted stem. Flower-stalk with a large oblique spatha, and gorgeous fls. Several fine species, Cape of Good Hope. *S. reginæ* has fls. with bright orange sepals and bright purple petals. *S. júncea* has rush-like petioles; the leaf-blades suppressed. 4. *Musa*. Herbaceous. Fls. grouped in the axils of large, richly-colored spathas, and borne on a large nodding spike. Lvs. large, oblong, their sheaths making a stem sometimes 30° high. Fr. a long, indehiscent, many-seeded, fleshy capsule; sds. often abortive through cultivation. Tropics of Old World, but transported to America before its discovery by Europeans. *M. paradisiaca*, PLANTAIN. Fig. 60. *M. sapientum*, BANANA. *M. textilis* furnishes MANILLA HEMP; Philippine Islands. Sev. other species, all useful. 5. *Helicônia*.

Resembling the others, but capsule dry, dehiscent, 3-seeded. *H. Mariæ Alexandrôvnæ*, resembles *Musa*; stem 20° high. Spikes flat, nodding, 2½° long; fls. red, with white bracts. N. Granada. Fibre of petioles useful. *H. psittacorum*, shoots edible. W. Ind.

Sub-Ord. 2. Zingiberææ. GINGERS.—Perianth double; calyx tubular, entire, or split like a spathe, 3-toothed or 3-fid. Corolla tubular, 3-partite, segments unequal, upper usually largest, cucullate. Stamines petaloid, forming a 2-lipped tube adnate to corolla tube. Stamens sol., on base of corolla tube, filament free, petaloid, often prolonged beyond the 2-celled anther, of which the cells are distant and marginal. Infl. spiked, racemed, or panicled. Ova. 3- (rarely 1-2-) celled, often surmounted with 1 or more stamines. Fr. a capsule. Sds. with perisperm and vitellus. Emb. with radicle protruded through vitellus and beyond albumen. Perennial *Herbs*, with creeping or tuberous rhiz., rarely fibrous rts. Stemless, or stem simple, enveloped by leaf-sheaths. Lvs. simple, blade flat, entire. More than 30 genera; many species, all valuable. Aromatic. Tropics, both worlds. Types only given here.

1. *Cúrcuma*. Fls. bracteate, spicate. Many Asiatic species; rts. furnish the medicine *Zédoary*. *C. lóngá*, rts. furnish *Turmeric*. E. Ind. 2. *Amómum*. Rhiz. jointed, creeping; lvs. lanceolate, 2-rowed. Fls. bracteate, in a spike or cluster, often showy. Fr. capsular; sds. aromatic. *A. Grána-Paradisi* (Guinea). Sds. are the *Grains of Paradise*. *A. Cardamómum* (E. Ind.). Sds. are *Cardamom sds.*, which are also furnished by several other species, all Asiatic. 3. *Zingiber*. Similar to *Amómum*, but inner lobes of corolla wanting. Several species, Old World. *Z. officinále*, rts. are the *Ginger* of commerce. Cultivated in all tropical countries. Fig. 151. 4. *Alpinia*, similar; several species, trop. Am., Ind. Archipel. *A. Galánga*, rts. are the *Galánga* of pharmacy, used for indigestion. *A. nútans*, stems tall, with lanceolate lvs. and terminal nodding spikes of lovely fls. 5. *Hedýchium*. Sev. spec. Trop. Asia. Rts. tuberous; stems with oblong lvs. and terminal spikes of bracteate large flowers, 6-partite, 5 segments narrow, the sixth large, notched, or divided; resembling the Butterfly Orchids, and called BUTTERFLY-LILIES. *H. coronárium*, GARLAND-FLOWER; stem 4°-5° high; fls. yellow. Other species, with white flowers, common in Southern gardens, and hardy as far north as Central Ky.

Sub-Order 3. Cannæææ. CANNAS.—Flower with 4 whorls: (1) *calyx*, 3-leaved; (2) *corolla* of 3 sub-equal divisions, tubular at base, colored; (3) *outer stamines* petaloid, inserted on corolla, interior one bilobed or ringent; (4) *inner stamines* petaloid, one labelliform, the other antheriferous, with a 1-celled anther. Style dilated, petaloid. Ova. adh.; 3-celled. Capsule 1-3-celled. Emb. straight or curved, with 2 chalazal canals crossing the perisperm. Perennial *Herbs*, with fibrous rts. or creeping rhizomes. Stem simple or branched. Lvs. petiolate, sheathing; blade plane, large, entire. 9 genera. Tropics, both worlds.

1. *Cánna*, INDIAN SHOT (from the black bullet-like sds.). Many fine species; fls. variously colored, spiked. *C. índica*, 5°-6° high, fls. red or yellow. *C. discolor*, 6°-10° high, fls. crimson, lvs. purple-tinged. *C. gláuca*. lvs. glaucous, stem 10°-15° high, fls. yellow or red, 4' long. *C. fláccida*, 2°-4° high, fls. 4' long, petals flaccid, yellow.

Swamps, S. Car., S. 2. *Caláthea* (stigma cup-shaped). Stem contracted; lvs. large, often variegated; fls. bracteate in terminal hds. or spikes. Trop. Am. *C. zebra*, ZEBRA-LEAF. Lvs. with alt. dark-colored and green stripes. Fls. in heads. Several other fine species. Trop. Am. 3. *Maránta*. Tubers fleshy, furnishing *Arrow-root*. Tropics, both worlds. Lvs. large. Fls. in panicles; bracts deciduous. Several species. *M. Allouya*, *M. nobilis*, *M. arundinácea*, W. Ind.; *M. ramosíssima*, E. Ind. 4. *Thália*. Lvs. stalked, with a powdery bloom like that of a plum. Fls. bracteate, in stalked panicles. Fr. a 1-seeded utricular capsule. Emb. hooked. Stemless herbs from fibrous rts. S. States, trop. Am. *T. dealbata*, lvs. distichous, long-petioled, cordate-ovate. Scape reed-like, with a spicate panicle of purple fls. Hardy; and very interesting on account of the lovely stellate cells composing horizontal partitions in air-canals of the leaf-stalk. Ponds and marshes, S. Car., Gulf States to Mex., thence to trop. Am.

SUB-CLASS II.—ÉXOGENS (DICOTYLÉDONS).

3 Divisions { 1. Apetalæ.
2. Monopetalæ.
3. Polypetalæ.

DIVISION I.—*Apetalæ*. 2 Subdivisions { 1. Ovary adh.
2. Ovary free.

Flowers achlamýdeous, or monochlamýdeous; rarely dichlamýdeous.

Subdivision I.—Ovary adherent when a perianth is present. Perianth more or less distinct.

Sandalwood Alliance (allied also to Olax).

Ovules usually reduced to a naked nucleus. Disk often apparent. Plants usually parasitic. 1. *Balanophoráceæ*. 2. *Santaláceæ* (sometimes dichlamýdeous). 3. *Lorantháceæ*.

Ord. 1. Balanophoráceæ.—Fls. ♂, ♀ ♂, rarely ♀ ♂ ♂, ♀; monochlamýd.; infl. spicate on a scape. Sta. 3-1-∞; free or monadelphous; anth. 1-2-∞-celled. Ova. adh., 1- rarely 2-celled; ov. sol. Fruit dry. Emb. minute, undivided. *Herbs*, fleshy, leafless, rhizomous, parasitic on roots of other plants. Intertropical, both worlds. 14 genera.

1. *Ombrophýtum*, MOUNTAIN MAIZE; springing up like Mushroom, after rain; edible. Peru. 2. *Balanophóra elongata*, waxy; used for candles, Java. 3. *Cynomorium coccinea*, MALTA MUSHROOM; edible. Mediterranean shores and islands.

Ord. 2 Santaláceæ. SANDALWOODS.—Fls. ♂, ♀ ♂ ♂ or ♀ ♂; monochlamýd., inconspicuous; infl. various. Perianth 5-4-3-lobed, isostémonous. Ova. adh. Ov. 2-3-5, pend., naked (without seed-coats) embryo-sac protruding from the nucleus, developing the embryo and perisperm outside the nucleus. Fr. a nut, rarely a berry. Sd. sol.; perisperm fleshy. *Herbs, Shrubs, or Trees*; often parasitic. Lvs. entire, exstip. 20 genera; 3 Tribes:

Tribe 1.—Fls. ♀ ♂, 4-merous; ♀ dichlamýd, sol.; ♂ clustered. Fr. a 1-seeded drupe. *Buckleya distichophylla*, only gen. and spec. Small tree or shrub; lvs. ovate-acuminate, fls. small. Mts. E. Tenn.

Tribe 2.—Monochlamýd. Ova. adh. at base only. 1. **Cervantèsia**. Trees or shrubs. Peru. Lvs. scattered. *C. tomentòsa*, sds. eaten as almonds.

Tribe 3.—Fls. ♂, rarely ♀ ♂; monochlamýd. Ova. adh. 1. **Sántalum** (Persian name), SANDALWOOD. Several spec., trees or shrubs, wood aromatic, used for fan-sticks, cabinet-work, etc. *S. álbum*, WHITE S. Ind., S. Pacif. Isles. *S. Freycinetiánum*, YELLOW S. Marquesas, Feejee Islands, Australia. 2. **Comándra**, BASTARD TOAD-FLAX. Fls. ♂, umbelled. Sta. 5, connected to perianth by tufts of hairs. Fr. nut-like. Lvs. pale, slender. *C. umbellàta*, small, suffruticose, parasitic on roots of trees. Rocky woods, U. S., Brit. Am. 3. **Pyrulària**. Fls. ♀ ♂, in spikes or racemes. Ova. half-adh. Fr. an oily, pear-shaped drupe. Trees or shrubs. *P. pùbera*, OIL-NUT. Straggling shrub, 4°-12° high. Alleghenies, Penn.

Ord. 3. Loranthææ. MISTLETOES.—Fls. diclinous or ♂, mono- or dichlamýd., isostémonous, 2-3-5-merous, usually small; infl. various. Anthers with porous, transverse, or longitudinal dehiscence. Ova. adh., usually crowned with an annular disk. Emb. (often several) axile or excentric; perisperm copious. Ov. reduced to the embryo-sac. Fr. a 1-seeded berry. Evergreen shrubs, parasitic; or terrestrial trees. Lvs. thick, coriaceous, simple, entire. 30 genera; 400 species. Cosmopolitan.

1. **Loránthus**. Dichlamýd. Dichotomous branching shrubs, usually parasitic. Fls. 4-8-merous. Fr. succulent. Tropical and subtropical; 300 species. *L. europæus*, on Oak, Chestnut; Eur. *L. longiflorus*, Ind.; *L. rotundifolius*, Brazil. 2. **Nuýtisia floribúnda**, FLAME-TREE, FIRE-TREE. Terrestrial tree, 25° high. Fls. dichlamýd., long, orange-colored, in large terminal racemes. Trunk exudes a gum resembling gum-arabic. S. W. Australia. 3. **Viscum**, MISTLETOE. Fls. ♂ or ♀ ♂, 4-merous. Monochlamýd.; anthers many-pored. Fr. a viscous berry, furnishing the Birdlime of commerce. Parasitic shrubs. *V. álbum*, CLASSICAL MISTLETOE; lvs. olive-green, berries white, shining. Parasitic on various trees; frequently on the Apple, rarely on the Oak. When found on either of these trees, it was held sacred by the Druids. Native to Europe. Plant, fls., Fig. 65; young cells, Fig. 217, B, C. 4. **Phoradéndron**. Fls. ♀ ♂ or ♂; monochlamýd., 3-merous; immersed in catkin-like spikes. Parasitic shrubs. Lvs. and stems yellowish-green. Many species; American, from U. S. to Brazil. *P. flavescens*, AMERICAN MISTLETOE. Berries white, viscous. On various trees. N. J. to Ill., and S. 5. **Mysodéndron** (an allied genus, connected also with Santalææ) ♀ ♂. ♂ achlamýd., ♀ monochlamýd.; infl. clustered. Fr. 1-celled, 1-seeded, 3-gonous, dry, with 3 longitudinal slits; from each slit a long plumose bristle protrudes, and twines around the stem, to which the seed is wafted, thus serving the function of the viscid berries of other genera. Whole plant bright yellow. Shrubs parasitic, especially on Beeches. Antarctic Am., Terra del Fuègo.

Oak Alliance.—Fr. 1-seeded. Perisperm 0. Cotyledons usually fleshy, folded or sinuous. Trees or shrubs. 4. **Cupuliferæ**. 5. **Juglandææ**.

Ord. 4. Cupuliferæ. CUPULE-BEARERS.—Fls. ♂, monochlamýd. Fr. a nut. Lvs. simple, alt., decid., or persistent. 9 genera; 280 species. Trees or shrubs. Cosmop. 1. **Carpinus**, HORNBEAM, IRON-

WOOD. Wood hard, valuable. Lvs. dentate, decid. Nut small; cupule leafy. Many species. *C. americana*, 10°-20° high. U. S. *C. Bétula*, HORNBEAM, 30°-70° high. Eur. 2. *Óstrya*, HOP HORNBEAM. Ripe catkin hop-like. 2 species, both trees, 30°-50° high, with doubly-serrate lvs.; *O. vulgaris*, S. Eur.; *O. virginica*, U. S. 3. *Corylus*. Shrubs. Cupule leaf-like; nut large, edible. *C. Avellana*, FILBERT, Eur., Asia. *C. americana*, HAZEL-NUT; *C. rostrata*, similar, cupule bristly; both American, U. S. 4. *Fagus*, BEECH. Cupule spiny; nuts triangular, edible. Lvs. dentate. Species few. *F. sylvatica*, fine tree, Eur., W. Asia; varieties: COPPER B., PURPLE B., lvs. colored; FERN-LEAVED B, lvs. pinnatisect. *F. ferruginea*, AMERICAN B., 50°-80° high U. S., Can 5. *Castanea*, CHESTNUT. Cupule prickly, with 2-3 large, edible nuts. Lvs. long, serrate. *C. vesca*, splendid tree, native of Asia, naturalized throughout Eur. for 2000 years; wood valuable; nuts large, edible; var *americana*, large tree, nuts smaller. Can. to Fla. *C. pumila*, CHINQUAPIN. Shrub; nut still smaller, sol. S. and E.

6. *Quercus*, OAK. Fls. and fr. described, Lesson XI. Numerous species. Northern hemisphere, Java, mts. of Mexico and S. Am. Fruit produced annually or biennially. Three great types: *Q. rubra*, *Q. Robur*, *Q. Cerris*.

A. Biennial fructification; American.

Quercus rubra, RED OAK. 70° high. Lvs. sinuate-pinnatifid. Cupule much shorter than the oblong nut. U. S. *Q. coccinea*, SCARLET OAK. 80° high. Lvs. pinnatifid, turning red in autumn. Cupule half covering the round nut. Var. *tinctoria*, Quercitron, bark used in tanning, dyeing. U. S. *Q. falcata*, SPANISH OAK. 60°-80° high. Lvs. falcate, 3-5-lobed. N. J., S., W. to Ill. *Q. nigra*, BLACK-JACK. 10°-25° high. Lvs large, 3-lobed. Barrens, U. S. *Q. imbricaria*, SHINGLE-OAK. 50° high, lvs. lance-oblong. Penn. to Ga., W. *Q. Phellos*, WILLOW-OAK, 30°-60° high. Lvs. linear-lanceolate. N. Y., S. *Q. laurifolia*, LAUREL-OAK. 30°-50° high. Lvs. oblanceolate, green, shining, persistent. S. Car., Fla. *Q. virens*, LIVE-OAK. 20°-50°-70° high. Lvs. small, oblong, entire (rarely spiny-dentate), evergreen. Wood valuable. Maritime regions, S. *Q. cinerea*, similar to last, but downier; small tree or shrub. S. E. Va., S. Several other species, of little worth.

B. Biennial-fruited; foreign.

Q. Süber, CORK-OAK. 30°-60° high. Lvs. ovate-oblong, entire or sharply serrate, evergreen. Acorns oblong, sweet. Outer bark is the cork of commerce. Hills, Spain (especially in Valencia and Catalonia), S France, Italy, N. Af. Tree, Frontispiece, E; section of trunk with bark, Fig. 229. *Q. coccifera*, KERMES-OAK (Ar. *kermes*, red worm; whence Gr. *kermesin*, Fr. *cramoisi*, crimson). Low bushy shrub. Lvs. elliptic, spiny-dentate, evergreen. Specific name *coccifera*, from the red berry-like clusters of the parasitic female insect *Coccus ilicis*, which literally becomes a part of it, furnishing a splendid crimson dye. S. Eur., Levant. *Q. Ilex*, ILEX-OAK, HOLM-OAK. Bush or tree, 30°-50° high. Lvs. oval, evergreen, large, entire or serrate, or spiny-dentate, resembling the true Ilex (Holly). Mediterranean States, Cochin China.

C. Annual-fruited; Am. and foreign.

Q. confertifolia, MEXICAN OAK. 30° high. Lvs. lanceolate, evergreen. Handsome mountain-tree. S. Arizona, San Francisco mts.

Q. Prinus, CHESTNUT-OAK. 60°-90° high. Lvs. long-petioled, obovate, dentate, decid.; acorns large, sweet. U. S., but not in N. Eng.

Several varieties. *Q. bicolor*. 60°-70° high. Lvs. similar to last; cupule fringed at margin. Swamps, U. S. *Q. lyrata*. 50°-80° high.

Lvs. lyrate. Cupule rough. N. C., S., W. *Q. macrocarpa*, BUR-OAK. 60°-70° high. Lvs. lyrate-pinnatifid. Cupule large, woody,

bur-like, border fringed. N. Eng. to Ill., S. *Q. obtusiloba*, POST-OAK. 40°-50° high, branching low. Lvs. deeply lobed. Cupule

naked, nut sweet. Mid., W., and S. States. Timber valuable, white. *Q. alba*, WHITE-OAK. 70°-80° high. Lvs. oblong, sinuate-pinnatifid. Wood white, valuable. Nut edible. U. S., Can.

Quercus Robur, BRITISH OAK, EUROPEAN OAK. 80°-180° high, with spreading branches, which sometimes cover a half-acre. Lvs.

lobed and serrate. Cupule without bristles. Nut edible. Two varieties: *pedunculata*, COMMON OAK. Cupules peduncled, wood light

in color; *sessiliflora*, DURMAST, cupules sessile; wood darker and heavier. Both furnish renowned timber; sometimes stained green by

the growth of a fungus (*Peziza æruginosa*), and then highly prized for cabinet-work. ♀ fl., Fig. 66. Eur. *Quercus Cærris*, TURKEY-OAK,

MOSSY CUP O. 60°-90° high. Lvs. evergreen or subevergreen. Cupule mossy. Fructification biennial or annual. Wood valuable.

Asia Minor; naturalized in Eur. Many fine varieties. *Q. Skinneri*,

GUATEMALA OAK, has an acorn with lobed and wrinkled cotyledons, resembling those of the Walnut (*Juglans*).

Ord. 5. Juglandaceæ. WALNUTS.—Fls. ♂, monochlamyd. Described, with the fr., Lessons XI. and XXVIII. Lvs. pinnate, alt.

Trees or Shrubs. 5 genera; 30 species:

1. *Platycarya* (FORTUNAËA) *sinensis*, only spec.; a bush resembling Sumach; nuts small, 2-winged, sol. in the axils of overlapping, hard-pointed bracts, which form an erect cone. N. China, Japan.

2. *Engelhardtia*, magnificent trees resembling Walnut. Nuts as small as a pea, seated singly on the base of a 3-lobed, colored bract,

thus forming drooping catkins more than 1° long. 10 species, Ind., Java, Philippine Islands. Wood valuable. *E. spicata*. 180°-230°

high, trunk large in proportion. Java. 3. *Pterocarya*. Trees; drupe small, 2-winged, indehisc. Several spec.; Caucasus, China, Japan.

4. *Carya*, HICKORY. Epicarp 4-valved, falling off at maturity. Wood fragrant and valuable. *C. porcina*, PIG-NUT HICKORY. 70°-80° high. Nuts small, astringent. Common, U. S. *C. amara*, BIT-

TER-NUT H. 70°-80° high. Nuts small, bitter. N., U. S. *C. tomentosa*. 40°-60° high. Nut edible; very thick endocarp. N.

Eng. to Va. and Ky., S. *C. sulcata*. 40°-80° high. Nut edible, endocarp thick. Penn. to Ga., W. *C. microcarpa*. 60°-80° high.

Nut small, edible, endocarp thin. Penn. to Ky. and Tenn. *C. alba*, WHITE HICKORY, SHELL-BARK H. 80°-90° high, slender; wood valuable. Nuts white, delicious; endocarp thin. Maine to Wis., S.

to Ga. *C. olivæformis*, PECAN (Pa-cahn) or PECANA. 80°-90° high. Nuts oblong, endocarp thin. River-bottoms, Ill. to La., W. 5. *Jug-*

lans, WALNUT. Epicarp fleshy-fibrous, indehiscent; endocarp fur-

rowed. *J. nigra*, BLACK WALNUT. 70°-90° high. Nut large, delicious. Wood valuable, deep violet color. Mid. States, W. and S. *J. cinerea*, BUTTERNUT. 40°-50° high. Nut oblong, sweet. Wood red, valuable. Can. to Ga., W. *J. regia*, ROYAL (called ENGLISH) WALNUT. 60°-80° high. Nut large, oblong, delicious; endocarp thin, with few furrows. Native of Persia, but naturalized throughout Eur. Sacred to Diana; the Jove's Nut of the Romans, BASÍLICON (royal) nut of the Greeks. Branch with lvs., fls., fr., Fig. 67.

Aristolòchia Alliance.—6. **Rafflesiaceæ.** 7. **Aristolochiaceæ.** Emb. undivided, or cotyledons minute. Perisperm 0 or present.

Ord. 6. Rafflesiaceæ.—Fls. ♀ ♂ or ♀, mono- or dichlamýd., 3-4-5-merous. Sta. ∞. Ova. 1-celled; ov. ∞. Emb. undivided. Fr. indehisc., dry or fleshy. Parasites, often nothing but a fl. and rts.; with scent of tainted meat. In both worlds. 4 Tribes; types given here:

Tribe 1. Apodánthes. Fr. a berry; perisperm 0. Sev. spec., small, parasitic on stems of Leguminosæ—Inga, etc. Guiana. **Tribe 2. Cýtinus.** Fr. a berry, on roots. Mediterranean region, Am., S. Af. **Tribe 3. Hydнора, JACKAL'S KOST.** Fr. fleshy. Roots of Euphorbia. S. Af. Eaten by natives. **Tribe 4. Rafflesia.** ♀ ♂, large, 5-merous. Described, Lesson XI. Fr. fleshy. 3 or 4 species, on rts. of Vines. Ind. Archipel. *R. Arnóldi*, in Sumatra. Fig. 68. Called by natives AMBUN-AMBUN—WONDER-WONDER.

Ord. 7. Aristolochiaceæ.—Fls. ♀, monochlamýd.; perianth usually large, colored. Infl. various. Sta. gynand. Ova. 6-4-celled, fr. a boll or a berry, ∞-seeded. Perisperm copious. Herbaceous plants; rhizomous, or shrubs. Lvs. simple, various in form. 3 Tribes; types given:

Tribe 1. Boll oblong or globose, 6-valved. **Aristolòchia.** Shrubs, usually climbing. Lvs. usually cordate; fls. large, tubular, often handsome. Many fine species, usually tropical, both worlds. *A. Serpentaria*, SNAKEROOT, low erect herb. Fl. purple, twice bent. Penn. to Ill. and La. Fig. 186. *A. Sipo*, DUTCHMAN'S PIPE. Shrubby twiner, climbing to a height of 40°. Fl. sol., brown, like a tobacco-pipe; lvs. large, ornamental. Penn. Ky., S. *A. grandiflora*, twiner, fl. immense, limb spreading, mottled, tailed. W. Ind. *A. cordata*, fls. 4° in circumference, playfully worn as bonnets by children. N. Granàda. **Tribe 2.** Boll siliquose, 4-valved. **Bragantia.** Perianth limb 3-cleft. Undershrubs, rts. bitter, medicinal. Sev. spec., trop. Asia. **Tribe 3.** Boll 6-valved, fleshy. Perianth 3-cleft, purplish. Lvs. reniform. Herbs, with perenn. rhiz. **Asarum.** Sev. spec. Eu., Asia, N. Am. *A. europæum*, ASARABÁCCA. N. Eur., Eng. *A. canadense*, WILD GINGER. Can. to Ga., W. Sd., Fig. 195. *A. virginicum*, Mts., Va. to Ky., Ga. *A. arifolium*, Va. to Fla. and La.

Subdivision II.—Ova. free, rarely adh. Perianth usually distinct.

Nepénthes Alliance.—8. **Nepenthaceæ.** Characters of Order.

Ord. 8. Nepenthaceæ.*—♀ ♂, monochlamýd. 4-merous. Infl. racemose. Sta. monadelphous. Ova. free. Ov. ∞. Boll 4-celled, 4-valved. Suffrutescent plants. Stem prostrate or sarmentose. Lf. transformed into a pitcher, described Lesson XVI. Only genus, **Nepénthes**, PITCHER PLANT. 20 spec. Insectivorous. Borneo, Sumatra, adjacent islands of Ind. Arch., China, Ceylon, Madagascar. *N. distillatoria*, Ceylon. Fig. 113. *N. Edwardsiana*, pitchers 18' long, elegantly colored. Singapore, Malacca, Sumatra, Borneo.

Pepper Alliance.—Ova. free, usually 1-celled, 1-ovuled. Perianth rudimentary or 0. Infl. spicate or racemose. 9. **Ceratophyllacæ**, 10. **Chloranthacæ**. 11. **Saururacæ**. 12. **Piperacæ**.

Ord. 9. Ceratophyllacæ. HORNWORTS.—Fls. ♂, achlamýd.; involucrate. Sta. ∞. Anthers buried in a cellular mass, rupturing irregularly. Fr. a nut. Perisperm 0. *Plumule green, polyphyllous*, equaling the cotyledons. Only gen. *Ceratophyllum*. Aquatic, submerged, branched *Herbs*; stem jointed; lvs. whorled, dissected. Few species, stagnant water. Eu., Asia, N. Am. *C. demersum*, N. Y. to Va., W. to Ill.

Ord. 10. Chloranthacæ.—Fls. ♂ or diclinous, achlamýd. Ova. 1-celled. Fr. a drupe, fleshy. Emb. minute. Perisperm copious. Small evergreen *Trees* or *Undershrubs*, rarely *Herbs*; aromatic; lvs. simple, dentate, rarely entire. Sev. gen., chiefly tropical. 1. *Hedyósmum*, resinous shrubs. Trop. Am., Brazil. 2. *Chloranthus*, fragrant shrubs. *C. officinális*, Java. *C. inconspicuus*, CHU-LAN; fls. used to perfume tea. China.

Ord. 11. Saururacæ.—Fls. ♂, achlamýd. Sta. 3-6. Ova. free, or sometimes *adh.*, 3-5-celled, or 1-celled, with parietal placentation. Perisperm mealy or horny. Emb. in the vitellus. Fr. follicular, or baccate. Aquatic or land *Herbs*. Stem jointed-knotted; lvs. entire, usually cordate; 5 gen.—reducible perhaps to 2—both worlds. 1. *Houttuýnia*. Fl. spicate. *H. cordáta*, curious and handsome. Cochin China. Other species in Japan, trop. Asia. 2. *Saururus*, LIZARD-TAIL; terminal spike of small white-stamened fls. Marshes. *S. cernuus*, U. S. and Can.

Ord. 12. Piperacæ. PEPPERS.—Fls. ♂ or ♂ ♀, achlamýd., in simple or fascicled spadices, with or without bracts. Sta. 2-3-6-∞. Ova. 1-celled, 1-ovuled. Berry dry or fleshy. Perisperm fleshy. Emb. minute, in the vitellus. Annual or perennial *Herbs* or *Shrubs*, aromatic, usually succulent; stems sometimes climbing. Lvs. simple, entire, opp. or whorled. 20 gen., 600 spec., hot regions, both worlds.

1. *Cubèba*. ♂ ♀. Shrubs, usually climbing. Fruit appearing stalked, from the withering of its lower part. *C. officinális*, berries the CUBEBS of pharmacy. Java. 2. *Peperómia*. An extensive genus; species varied; some handsome foliage-plants. Cent. and S. Am., Sandwich Islands, S. Af., E. Ind. 3. *Chavica*. Shrubs. Fls. diclinous. *C. Roxbúrghii*, *C. officinàrum*, unripe spikes of fls., dried, are the LONG-PEPPER of commerce; *C. Bètlè*, BETEL PEPPER. Climbing shrub. Lvs. wrapped about slices of the *Areca* nut and chewed. (See *Arèca*.) Equatorial Asia. 4. *Piper* (old Hindoo name), PEPPER. Fls. ♂ or diclinous by arrest; many species, usually climbing shrubs. Ind. Arch., Sandwich Islands. *P. nigrum*, climbing 20°-30°; ripe berries red, black when dry, and called PEPPERCORNS; they are the BLACK PEPPER of shops. Stripped of the outer skin they become WHITE PEPPER. Cultivated in both tropics.

Euphórbia Alliance.—Fls. ♂ or diclinous. Mono- or achlamýd., rarely dichlamýd. Infl. various. Ova. free, 2-∞-celled. Disk developed or 0. Fr. usually caps., 1-∞-celled. Perisperm present, various. 13. **Lacistemacæ**. 14. **Geissolomacæ**. 15. **Penacæ**. 16. **Euphorbiacæ**.

Ord. 13. Lacistemacæ.—Fls. ♀ ♂ or ♂. Perianth 4-parted, minute. Infl. spicate. Sta. 1. Ova. 1-celled. Drupe with 3-valved

endocarp, 3-seeded. *Shrubs* or *Trees*. Lvs. simple, alt., persistent. 2 gen., both trop. Am. 1. *Synzyganthéra*. Fls. ♂. Shrub. 2 species. 2. *Lacistema*. Fls. ♀ ♂. Trees or shrubs, few species.

Ord. 14. Geissolomacææ.—Consisting of a single genus and species, *Geissoloma marginata*, a shrub with red monochlamydeous fls. surrounded by bracts; perianth-segments 4, stamens 8. Close to *Penæacææ* (which see). Mts. S. W. Af.

Ord. 15. Penæacææ.—Fls. ♀. Monochlamydeous. Perianth colored, 4-lobed, isostemonous, accrescent. Ova. free, 4-celled, 4-valved. Boll 4-valved. Heath-like evergreen *Shrubs*, S. Af. 2 Tribes; types given: **Tribe 1.** Ov. 4 in each cell, 2 ascending, 2 pend. 1. *Endonema*. **Tribe 2.** Ov. 2 in each cell, erect. 1. *Penæa*; 2. *Sarcocolla squamosa* (*Penæa Sarcocolla*) yields the resin SARCOCOL of pharmacy. Fls. clustered in the axils of large colored bracts, which yield the resin.

Ord. 16. Euphorbiacææ.—Fls. diclinous, mono- rarely dichlamydeous, or achlamydeous. Infl. various. Ova. free, 3-1-∞-celled. Fr. (boll) of 3 cocci, rarely a berry. Perisperm present, fleshy. Emb. axillary. Large or small *Trees*, *Undershrubs*, or *Herbs*, of very various habits, with milky acrid or watery juice. 230 known gen.; 2600 species. 11 Tribes:

Tribe 1. Buxinææ.—Fls. ♂. Ovarian cells geminate-ovuled. Involucre 0. ♂ tetrandrous. 5 gen. 1. *Buxus*, Box. Shrubs or small trees; lvs. evergreen. Fls. in axillary clusters, 1 ♀ at top of each cluster. Sev. spec., Eur., Asia. *B. sempervirens*, COMMON B., 20°-30° high; wood valuable; dwarfed for gardens. *B. balearica*, 60°-80° high; lvs. larger, paler; wood coarser. Medit. Islands, Asia Minor. 2. *Simmondsia* (*Bröchia*) *californica*, evergreen bush; ♂ fls. clustered, ♀ sol.; fr. size of an acorn, edible. Cal.

Tribe 2.—Ovarian cells 1-ovuled. Fls. involucrete; involucre 2-sexual, flower-like. Infl. cymose. ♂ fl. monandrous. Several gen.

1. *Euphorbia*. Fls. described, Lesson XX. Very many species, various in appearance and habit, except as to the fls. 30 species are mere weeds in U. S. *E. corollata*, ☿ herb, 2°-3° high; involucre white. Fig. 146. Can., U. S. *E. marginata*, ☉ herb, 1°-3° high. Involucre white; lvs. white-margined. Western U. S. *E. fulgens*, shrub, involucre bright red. Mex. *E. splendens*, shrub, stems covered with frightful prickles; bracts large, red, like 2 petals below the cup-like involucre. Mauritius. *E. (Poinsettia) pulcherrima*, thornless shrub; lvs. next below the fls. bright red, showy. Mexico. *E. phosphorea*, milky juice phosphorescent. Brazil. See Lesson XXXII. *E. grandidentis*, stem fleshy, leafless, like a tree-cactus. S. Af. *E. canariensis*, similar, small. Canaries.

Tribe 3.—Like last, but ♂ fl. polyandrous. Only genus *Dalechampia*. Stem twining or scrambling to a great height. Involucre 2-leaved, colored, showy. Tropics, both worlds.

Tribe 4.—Ovarian cells 1-ovuled. Involucre 1-sexual. 16 subtribes, many gen. and spec. Types only given here.

1. *Hura crepitans* (only species), SAND-BOX TREE, MONKEY'S DINNER-BELL. 30°-40° high; lvs. resembling those of Poplar. Fls. ♀ ♂. Boll many-celled, flattened vertically, grooved, as large as an orange, hard-shelled, exploding when ripe with a noise like a pistol-shot. Dried and emptied before ripening, it makes an elegant sand-box.

Trop. Am. **2. *Stillingia sebifera***, TALLOW TREE. 30°-40° high. Lvs. entire, oblong. Sds. white, yielding a fine wax. China. Naturalized in S. C. **S. *ligustrina***, shrub, N. C., S. **3. *Hippomane mancinella***, MANCHINEEL. Tree 40°-50° high. Lvs. shining green. Fls. ♂, spicate. Fr. a yellow berry; juice of any part of the tree or fr. deadly poisonous. W. Ind., Venezuela, Panama. **4. *Codiaeum***. Fls. ♂, ♂ polyandrous. Shrubs with beautifully painted leaves. Several species. **C. *pictum***, Moluccas; used for hedges. **5. *Jatropha***. Fls. ♂, monochlamyd., calyx white, showy. Infl. cymose. Boll 3-celled; covered with stings. **J. *stimulosa***, BULL-NETTLE, TREAD-SOFTLY. ♀ herb; lvs. large, palmate-lobed, with lacerated segments, spreading in a crown, in the centre a large showy cyme of white fls. Handsome plant, but beset with stings. Sands, shores of Gulf of Mexico. **6. *Manihot***. Fls. ♂, paniculate. Shrubs with fleshy tuberous roots. Many species, all American; two of which furnish the MANDIAC OF CASSAVA of commerce: **M. *utilissima***, BITTER CASSAVA; rts. bitter, but made wholesome by preparation; and **M. *Aipi***, SWEET CASSAVA; rts. wholesome from the first. Trop. Am.

Tribe 5.—Ovarian cells 1-ovuled. **1. *Ricinus***. Fls. ♂, monochlamyd., in paniced clusters, ♀ above. Sta. polyadelphous. Boll large, prickly, 3-seeded; sds. bug-like. Lvs. large, 7-lobed. **R. *communis***, CASTOR-OIL PLANT, PÁLMA CRÍSTI. Tree, or herb, according to climate (see Lesson XV.); 15°-20° high, and perennial in trop. countries, annual in cold climates. Sds. furnish the castor-oil of pharmacy. Ova., Fig. 195, C; boll, Fig. 203, A. **2. *Acalypha***, THREE-SEEDED MERCURY. Fls. ♂, spicate; ♂ above, or on a separate spike. 100 species, chiefly S. Am. Trees, shrubs, herbs; lvs. nettle-like. **A. *rùbra***, the beautiful little STRINGWOOD TREE of St. Helena, has lately become extinct; its sterile string-like spikes of red fls. were a foot long. Other and similar species in both worlds. **A. *virginica***, **A. *caroliniana***, Southern weeds. **3. *Tragia***. Fls. ♂, racemose. Lvs. serrate or lobed. ♀ herbs or undershrubs, sometimes climbing. **T. *macrocarpa***, ***urticæfolia***, ***urens***, are Southern weeds. **4. *Cælebogyne***, VIRGIN PLANT. Described, Lesson XXV. **C. *ilicifolia***. Fls. ♀ ♂, monochlamyd. Shrub resembling Holly. ♂ fls. spicate, with 4 to 8 stamens. ♀ fls. in cymes. N. Holl. **4. *Siphonia*** (**Hèvea**). Fls. ♂, monochlamyd., paniced, ♀ above. Lvs. ternate. Trees from 25°-100° high. 6 species, S. Am. **S. *elastica***, French Guiana; **S. *brasiliensis***, **S. *lutea***, **S. *brevifolia***, the three last 100° high; milk is the Caoutchouc or INDIA RUBBER of commerce. Para, Amazon.

Tribe 6.—Ovarian cells 1-ovuled. **1. *Cròton***. Fls. ♂, 5-merous; ♂ dichlamyd., ♀ monochlamyd. Fr. 3-coccus. Many species, herbs or trees. **C. *Tigium***, a tree; sds. yield CROTON OIL. Ind. Arch.

Tribe 7.—Ovarian cell 2-ovuled. ♂ calyx valvate. **Bridèlia**.

Tribe 8.—Ovarian cell 2-ovuled. ♂ calyx quincuncial. **1. *Aporosa*** (**Scèpa**). Fls. ♂ ♀. Monochlamyd., in catkins. 12 species, trees or bushes, Ind., Java. **Aporosa** (or **Scèpa**, or **Lepidostachys**) **Roxburghii**, KOKRA TREE, wood valuable. **2. *Phyllanthus*** (**Xylophylla**). Fls. ♂, monochlamyd., clustered. Many species, herbs or trees, hot regions, both worlds. **P. (*Xylophylla*) *montana***, ***latifolia***, are curious from the leafless stems which are expanded into leafy shapes, with the fl. clusters on their margins. W. Ind.

Tribe 9.—Ovarian cell 1-ovuled. ♂ calyx valvate. **Monotáxis.** Fls. ♂, cymose, ♀ in centre, dichlamýd.; ♂ monoclamýd. Shrubs, heath-like. Australia.

Tribe 10.—Ovarian cell 1-ovuled. ♂ calyx quincuncial. **Ricinocarpus.** Fls. ♂, dichlamýd., sol., 8 species, similar in habit, all Australian, Rosemary-like bushes.

Tribe 11.—Ovarian cell 2-ovuled. ♂ calyx quincuncial. **Poranthéra.** Fls. ♂, 5-merous, dichlamýd., clustered, involucrate. Sta. quadrilocular, dehiscence porous. Heath-like shrubs. Australia. *P. ericifolia*, sta., Fig. 168, B. Allied genus: *Oldfieldia africana*, **AFRICAN TEAK TREE**; wood valuable.

Ament Alliance.—Fls. ♀ ♂ or ♂, mono- or achlamýd. in catkins or cone-like hds. Ova. free, 1-2-celled. Perisperm 0 (except in *Platanus*). Trees or shrubs.

17. **Salicáceæ.** 18. **Casuarináceæ.** 19. **Myricáceæ.** 20. **Platanáceæ.** 21. **Betuláceæ.**

Ord. 17. Salicáceæ. WILLOWS or POPLARS.—Fls. ♀ ♂, in catkins. Perianth 0 or reduced to a disk. Sta. 2-∞. Ova. 1-celled, ∞-ovuled. Fr. caps. 2-valved; sds. comose. *Trees, Shrubs, or creeping Undershrubs.* Lvs. petioled, simple, entire or angular-toothed; stipule scaly or foliaceous. 2 gen., nearly 300 species. Types only given here:

1. **Pópulus. POPLAR.** Catkin-scales jagged. Sta. 4-30. Trees of temperate climates, both worlds. Species near 150, all ornamental. A favorite in Roman gardens, where it was called **Arbor pópuli**, the People's Tree. *P. balsamífera*, **BALSAM P.** 60°-80° high. Lvs. lobed, dentate; buds resinous; var. *cándicans*, **BALM-OF-GILEAD.** N., N. W. *P. monilífera*, **NECKLACE P., COTTONWOOD.** 60°-80° high. Lvs. triangular-cordate; sds. silky-cottony. Western Vt. to Ill. and La. *P. anguláta* (var. of last?), larger; Penn. to Wis., *S. P. trémula*, **ASPEN**, 60°-90° high. Lvs. round-ovate dentate. Eur. *P. graeca*, **GREEK POPLAR (W. Eur.)**; and *P. grandidentáta*, 46° high, *P. tremuloides*, 40° high (**AM. ASPENS**), are probably varieties of *P. trémula*. *P. álba*, **ABELE TREE**, 80°-90° high. Lvs. cordate, dentate or lobed, snow-white, canescent beneath. Eur. *P. fastigiáta*, **LOMBARDY P.**, 90°-130° high, branches fastigiate; lvs. round-triangular, pointed; probably a form of *P. nígra*, **BLACK P.**, 80°-100° high, branches spreading; both native to Eur., Asia Minor.

2. **Sálix. WILLOW.** Catkin-scales entire. Sta. 2-3-5-10. Trees or shrubs, temperate regions both worlds; loving moisture; few species arctic. More than 150 species, chiefly in Old World. *S. pentándra*, **BAY WILLOW**, 25° high, lvs. lanceolate, glossy, deep green, laurel-like; ♂ catkins golden, fragrant. Gt. Brit. *S. lucida*, 15°-20° high, similar. Mid. States, N. Eng., Can. *S. nígra*, trunk black, 20° high. Can. to Fla. and Ark. *S. fragílis*, **BRITTLE W.**; 60°-80° high. Gt. Brit. *S. babylónica*, **BABYLON W., WEeping W.**, 60°-80° high, hd. 70°-80° in diam., branches weeping. Cent. Asia, N. Af. *S. cinèrea*, **GRAY SALLOW**, 20°-30° high; *S. caprea*, **GOAT SALLOW**, 20°-30° high; wood made into charcoal. Eur. *S. álba*, 60°-80° high; lvs. canescent beneath. Eur., Asia. Var. *vitellina*, **GOLDEN OSIER**, has bright yellow branches, very handsome. *S. viminalis*, **OSIER, BASKET W.** Eur. Twigs used in basket-making, as are those of many other species in Am. and Eur. Many dwarf species; both worlds: *S. herbácea*, stems 1'-2'

long. White Mts., N., Welsh mts, Scotch Highlands. *S. rosmarinifolia*, ROSEMARY WILLOW, 2°-3° high. Lvs. linear-lanceolate, silky-silvery, with few teeth or entire. Eur. Fig. 69, A.

Ord. 18. Casuarinææ. BEEFWOOD TREES.—Fls. ♂ or ♀ ♂, achlamýd.; ♂ in catkins; ♀ in cone-like hds. of woody bracts. Fr. a winged caryopsis. *Shrubs* or *Trees*, with many branches; branches slender, pend., jointed, striate, leafless, with scales for lvs. Resembling *Equisetum*. Wood hard, heavy, the color of raw beef; made into war-clubs by the Māoris. Only genus *Casuarina*; several species. Australia, New Caledonia, Ind. Arch.

Ord. 19. Myricææ. WAX-MYRTLES.—Fls. ♂ or ♀ ♂, achlamýd., in short, cone-like catkins. Fr. a nut, or a drupe, succulent or waxy, often edible. Fragrant *Shrubs*. 2 gen.; about 20 species.

1. *Comptonia*. Fls. often ♂. ♀ catkin globular, bur-like. Fr. a nut. *C. asplenifolia*, only species, SWEET FERN. 1°-2° high. Lvs. linear-lanceolate, pinnatifid, fern-like, decid. Can. to Maryland and Wis. 2. *Myrica*. Usually ♀ ♂. Fr. a drupe. Species about 20, temperate regions, both worlds. *M. Gale*, SWEET GALE. 2°-4°. Lvs. cuneate-lanceolate, dark green, decid. Fig. 111 Wet shores of ponds, Can. to Car., W. to Wis. *M. cerifera*, WAX-MYRTLE, 3°-8° high. Lvs. evergreen, dry-looking, cuneate-oblong. Drupe crusted with white valuable wax; used as candles. Sandy sea-shores, Nova Scotia to Fla., W.; also on Lake Erie. *M. capensis*, finest of the species. Lvs. cordate, dentate, evergreen; wax as in *cerifera*, but finer; used as candles by farmers; eaten as bread by Hottentots. S. Af.

Ord. 20. Platanææ. PLANE TREES.—Fls. ♂, achlamýd., in separate spherical hds. and intermixed with scales. ♀ hds. long-peduncled, persistent. Fr. a nut. Perisperm thin when present. Lofty trees with spreading branches, and large petioled palmate decid. lvs. Only genus *Platanus*. 5 or 6 species, closely resembling. Eur., Asia, N. Af., N. Am. *P. orientalis*, ORIENTAL PLANE TREE. 80° high. Lvs. 5-lobed. Levant. A favorite in all European gardens. *P. occidentalis*, AMERICAN PLANE TREE (miscalled SYCAMORE). 40°-50° high. Lvs. 5-angled. Trunk large, often 12° in diam.; outer bark falling off annually. River-banks. Common, U. S.

Ord. 21. Betulææ. BIRCHES.—Fls. ♂, in separate scaly catkins. ♀ achlamýd., ♂ monochlamýd. Ova. 2-celled, 2-ovuled. Fr. a nut or samara, 1-celled, 1-seeded. *Trees* or *Shrubs*. Lvs. decid., simple, alt. 2 gen., more than 60 species. Forests of Eur. (abounding in Russ.), Asia, N. Am., Peru, Colombia, Antarctic regions. 1. *Alnus*, ALDER. Anthers 2-celled. *A. marítima*, SEA-SIDE ALDER. 20° high. Lvs. oblong, serrate. Del., Maryland. Also in Japan. *A. glutinosa*, COMMON ALDER. 50°-70° high. Lvs. ovate, serrate. Many fine varieties. Eur., Asia, N. Af. Wood valuable. The Rialto in Venice is built of it. 2. *Bétula*, BIRCH. Anthers 1-celled. *B. álba*, COMMON BIRCH, WHITE B. 60°-80° high. Lvs. deltoid-ovate, pointed, serrate. Bark white. Eur. Many fine varieties; one, *populifolia*, an Am. tree 15°-20° high. Penn. to Maine. *P. papyræa*, PAPER B. Lvs. similar; tree 60°-70° high; wood and bark valuable. N. Eng. to Can. and Wis. *P. nigra*, BLACK B. Lvs. ovate, lobed. 30°-50° high. River-banks, Mass., S. to Fla. and W. *B. lenta*, PLIANT B., CHERRY B. 60° high. Lvs. cordate-acuminate, serrate. Wood red,

valuable. N. Eng. to Ill., S. *B. pumila*, DWARF B. 2°-6° high. Lvs. long-petioled, obovate or orbic., serrate. Fig. 69, B. Mts., N. States to Hudson's Bay. *B. nana*, TINY BIRCH. 6'-3° high. Lvs. orbic., crenate. White Mts. to Hudson's Bay; Scotland, Sweden, Lapland, Russia.

Nettle Alliance.—Fls. diclinous (♂ in Ulmaceæ), monochlamýd., rarely achlamýd., isostémonous. Ova. free, 1-celled (2-celled in Ulmaceæ). Ov. sol. Fr. usually an akaine or samàra. Perisperm present or 0. **22. Urticaceæ.**

Ord. 22. Urticaceæ. NETTLES.—4 Sub-Orders:

Sub-Order 1. Ulmaceæ.—Fls. ♂ or ♀ ♂ ♂, monochlamýd.; fascicled or sol., racemed or paniced. Ova. 1-2-celled. Fr. a samàra or nut. Perisperm 0. *Trees* or *Shrubs*. Lvs. simple, serrate, penninerved, stipulate. 12 gen., temp. regions, N. hemisphere. **1. Plànera Richàrdi**, ZÉLKOUA TREE. 75°-80° high, 4° in diam. Fls. fragrant, sol. Wood valuable. Western Asia. *P. aquatica*. 30°-40° high. Fls. clustered. Swamps, N. C. to Ga. **2. Úlmus**, ELM. Fls. ♂, clustered. Fr. a samàra. Wood valuable, used in ship-building, and from immemorial time made into troughs for conducting the water of salt-springs (Saxon *Wyeh*, salt-spring). The term *Wyeh* was once given to all Brit. elms.—Gen. and spec. not well discriminated. 2 types: **A. U. campèstris**, FIELD E., COMMON E. 60°-80° high. Many varieties; timber trees and ornamental trees. Medit. States, but naturalized throughout Eur. **U. americana**, WHITE E. 50°-100° high. U. S. and Can. **U. racemosa**, fl. clusters racemed (N. Eng., W.), and **U. alata**, WINGED E., WHÀHOO (Va. to Ill., S.), branches broadly corky-winged. **B. U. montàna**, WYCH E., SCOTCH E. 60°-120° high, 5°-17° in diam. N. Eur. Many varieties. **U. fúlva**, RED E., SLIPPERY E. 20°-40° high; bark mucilaginous. Common, U. S. **3. Céltis**, LOTE TREE, NETTLE TREE. Fr. a small black drupe, deliciously sweet, once thought to be the Lotus of the Lotophagi, which, however, belongs to Rhamnaceæ. **C. australis**, LOTE TREE, HONEY-BERRY. 30°-50° high. Medit. States. Wood valuable, made into flutes, whip-handles, etc. **C. occidentàlis**, HACKBERRY. 40°-70° high. N. Eng., S. and W.

Sub-Ord. 2. Cannabinaceæ.—Fls. ♀ ♂, monochlamýd.; ♂ racemed or paniced, ♀ strobiloid. Fr. an akaine (Hop) or caryopsis (Hemp). 2 monotypic genera. *Herbs*. Lvs. serrate. Temp. regions, Old World, cult. everywhere. **1. Hùmulus Lùpulus** (*Lupus* of Pliny), HOP. Rt. perenn. Stems ann., rough, twining high. Lvs. cordate. 3-7-lobed. Sev. var. **2. Cànnabis sativa**, HEMP, HÁSHESH. Erect, ann., 4°-20° high. Lvs. digitate, 5-7-lobed. Bark makes HEMP. Dried lvs. are HÁSHESH; fresh lvs. yield the resin CHÚRRAS; both smoked in pipes, and very intoxicating. Ind., Af. Several varieties.

Sub-Ord. 3. Moraceæ.—Fls. ♀ ♂ or ♂. Monochlamýd. (achlamýd. in Dorstènia). Fr. multiple, accrescent. *Trees, Shrubs, or Herbs*; juice milky. 31 gen., 253 spec. **1. Broussonètia papyrifera**, PAPER MULBERRY, ♀ ♂. Low, mulberry-like trees. China, Japan, S. Sea Islands. **2. Mòrus**, *Mulberry*. Fls. usually ♂; in separate spikes; lvs. large, coarse, cordate, entire or lobed. Sev. spec. **M. nigra**, BLACK M. 30°-40° high; fr. black, delicious. Levant. **M. rubra**, RED M. 40°-80° high; fr. red, edible. U. S. **M. álba**, WHITE M. Low tree, fr. white. Lvs. fed to silk-worms. Native of the province Seres,

China; whence the L. name *sèrica*, silk. **3. Maclùra aurantiaca**, OSAGE ORANGE, BOIS D'ARC (Fr. Bow-wood; made into bows by Indians). Spiny tree, 30°-60° high, resembling the orange tree, but lvs. decid.; used for hedges. Fr. a multiple solid yellow globe, resembling an orange. Red and Ark. Rivers. Hardy. **4. Ficus**, FIG. Erect or creeping trees. 160 spec., trop., Old World and S. Ocean. **F. Càrica**, COMMON FIG. 10°-30° high. Fr. described, Lesson XX., Fig. 140. **F. indica**, BANYAN, Fig. 91. E. Ind. **F. Sycomòrus**, Sycamore of Bible; large tree, Levant. **F. religiòsa**, PEEPÙL tree, handsome, sacred to Vishnu; lvs. cordate, acuminate-tailed. Ind. This and **F. indica** furnish the LAC of commerce. **F. elàstica** furnishes Caoutchouc; Cystoliths, Fig. 236. Ind. **5. Dorstènia**. *Herbs*, 36 spec., trop. Am.; rhiz. medicinal. **D. contrayèrva**, described, Lesson XX., Fig. 141.

6. Artocàrpus, BREAD-FRUIT. ♂. Several spec. Trees. **A. incisa**, tree of moderate size; fr. 1° in diam., cooked as bread. Fig. 213. S. Sea Islands. **7. Bròsimum**. ♂ or ♀. Large trees. **B. Galactodéndron** (*Galactodéndron útilis*), COW TREE. 100° high, yields an excellent milk. Venezuèla. Fig. 238. **8. Antiàris toxicària**, UPAS TREE. ♂ ♀. Sol. Fr. a drupe. A very poisonous tree. Java. **9. Cecròpia**. Fr. a spike of small fleshy drupes. 25 species, trees. S. Am., W. Ind. **C. peltàta**, TRUMPET TREE; lvs. peltate; branches hollow, made into flutes, trumpets, drums, by natives.

Sub-Ord. 4. Urticææ.—Fls. ♂, ♀, ♂, ♀, ♂, in loose or capitate cymes, rarely sol. *Herbs, Undershshrubs, or Shrubs*. 36 gen., trop. or subtrop., both worlds. **1. Parietària officinàlis**, PÉLLITORY-OF-THE-WALL, herb, perenn., bushy, 18' high, stems red; pollen exploded as in *Pilea*. Ovule, Fig. 180, A. **2. Bœhmèria**, many species. **B. nìvea** (RAMIE), China; shrub, with the fine fibre which makes Grass Cloth. **3. Pilea**, 130 species, herbs or undershrubs, tropics, both worlds; insignificant except **P. serpyllifòlia**, ARTILLERY PLANT, a small, graceful plant; ♂ fls. audibly exploding their pollen, which resembles smoke. **4. Úrtica**, NETTLE. Many species, cosmop.; all with frightful stinging hairs; some yielding a fine fibre. **5. Lapòrtea**, shrubs or trees, beset with stings; both worlds. **L. canadènsis**, 20°-60° high, fibre valuable. U. S., Can. **L. gigas**, GIANT NETTLE; tree with a spiny trunk of immense buttresses 120° high, then branching into a spreading hd. Lvs. 1°-18° long. Young trees formidably armed. Australia.

Daphne Alliance.—Fls. usually ♂; monochlamýd. Ova. free (adh. in *Hernándia*). 1- rarely 2-celled. Ova. usually sol. Perisperm 0, or scant. Lvs. exstip. **23. Proteàcææ**. **24. Eleagnàcææ**. **25. Thymeleàcææ**. **26. Hernandiàcææ**.

Ord. 23. Proteàcææ. PROTEAS.—Fls. usually ♂; 4-merous; honey-bearing; infl. compound, rarely sol. *Shrubs, Trees, rarely Herbs*. Lvs. very variable. South temperate regions. 46 gen., 600 species. 2 Sections. *Section 1*. Fr. follicular, 1-2-valved, 1-∞-seeded. Australia, Tasmania. **1. Bánksia**. 50 species, trees or shrubs; sds. winged. **B. grándis**, 50° high. **B. littoràlis**, 30° high. Branch, Fig. 165. **B. coccinea**, fls. deep red, in a large hd. **2. Hákea**. Fine genus. More than 100 species; trees, shrubs. Australia, Tasmania. **3. Grevillea**. Handsomest and largest genus. **G. robùsta**, SILK-OAK, 100° high, 8° in circumference. **G. lithidophýlla**, smaller. Hairs, Fig. 106, 7. *Section 2*. Fr. an indehiscent nut or drupe. **Austra-**

lia, S. Af. 4. *Pròtea*. Fls. in hds. 6'-8' in diam., often with showy colored silky bracts. Extensive genus. Trees or shrubs; chiefly S. African.

Ord. 24. *Elæagnææ*. OLEASTERS.—Fls. ♂, ♀ ♂, ♀ ♂ ♂; infl. compound or sol. Fr. berry-like, an akaine in the accrescent (edible) perianth. *Trees* or *Shrubs*, with silvery-scaly, simple, entire lvs. 4 gen., 30 species. Northern hemisphere. 1. *Elæagnus horténsis*, OLEÁSTER, 20° high, Eur.; *E. argéntea*, similar, Western U. S. 2. *Shephérdia canadénsis*, Can.; *S. argéntea* with red berries, N., N. W., two low, pretty shrubs. 3. *Hippóphaë*, SEA BUCKTHORN, SALLOWTHORN. Few gen. Trees or shrubs. Berries bright orange, edible. Eur., Asia. *H. rhamnoides*. Tree 20°-30° high, branches spiny-tipped. Eur. 4. *Coniolum*. Bush, fruit unknown. W. Af.

Ord. 25. *Thymelæææ*. DÁPHNES.—Fls. ♂ or ♀ ♂ ♂, infl. sol. or compound, often handsome, fragrant. Fr. a nut, drupe, berry, or boll. *Trees* or *Shrubs*. Lvs. usually shining. 40 gen., 370 spec., cosmop. 2 Sub-Orders:

Sub-Ord. 1. Ova. 2-celled. *Aquilária Agállocha*, EAGLE-WOOD of ancients, ALOES-WOOD of Scripture. Large tree, wood fragrant, burnt as incense. Asia. Sub-Ord. 2. Ova. 1-celled. 1. *Dáphne*. Shrubs. Fls. clustered. Fr. a drupe. Many fine species. Tropics, both worlds. *D. Mezèreum*, MEZÉREON. Bush, fls. pink, appearing before lvs. Eur. Ov., Fig. 180, D. *D. odóra*, China. 2. *Lagétta linteària*, LACEBARK TREE. Small tree. Liber fine, strong, lace-like. Jamaica. Fig. 230. 3. *Dirca palústris* (only species), LEATHERWOOD. 2°-6° high, liber tough. U. S., Can.

Ord. 26. *Hernandiææ*.—Fls. ♂, in threes, ♀ in centre; involucre, paniced. Ova. adh. Fr. a large dry drupe, included in the hollow calyx-tube. *Trees*; lvs. entire, cordate, peltate. Wood spongy, used for tinder. Only genus *Hernándia*, 4 species. E. and W. Ind., Guiana. *H. sonóra*, JACK-IN-A-BOX. Fruits (dry drupe in the large, hollow, closed calyx-tube) emitting, when the wind blows, a wild loud whistling sound, the terror of ignorant travellers.

Laurel Alliance.—Characters of *Daphne* Alliance, but ova. always free. Sta. often quadrivalvular. Perisperm 0. Lvs. simple, entire, exstip. One Order:

Ord. 27. *Laurææ*.—*Trees*, *Shrubs*, *Undershrubs*; sometimes climbing; aromatic, sometimes fetid; rarely parasitic, leafless twiners. Fr. fleshy or dry. 50 gen., 500 species. 3 Sub-Orders. Types only given:

Sub-Ord. 1. *Gyrocárpus*.—Fls. ♀ ♂ ♂, in dense panicles. Fr. nut-like, winged. *Trees*, trop. Am., E. Ind. Sub-Ord. 2. *Cássytha*, DODDER-LAUREL. Fls. ♂, spicate. Leafless Dodder-like twiners; several spec.; tropics, both worlds, Australia. Fr. drupe-like, often edible.

Sub-Ord. 3. **True Laurels.**—Fls. usually clustered. 1. *Benzòin* (*Líndera*), SPICEBUSH, BENJAMIN. Fls. ♀ ♂; berries red. Aromatic, decid. Shrubs; 12 species, N. Am., S. Af. *B. odoríferum*, 6°-15° high, U. S., Can.; *B. melissæfòlia*, 2°-3° high, S. States. 2. *Laùrus*, LAUREL. ♀ ♂ or ♀ ♂ ♂; berries black. Shrubby evergreen trees or shrubs. Lvs. lanceolate. Few species, many var.; *Medit. States*, Asia. *L. nóbilis*, NOBLE (CLASSIC) L., BAY. Shrubby tree, 15°-60° high. *Medit. States*. 3. *Tetranthéra*. Many species,

large trees or bushes, evergreen or decid.; warm regions, chiefly in Old World. *T. geniculata*, POND SPICE, lvs. decid., drupe red. 8°–15° high. Va. to Fla. 4. *Sassafras*. Fls. ♀ ♂. Lvs. decid., variable in form. *S. officinale*. Drupe blue on a crimson fleshy stalk. Fragrant tree, 10°–20° high. U. S. and Can. 5. *Pérsea*. Fls. ♂. Fr. a drupe. Evergreen trees. *P. gratissima*, AVOCADO, ALLIGATOR PEAR. 20°–30° high; drupe large, edible. W. Ind., trop. Am. *P. carolinensis*, RED BAY, 30°–40° high. Drupe small, blue. Va. to Fla., swamps. 6. *Cámphora officinarum*, CÁMPHOR TREE. Fls. ♂. Drupe small. Lvs. ribbed. Wood and lvs. yield Camphor. China, Japan. 7. *Cinnamómum*. Trees. Several species. Asia, E Ind. Fls. ♂. Drupe small, in a cup-like calyx. Lvs. ribbed. *C. zeylánicum*, bark is the CINNAMON of commerce. Ceylon. Branch, lvs., fls., Fig. 170.

Goosefoot Alliance.—Fls. usually ♂; monochlamýd., rarely achlamýd. Ova. free (adh. in *Cynocrambææ*), 1- rarely ∞-carpelled. Ov. sol. (2 or more in some *Amaranthææ* and *Paronychiææ*). Emb. coiled or curved. 28. *Cynocrambææ*. 29. *Chenopodiææ*. 30. *Amaranthææ*. 31. *Polygonææ*. 32. *Phytolaccææ*. 33. *Nyctaginææ*.

Ord. 28. Cynocrambææ.—Fls. ♂, monochlamýd.; perianth 2-leaved. Ova. adh. Fr. a drupe. Only genus and species, *Thelygonum Cynocrámbe*. Smooth succulent herb; lvs. oval; used as a pot-herb. *Medit. regions.*

Ord. 29. Chenopodiææ. GOOSEFOOTS.—Fls. ♂ or diclinous, 3-4-5-merous, sol. or clustered. Fr. a utricle, caryopsis, or berry; always included in the dry or fleshy perianth. *Herbs*, rarely frutescent; sometimes climbing. Lvs. simple, sometimes fleshy; entire, dentate, sinuate, or cut. 78 gen., 530 spec.; temp. and trop. regions. 1. *Boussingaultia baselloides*, miscalled MADEIRA PLANT. Elegant succulent twining herb; rts. tuberous; lvs. cordate; fls. small, white, fragrant, in long racemes. Andes. 2. *Salicornia herbæcea*, GLASSWORT. Low, jointed, branching, leafless, fleshy herbs; fls. sunk in fleshy spikes. Sea-coasts, N. hemisphere; and 3. *Salsola*, sev. spec., herbs; yield SODA. 4. *Spinacia*, SPINACH. Sev. var., pot-herbs; W. Asia. 5. *Blitum capitatum*, STRAWBERRY BLITE, herb; fls. capitate, perianths accrescent, red; hds. like strawberries. Eur. Fig. 120. 6. *Chenopodium*, GOOSEFOOT. Many species, both worlds. *C. album*, LAMB'S QUARTERS, pot-herb. *C. quinoa*, sds. edible; Peru, Chili. 7. *Beta vulgaris*, BEET, (2) herb; rt. fleshy, edible. Sev. var. S. Eur. Cells, Fig. 215, B; raphides, Fig. 235, B.

Ord. 30. Amaranthææ. AMARANTHS.—Resembling *Chenopodiææ*; but fls. with sometimes monadelphous stamens; persistent bracts often bright-colored; and fr. with circumscissile dehiscence. 46 gen.; about 500 spec.; nearly all useless weeds. Types: 1. *Frœlichia floridana*. ☉. Arachnoid herb, 1°–2° high, fls. spicate, lvs. lanceolate. Ill. to Gulf of Mex. 2. *Gomphrena*. Undershrubs or herbs. 90 spec., S. Am., few in Asia, Australia. *G. globosa*, GLOBE AMARANTH. ☉. Fls. in round, small hds., crimson, pink, white. Ind. 3. *Achyranthes*. 30 spec. Trees or shrubs, sometimes climbing; tropics, Old World. *A. Verschaffeltii*, *A. Lindenii*, foliage-plants, with carmine and crimson foliage. 4. *Amaranthus*, AMARANTH. ☉. Herbs. *A. caudatus*, LOVE-LIES-BLEEDING; lvs. bright green, spikes

of fls. red, in a long drooping panicle. Ind. Fig. 121. *A. speciosa*, PRINCE'S FEATHER, lvs. purple, fl. spikes erect, crimson. *A. tricolor*, JOSEPH'S COAT, lvs. brilliantly variegated with red, yellow, purple. China. 5. *Celòsia cristàta*, COCK'S-COMB. ☉. Infl. anomalous, crested, bright red, rose, yellow, or white. Ind.

Ord. 31. Polygonaceæ. BUCKWHEATS.—Fls. ♂ or diclinous, monochlamýd. Infl. sol. or compound. Perianth usually colored, disk lining its base. Sta. 1-15. Ova. sol., of 2-4-carpels. Fr. a 3-angled akaine or caryopsis in the accrescent and sometimes fleshy calyx. *Herbs*, rarely *Shrubs*, erect or twining, rarely leafless, stemless. Stem jointed, tumid; lvs. alt. simple, usually ochreate. 33 gen., nearly 400 spec., temp. regions, cosmop.

1. *Antigonon leptopus*. Fls. ♂. Perianth-segments 5, petaline, colored; 3 outer large. Handsome, sub-shrubby, twining high; lvs. broadly cordate; fls. large, rose-color, in large showy racemes. Mexico.

2. *Polygonum*. Fls. pink or white, spiked or racemed. Many species. *Herbs* or undershrubs, including the SMARTWEEDS (juice acrid), KNOTGRASSES, and CLIMBING BUCKWHEATS. Fig. 3.

3. *Triplaris*. Fls. ♀ ♂ ♂. Trees or shrubs. S. Am. T. *Schomburgkiana*, tree; internodes hollow, occupied by venomous ants. Guiana. 4. *Fagopyrum esculéntum*, BUCKWHEAT. ☉ herb. Fls. ♂, white, paniced, fragrant. Sds. farinaceous. Asia.

5. *Rumex*, DOCK, SORREL. *Herbs* or undershrubs. Many species, both worlds. Common. Foliage acid. R. *Acetosélla*. Fr., vert. sec., Fig. 189, A; raphides, Fig. 235 A.

6. *Rheum*, RHUBARB. Sev. spec. Cent. Asia. Perennial, rhiz. large, often bitter, medicinal; lvs. acid. R. *nobile*. Lvs. rad., large. Infl. 5° high, cone-like, of large straw-colored imb. bracts edged with pink.

7. *Eriogonum*. Resembles Buckwheat, but lvs. exochreate, fls. involucrate. U. S., S. and W.

Ord. 32. Phytolaccææ. POKEBERRIES.—Fls. ♀, rarely ♀ ♂, mono- or dichlamýd., 4-5 merous. Infl. comp. Ova. of 1 carpel, or ∞ carpels whorled. Fr. a berry, utricle, coccus, or samàra. *Herbs*, *Undershrubs*, or *Trees*. Lvs. simple, entire. 20 gen., 80 species. Warm regions, Am., Asia, Af.

1. *Phytolacca*. Fr. many-carpelled, berry-like. 10 species. P. *decúndra*, COMMON POKEBERRY. Branching herb, 8°-12° high. Berries dark purple, racemed.

2. *Rivina*. 10 spec., trop. Am. Undershrubs, fls. racemed. R. *humilis*, small; with lovely racemes of small scarlet berries. Texas to Brazil, W. Ind.

3. *Pircúnia dioica*, BELLA-SOMBRA. Fls. ♀ ♂. Tree, stem enormously swollen at base, hd. spreading. La Plata.

Ord. 33. Nyctaginææ. PRETTY-BY-NIGHTS.—Fls. ♀, rarely diclinous; monochlamýd.; usually involucrate. Perianth petaloid, tubular, colored. Ova. 1-carpelled, 1-celled. Fr. an akaine, included in the accrescent woody perianth-tube. *Trees*, *Shrubs*, *Herbs*, knotty, often spiny. 20 gen., 100 spec.; warm regions, both worlds.

1. *Neèa*. Fls. exinvolucrate, paniced. Trees and shrubs, trop. Am.

2. *Bougainvillea*. Fls. small, in threes, concealed by large showy bracts, in splendid massy panicles. Sev. spec., S. Am. B. *spectàbilis*, climbing shrub or small tree; bracts rose-color.

3. *Abrònia*, 2 herbs. Perianth salver-shaped, flower-like, small, bracts small. Fls. umbelled, fragrant. A. *umbellàta*, day-blooming, fls. purple, Cal. A. *fràgrans*, vespertine, Rocky Mts. 4. *Oxybaphus*. 2 herbs. Fls. small, rose-purple, few together, surrounded by an accrescent salver-shaped invo-

lucre. Sev. spec., *W. O. albidus*, *N. Car.*, *S. 5. Mirabilis*. **MARVEL-OF-PERU, BELLE-DE-NUIT, PRETTY-BY-NIGHT, FOUR-O'CLOCK.** ♀ herbs, rts. fleshy. Perianth large, flower-like, funnel-shaped. Fls. fragrant, sol. or few, in a green calyx-like involucre. Several spec. *Trop. Am.* *M. Jalapa*, fl. 2' long, red, yellow, white, or varieg. *Fr.*, *Fig.* 189, *B. W. Ind.* *M. longiflora*, fl. 6' long, border white, spreading. *M. Wrightiana*, 4' long, border white, rose-tinged. *Texas, Mex.*

DIVISION II.—Monopétalæ. 2 Subdivisions { 1. Ovary free.
2. Ovary adh.
Flowers usually dichlamýdeous. Petals usually connate.

Subdivision I.—Ovary usually free. 2 Sections. { 1. Flowers irregular.
2. Flowers regular.

Section I.—Flowers irregular, rarely regular.

Mint Alliance.—Fls. 8. Calyx and corolla tubular, 5-4-merous; usually tubular; 2-labiate, lips 2- and 3-fid; rarely reg. (in some *Verbenacæ*).—*Sta.* 4, didynamous, or 2, rarely 5 (in some *Verbenacæ*). *Ova.* free, 4-2-1-celled. *Fr.* dry or fleshy. *Perisperm* present or 0. *Lvs.* exstip., often opp. *Herbs, Shrubs, Trees*; often fragrant. **34. Labiátæ.** **35. Verbenacæ.**

Ord. 34. Labiátæ. LIPPED FLOWERS. MINTS.—Fls. always irreg. *Ova.* 2-carpelled, stylé gynobásic. *Fr.* 4 nuts in the persistent often accrescent and showy calyx. *Herbs* or *Undershrubs*, usually aromatic. *Stems* square; *lvs.* opp. 100 gen., 2500 spec.; temp. regions, both worlds. 7 Tribes, distinctions in akaines and sta. Types given:

Tribe 1. Teucrium, GERMÁNDER.—Herbs and shrubs. 100 spec., chiefly in Old World. *T. Scorodonia*, **WOOD SAGE**; taste and smell of Hops. *Eur.* *Fig.* 160. *T. canadense*, ♀ herb, 1°-3° high, fls. purple. *U. S., Can.* **Tribe 2. Prostanthera, anth. spurred.** Shrubs with powerful odor. *Australia.* *P. lasianthos*, fls. hairy. **Tribe 3. Akiunes fleshy. Prasiun majus, only spec.** Evergreen shrub. *Eur., N. Af.* **Tribe 4. 1. Moluccella laevis, MOLUCCA BALM, SHELL-FLOWER.** ☉. Low, smooth; calyx shell-like, 1' long; fls. small, yellow, racemed. *Levant.* **2. Lamium.** ☉, ♀ herbs. Sev. spec., Old World. Fls. often handsome, white, purple, or spotted. *L. amplexicaule*, **DEAD NETTLE**, weed; fls. purple; autumnal ones cleistogamous, *Fig.* 183. **3. Marrubium, HOARHOUND.** Bitter herbs. Sev. spec. *S. Eur., W. Asia.* *M. vulgare*, **COMMON H.** Stem and rugose lvs. hoary (frosted with white hairs), fls. white. **Tribe 5. 1. Cedronella.** ♀ herbs or shrubs, fragrant. Sev. spec., both worlds. *C. mexicana*, fls. large, pink. *New Mex.* **2. Nepeta.** ♀ herbs. Many spec. *Eur., Asia.* *N. Cutaria*, **CATNIP**, 1°-3° high, soft, downy; lvs. cordate, crenate; fls. white. *N. Glechoma*, **GROUND IVY, GILL**; creeping, spreading; lvs. smooth, reniform, crenate, petioled; fls. light blue. Run wild in *U. S.* **Tribe 6. Sta. 2. Anth. lobes sol. or separated by a long connective. 1. Monarda.** ♀ herbs. Fls. in glomerules; calyx and bracts brightly colored. Sev. *Am. spec.* *M. didyma*, fls. crimson, 15" long, fragrant. Swamps, *Can. to Ga.* **2. Rosmarinus officinalis, ROSEMARY.** Evergreen shrub, lvs. hoary beneath, fragrant; fls. pale blue. *S. Eur., Asia Minor.* **3. Salvia, SAGE.** Undershrubs, herbs. Fine genus; species numerous, both worlds; all pretty; many ornamental in fl. and lf. *S. splendens*,

Brazil, *S. fulgens*, Mex., have scarlet fls. 2' long. *S. argentea*, lvs. silvery white, fls. white. Spain. *S. officinalis*, GARDEN S. Lvs. medicinal; fls. blue. Eur. Fls. with bee, Fig. 187; hairs, Fig. 106, 10; sta., Fig. 168, D. Tribe 7. Sta. 4-2. 1. *Hyssopus officinalis*, HYS-SOP, \mathcal{Q} herb. S. Eur. 2. *Thymus*, THYME. 50 spec., \mathcal{Q} herbs. Eur. Asia, N. Af. T. *Serpjllum*, WILD T.; creeping, turfy. T. *vulgare*, GARDEN T. 3. *Hedeoma pulegioides*, AMERICAN PENNYROYAL. \odot , low, fls. blue. Can., U. S. 4. *Calamintha*. \mathcal{Q} herbs, many spec., both worlds. C. *coccinea*, fls. scarlet. Fla., Ala. 5. *Melissa*. \mathcal{Q} herbs, N. Hemisphere; fls. honey-bearing. M. *officinalis*, BALM; fls. white. Eur. 6. *Satureia hortensis*, SUMMER SAVORY, \odot ; fls. purple; S. *montana*, WINTER S., dwarf, suffrutescent evergreen; fls. pale purple. S. Eur. 7. *Origanum*, sev. spec.; herbs, shrubs; fls. with showy colored bracts. S. Eur., Ind. O. *Majorana*, MARJORAM; O. *Dictamnus*, DITTANY; both herbs. 8. *Mentha*, MINT. \mathcal{Q} herbs. Corolla 4-lobed, purplish white. Sev. spec., both worlds. M. *pulegium*, PENNYROYAL, Eur. M. *viridus*, SPEARMINT; M. *piperita*, PEPPERMINT; M. *citrata*, BERGAMOT. All in wet places; Eur.; run wild in U. S. 9. *Pogostemon*, *Patchouly*, \mathcal{Q} herb; yields the perfume *Patchouli*. E. Ind. Tribe 8. 1. *Lavandula*, LAVENDER, fragrant undershrubs; Old World. L. *vera*, COMMON L., lvs. linear, grayish; fls. blue. S. Eur. 2. *Coleus*, herbs or shrubs. Asia, Af. C. *Blumei*, herb, foliage variegated. E. Ind. 3. *Ocimum*, herbs, small shrubs; many species, trop. Asia, Af., Am. O. *basilicum*, SWEET BASIL. \odot , fragrant; fls. bluish white. Ind.

Ord. 35. **Verbenaceæ.** VERBENAS.—Characters of Labiatae, but style terminal; fr. sometimes baccate; fls. sometimes reg.; sta. sometimes 5. *Herbs, Shrubs, Trees.* About 56 gen., 700 spec., both worlds, chiefly in S. Hemisphere. 2 Sub-Orders. Types given:

Sub-Ord. 1. **Myoporaceæ.**—1. *Phryma leptostachya*, LOP-SEED, only spec. \mathcal{Q} herb, 2°-3° high; fls. purple, small; fr. an akaine. Can., U. S. 2. *Selago*, 70 spec., herbs or undershrubs. Fr. 2 1-seeded akaines. Cape of Good Hope. 3. *Globularia*, 4 spec., shrubs, herbs. Fr. a caryopsis. S. W. Eur. 4. *Bontia*, monotypic. Small evergreen olive-like tree. Fr. baccate, 8-seeded. Antilles. Sub-Ord. 2. **Verbenaceæ.** 4 Tribes. Tribe 1. Heath-like shrubs, S. Af. Fr. a 2-celled dehisc. boll or a utricle. *Stilbe*, 4 spec. Cape Colony. Tribe 2. Small evergreen trees. Ova. 2-celled, ov. twin. Fr. indehisc. Emb. germinating in pericarp. Only gen., *Avicenna*, WHITE MANGROVE, sev. spec. Tidal estuaries, tropics, both worlds. A. *tomentosa*, trop. Am. A. *officinalis*, N. Zealand. Tribe 3. Infl. def. 1. *Vitex*. Shrubs or small trees, fragrant, many spec., tropics, both worlds. Fr. a drupe. V. *Agnus-Castus*, CHASTE TREE, SAGE T. 8°-15° high, lvs. digitate, lfts. entire. Fig. 126. S. Eur. V. *incisa*, smaller, lfts. incised. China. 2. *Clerodendron*. Shrubs or trees; sometimes climbing. Lvs. simple, fls. showy, fragrant. 80 spec., trop. Asia, Af., Am. 3. *Callicarpa*. Shrubs. Fr. a 4-seeded, small drupe. Sev. spec. Trop. Asia, Af., Am. C. *americana*, FRENCH MULBERRY. Lvs. mulberry-like; drupes showy purple. S. States. 4. *Tectona*. TEAK TREE. Enormous trees, wood valuable; fls. reg., panicled; sta. 5-6. 2 spec. E. Ind. and Islands. Tribe 4. Infl. indef. 1. *Petraea*. Twining shrubs or small trees. Fls. showy. 13 spec., trop. Am. 2. *Lantana*. Shrubs, rarely herbs; 50 spec.; trop.

Am. Fls. small, in hds. Drupe 2-seeded. 3. *Aloysia citriodora*, LEMON VERBENA; boll 2-seeded. Small fragrant shrub, Chili. 4. **Verbena**. Fr. splitting into 4 akaines. Herbs or shrubs. 5. *officinalis*, VERVAIN; herb, held sacred by the ancients, especially Druids. Eur. 6. *Aublètia*, fls. purple, Ill. to Car., S.; and 7. *chamædrifolia*, fls. scarlet, S. Am., are the originals of most garden Verbenas.

Foxglove Alliance.—Characters of Mint Alliance, but plants not fragrant; ovules ∞ ; fr. frequently a boll. 36. **Acanthaceæ**. 37. **Bignoniaceæ**. 38. **Gesneraceæ** (ova. sometimes adh.). 39. **Columelliaceæ**. 40. **Orobanchiaceæ**. 41. **Lentibulariaceæ**. 42. **Scrophulariaceæ**.

Ord. 36. Acanthaceæ.—Anther-cells often sepa. and superimposed. Fr. a boll. Sds. supported by hooks (or a papilla) arising from placenta. Perisperm 0. *Herbs*, rarely *Shrubs*. 155 gen., 1100 spec., for the most part weeds, a few beautiful. Chiefly trop., both worlds. **Sub-Ord. 1.** Sds. on hooks. A. Sta. 2. 1. *Dianthèra*, WATER-WILLOW. Lvs. long, fls. usually reddish, spiked. Many spec., herbs or shrubs; weeds. U. S., trop. Am. 2. *Libònia floribunda*, only spec., similar, smaller; fls. scarlet, yellow-tipped. Brazil. 3. *Justicia*, herbs or shrubs; fls. showy, red. Ind., S. Af. 4. *Gymnostachyum* (*Fittònia*), dwarf plants; lvs. with colored veins. G. *zeylanicum*, Ceylon. G. *Verschaffèltii*, Para. B. Sta. 4, anth. 1-celled. 5. **Acanthus**, elegant foliage-plants of S. Eur.; lvs. large, sinuate-pinnatifid. A. *mollis*, lvs. nearly smooth. A. *spinòsus*, CLASSICAL A., lvs. spiny. Lesson XXVII., Fig. 123. **Sub-Ord. 2.** Seeds hooked or papillate. Sta. 4, 2-celled. 1. *Ruèllia*. Pilose herbs, fls. blue or purple. Many fine spec., U. S., Asia, Australia. R. *formòsa*, hairs, Fig. 106, 8. R. *strèpens*, fls. blue, Penn., W. and S. **Sub-Ord. 3.** Sds. papillate. Calyx reduced to a ring. Sta. 4, 2-celled. 1. *Thunbèrgia*, climbing herbs; fls. showy; boll beaked.

Ord. 37. Bignoniaceæ.—Characters of last; but 5th sta. sterile or 0. *Trees* and *Shrubs* (often climbing), rarely *Herbs*. Fls. large, showy, often trumpet-shaped. Fr. a boll, berry, or drupe. 70 gen., 520 spec., trop., both worlds, chiefly in Old World. 3 Sub-Orders. **Sub-Ord. 1.** Herbs. Sds. wingless. Placentation parietal. 1. *Martynia*, UNICORN, DEVIL'S CLAWS. Fls. showy, fragrant, racemed; boll with 2 long curving horns. M. *proboscidea*, S. and Western U. S. M. *fràgrans*, Mex. 2. *Uncària procumbens*, only spec. GRAPPLE-PLANT. Prostrate. Boll covered with strong branched sharp hooks. S. Af. 3. *Sésamum indicum*, sds. oily, edible. Ind. **Sub-Ord. 2.** Small trees. Fr. woody, indehisc. Both worlds. 1. *Crescèntia*, CALABASH T. Fls. large, adventitious. Fr. (pepo) large and horny, almost indestructible. C. *Cujète*, 30° high; lvs. simple in 5s. Gourds 1° in diam., made into various useful vessels. Fig. 209. W. Ind., trop. Am. C. *alàta*, HOLY CROSS T., 30° high; lvs. in 3s; 2 outer simple, sessile; central one ternate at apex of an alate petiole, imitating a cross. Gourds small, made into drinking-cups. Mex. 2. *Parmentiera*, CANDLE T. Fls. of last. Lvs. simple or trifoliate. Pepo long, slender, fleshy, imitating a yellow wax candle; edible. 2 spec.: P. *cerifera*, candles 4° long; Panama; P. *edulis*, candles shorter, sweeter; Mex.

Sub-Ord. 3. Bignoniaceæ.—Trees, shrubs, often climbing or creeping, rarely herbs. Fls. usually large, usually trumpet-shaped; always

showy. Boll usually 2-valved; usually long and slender; sds. winged. Lvs. usually compound, rachis often terminating in tendrils. 46 gen., 452 spec.; tropics, both worlds; chiefly in Old World. 4 Tribes: **Tribe 1.** Only gen. *Eccremocarpus* (*Calámpelis*). Stem shrubby, branches long, succulent, climbing by lf.-tendrils. *E. longiflorus*, lvs. 3-pinnate; calyx red, corolla-tube yellow, border green; *E. scaber*, lvs. 2-ternate, fls. orange-yellow, Chili. **Tribe 2.** Erect small herbs; fls. racemed. 1. *Amphicome Emodi*, fls. pink, sds. comose; lvs. pinnate. N. W. Ind. 2. *Incarvillea*, monotypic, fls. scarlet; lvs. pinnatisect. China. **Tribe 3.** Trees, rarely shrubs or herbs. Fls. usually in large panicles. Lvs. large, cordate; fls. white, mottled with colors. 1. *Catalpa*, INDIAN BEAN. Trees 30°-50° high; boll long, slender. 4 or 5 spec. N. Am.; W. Ind., Japan, China. **C. bignonioides**, Southern U. S. 2. *Pandorea*. Shrubs, only twiners in the Order; lvs. pinnate. 3 spec., Australia. **P. jasminoides**, fls. white, throat pink. 3. *Tecomaria*. Erect shrubs; lvs. pinnate, pinnae serrate; fls. orange-yellow. 6 spec., S. Am. **T. capensis** (specific name given under the supposition that the shrub came from S. Af.) is the best known 4. *Stereospermum*. Trees; lvs. pinnate; fls. white, very fragrant. 12 spec., trop. Af., Asia. 5. *Spathodea*. Tall trees; lvs. pinnate; fls. orange or purple. Several spec., trop. Af., Asia. 6. *Jacaranda*. Trees; lvs. 2-pinnate; fls. blue; numerous spec., trop. Am. 7. *Zeyheria montana*, only spec.; large, stately tree; lvs. digitate, fls. gold-color. Brazil. 8. *Tecoma*. Tall trees; lvs. digitate; fls. golden-yellow, purple, pink, or white. Wood (called ROBLE, from *Röbur*, oak) almost indestructible. 50 spec., trop. Am.

Tribe 4. Eubignoniæ.—True Bignonias. High-climbing or high-creeping shrubs, or tall, slender trees; fls. large, trumpet-shaped, sometimes ill-scented. 1. *Calosanthus*, monotypic. Very tall, slender tree; lvs. 2-pinnate; fls. white, fetid. Ind. 2. *Campsis*. High-creeping, rooting, like ivy; lvs. pinnate; fls. large, scarlet or pink. 6 spec., N. Am., E. Ind., Japan, China. **C. radicans**, TRUMPET-CREEPER; creeping up trees, walls, etc., to height of 80°; fls. scarlet. Penn. to Ill., S. and S. W. **C. grandiflora**, not so tall. China. 3. *Campsidium chilense*, only spec.; lvs. pinnate, fern-like; stem slender, climbing (not rooting) to height of 40°; fls. orange-yellow. Chili. 4. *Adenocalymna*. Lvs. binate, tendrilled; fls. orange or pink. Stem rope-like, branching, climbing the tallest trees; several spec. Brazil. 5. *Arrabidaea*, similar; fls. much smaller, but in handsome panicles; 20 spec., chiefly in Brazil. 6. *Bignonia*, similar, but fls. largest and finest of all, of various colors. Many spec.; lvs. of some yielding colored pigments; all trop. Am. **B. capreolata**, CROSS-STEM; lvs. evergreen; fls. orange-red; wood in the form of a cross (Lesson XXXI.) S. Va., S. and W. to Mex. **B. picta**, S. Am. Fig. 70.

Ord. 38. Gesneriæ.—Characters of Bignoniæ; but sta. sometimes 5, fertile, ova. 1-celled, sometimes adh., and sds. wingless. Anthers often cohering. Fr. a boll or berry. *Herbs* or *Undershrubs*, often with tuberous rhizomes. Lvs. simple. 80 gen., 300 spec., chiefly tropical; both worlds, chiefly in New World. 3 Tribes:

Tribe 1. 1. *Ramondia pyrenæica*, monotypic. Stemless ♀ herb; lvs. rad.; corol. nearly reg., limb rotate, sta. 5, fertile. Fls. purple, few, on a seape. Pyrenees, Piedmontese Alps. 2. *Æschynanthus*. Splendid epiphytes; stem pendent, lvs. fleshy, fls. (irreg., sta. didyna-

mous) large, scarlet or orange. Several spec., Java, Borneo. **Tribe 2.** **1. Columnea.** Erect or climbing; lvs. fleshy; fls. scarlet. **C. scandens**, SYRUP-STEM; fls. honey-bearing; trop. Am. **Tribe 3.** **Ova.** adh.; fr. a boll. **1. Achimenes:** fleshy-stemmed erect herbs; fls. large, showy; pedicels (and base of stem) tuber-bearing. Many spec.; Mex., Cent. Am., Jamaica. **2. Nægèlia.** Herbs, from scaly rhizomes. Lvs. large, velvety, richly tinted; fls. large, showy. Several spec., S. Am. **N. Zebrina**, ♀, best known. **3. Gesnèra.** Herbs from tubers; lvs. and fls. handsome. **G. discolor**, best known. S. Am. **4. Gloxinia**, similar, without tubers. Many fine spec.; may be propagated from the lvs. S. A.

Ord. 39. Columelliaceæ.—Like last; with ova. adh., 2-celled; sta. 2, epipetalous; anthers sinuous, connivent at top; corol. rotate, nearly reg. Only gen., **Columèlia**, several species; evergreen *Shrubs* or *Trees*; lvs. opp., entire or serrate; fls. small, yellow. Mex., Peru.

Ord. 40. Orobanchiaceæ.—Characters of Gesneraceæ. Corol. irreg.; sta. 4, didynamous; ova. free, 1-2-celled. Fr. a boll enclosed in the marcescent corol. Small *Herbs*, root-parasitic, leafless, scaly, never green. 12 gen., 100 spec., N. Am., S. Eur., Asia, S. Af. **1. Orobanche**, BROOMRAPE; on rts. of Broom and other leguminous plants. **O. major**, 18' high, russet; **O. rubra**, red; Fig. 159. Eur. **2. Epiphègus virginiana**, 1° high, purplish; **Conòpholis americana**, yellowish, 5'-6' high; both on rts. of forest trees, N. Am.

Ord. 41. Lentibulariaceæ.—Characters of Alliance. Corol. often spurred. Sta. 2, anth. 1-celled; boll 2-valved; fls. showy. Small aquatic or marsh *Herbs*; lvs. finely dissected or entire. 4 gen., 180 spec.; chiefly trop., both worlds. **1. Pinguicula**, BUTTERWORT. Lvs. entire, greasy to the touch. Many spec. **P. vulgaris**, fls. sol., purple. Cold bogs, Eur., U. S. Fig. 88 **2. Utricularia**, BLADDERWORT. Aquatic, usually floating; lvs. finely dissected, submerged; fls. yellow, above water. Many handsome spec.; **U. vulgaris**, common; slow or still waters.

Ord. 42. Scrophulariaceæ.—Characters of Bignoniaceæ, but perisperm present. Fls. showy; sometimes spurred and personate. *Herbs*, *Shrubs*, rarely small *Trees*; 180 gen., 1800 spec., cosmop. 3 Sub-Orders, distinctions slight. Only well-known types given. **Sub-Ord. 1. Castilleja**, PAINTED CUP. Herbs; fls. small, bracts large, colored. 40 spec. **C. coccinea**, 8'-12' high; bracts scarlet. Can., U. S. **2. Gerardia.** Herbs ♂ ♀, more or less root-parasitical; fls. purple or yellow. 12 spec.; N. and S. Am.; handsome. **3. Veronica**, SPEEDWELL. Fls. blue or white; herbs, undershrubs; cosmop., many spec.; many ornamental. **V. spicata**, ♀, tall, fls. blue. Eur. **4. Digitalis purpurea**, FOXGLOVE. ♀, fls. large, purple. Eur. Boll, Fig. 203, C. **Sub-Ord. 2. 1. Mimulus**, MONKEY-FLOWER. ♀, fls. showy, of various colors. Sev. fine spec. in U. S. **2. Russetia juncea**, grass-like, drooping stems; lvs. small, scale-like; fls. scarlet. Mex. **3. Scrophularia**; herbs, undershrubs; 100 spec., all weeds; Old World. **S. nodosa**, ♀, 3°-4° high, fls. small, lurid, fetid. U. S., adv. from Eur. **4. Paulownia imperialis**, only spec. Handsome tree, resembling Catalpa, but pods nearly globose, small. Japan. **5. Maurandia.** Erect or climbing herbs, with twining petioles and peduncles. 5 spec. 2 erect, Cal.; 3 climbing, with fine fls., Mex. **6. Antirrhinum**, SNAP-DRAGON; herbs, undershrubs; fls.

showy. 14 spec., Medit. region; a few in Cal. **A. majus**, 1°-3° high, fls. variegated. Eur. Fig. 161. **7. Linaria**, TOAD-FLAX. Herbs, often trailing; fls. personate, purple, yellow, showy. Lvs. usually linear. Sev. spec., Eur. **L. Cymbalaria**, miscalled **KENILWORTH IVY**; lvs. ivy-like; stems delicate, trailing. Eur. **8. Verbascum**, **MULLEIN**. Sta. 5, fertile, epipetalous; filaments unequal; fls. yellow, purple, or white. Strong erect herbs, usually woolly. 90 spec., Eur., Asia, N. Af. **V. Thapsis**, **COMMON M.**, **HIG-TAPER** (Sax. *Hig*, hedge), with 2 or 3 other spec., run wild in U. S., Can. Hairs, Fig. 106, 5. **9. Calceolaria**. Corolla-lips usually saccate; sta. 2. Herbs or shrubs. Many spec., all with showy fls. S. Am. **Sub-Ord.** **3. Infl. def. 1. Schizanthus**. Sta. 2; staminodes 2 or 3. Herbs ☉; lvs. compound or pinnatisect; corolla-limb fimbriate; fls. showy; few spec., Chili. **2. Salpiglossis**. Sta. 4; staminode 1. Similar, fls. funnel-shaped; showy; Chili. **3. Browallia**. Sta. 4. ☉, bushy, 1°-2° high; lvs. ovate; fls. bright blue; S. Am. **4. Brunfelsia**. Sta. 4, anthers confluent at top; corolla-tube long, border flat, 5-lobed. Boll fleshy, sometimes indehisc., drupe-like. Shrubs or small trees; lvs. oblong; fls. large, blue or white, fragrant. Several spec., W. Ind., S. Am. These last lead directly to Solanaceæ.

Section II.—Flowers usually regular.

Nightshade Alliance.—One Order.

Ord. 43. Solanaceæ.—Characters of Scrophulariaceæ; but corolla often regular; sta. 5, fertile, epipetalous, equal or not; anthers sometimes connivent or coherent, opening by a pore at top; ova. usually 2-celled, syncarpous; cells usually ∞ -ovuled; lvs. rarely pinnate; usually alt. Fr. a boll, pyxidium, or berry. *Herbs, Shrubs, rarely Trees*, often with narcotic, deadly juices. About 70 gen., 1600 species, cosmop., most abundant in tropics. 10 Tribes. Types given:

Tribe 1. Boll few-seeded. **1. Metternichia**. Trees. Fls. showy, white or pink; corol. funnel-shaped, 5-lobed. Brazil. **Tribe 2.** Boll 2-valved; sds. few. **1. Lonchostoma**. Shrubs. Fls. smaller. Cape of Good Hope. **Tribe 3.** Boll or berry; sds. ∞ . **1. Habrothamnus**. Shrub. Corol. 1' long, border 5-toothed; fls. red or purple in splendid panicles. Berry, in calyx. Mex. **2. Céstrum**, **NIGHT JESSAMINE**. Berry like last. Corol. border 5-lobed, 1' long; fls. greenish white, clustered, fragrant at night. **C. nocturnum**. W. Ind. **C. Parqui**, Chili. **Tribe 4.** Berry 2-4-celled. **Triguiëra**. Herb. Spain. **Tribe 5.** Drupe with 4 pyrenes. **1. Grabowskia boerhaav-izæfolia**, spiny shrub. Brazil. **Tribe 6.** Style gynobasic; ova. 5-8-10- ∞ , distinct, ripening into drupes. Small shrubs or herbs. **1. Dölia**. Heath-like littoral shrubs; lvs. fleshy; fls. small. S. Am. **2. Nolana**. Prostrate; fls. bell-shaped, large, showy. Sev. spec., Peru, Chili.

Tribe 7. Solanææ. Anthers often connivent, sometimes coherent. Fr. a berry, 2- ∞ -celled; rarely a boll without valves. Herbs or shrubs. **1. Lycium**, **BOX THORN**, **MATRIMONY**. Shrubs, often scrambling and spiny; lvs. and purple (usually 5-merous) fls. small; berries scarlet or orange. Many fine spec.; Medit. States, China, N. and trop. Am. **L. carolinianum**, low, spiny; fls. 4-merous. Salt marshes, S. States. **2. Mandrâgora**, **MANDRAKE**. Poisonous herbs; rt. usually fleshy, forked; fls. deep blue; showy. Berry 1-celled. S. Eur., Asia.

3. *Atropa Belladonna* (only spec.), DEADLY NIGHTSHADE. ♀. Low; lvs. ovate, petioled; fls. small, purple; single or in pairs, nodding; berries small, black, sweet, *deadly* poisonous. S. Eur., W. Asia.

4. *Lycopersicum*, TOMATO, LOVE-APPLE. Trailing herbs; lvs. interrupted-pinnate; anthers coherent; fls. small; berries large, shining, yellow or red, 2-4-∞-celled. 10 spec., ☉, ♀; several edible. Chiefly in Peru. L. *esculentum*, finest.

5. *Solanum*, NIGHTSHADE. Anthers connivent. Berry ∞-seeded, often large, showy; fls. clustered. Herbs, shrubs, small trees. Lvs. various, pinnate, sinuate, or entire. Many spec.; often deadly; some few wholesome. S. *sodomæum*, SODOM APPLE. Berry as large as an apple, showy, deadly. S. Eur., Af., Australia. S. *Melongèna*, EGG-PLANT, AUBERGINE. Berry still larger, purple or white, edible. ☉. Fig. 158. Pern. S. *tuberosum*, IRISH POTATO. Berries small, green, poisonous; fls. showy; tubers wholesome, the staple food of Ireland. Starch grains, Fig. 239, A. Chili. S. *Dulcamàra*, BITTERSWEET, WOODY NIGHTSHADE. Stem woody at base, tall, scrambling; lvs. cordate; fls. purple; berries red. Eur. S. *jasminoides*, shrub high-climbing by petioles of the simple or ternate lvs.; fls. blue or white. Brazil. S. *Pseudo-Capsicum*, JERUSALEM CHERRY. Small shrub, berries red. Madeira. 6. *Capsicum*, CAYENNE or RED PEPPER, CHILLI. Bnshy herbs; berry large, dry, inflated, red or yellow, hot-pungent. Many spec., trop., both worlds. 7. *Physalis*. Herbs or shrubs; berries edible. Calyx accrescent, colored. Many spec., several in U. S. P. *Alkekengi*, WINTER CHERRY, ♀, bushy; berries and calyx red. Medit. States. P. *pennsylvànica*, GROUND C., berries red. U. S. Tribe 8. *Pyxidium*, 2-celled. 1. *Hyoscyamus*, HENBANE. ☉, ② Sev. spec., Eur. H. *niger*, fr., Fig. 197, D. Tribe 9. Calyx decid.; boll or berry. 1. *Datura*. Corolla funnel-shaped, large, showy, white, purple, or scarlet, often fragrant. Herbs or shrubs, often very poisonous. Many spec. Both worlds, chiefly tropical. D. *Stramonium*, THORN-APPLE, JAMESTOWN WEED; ☉; fls. 3' long, white. Boll thorny. Common, U. S. D. *Mètel*, D. *Meteloides*, similar, fls. in last fragrant. Mex. D. (*Brugmansia*) *arboorea*, tree 20' high; fls. white, 10' long, boll smooth. D. (B.) *sanguinea*, 20' high, fls. scarlet; trop. Am. Tribe 10. Boll 2-celled, 2-valved. 1. *Nicotiana*. ☉. Herbs with sticky lvs; fls. showy, large, funnel-shaped, border 5-lobed. Many spec., trop. Am. N. *Tabacum*, TOBACCO, lvs. smoked, chewed, and powdered into SNUFF. N. *longiflora*, N. *noctiflora*, handsome white fls., vespertine, fragrant. 2. *Petunia*. ♀ small herbs; lvs. sticky; fls. large, often fragrant. P. *nyctaginiflora*, fls. white; P. *violacea*, fls. blue, are the originals of all the varieties. S. Am. 3. *Fabiàna*. Small heath-like shrubs; fls. white, purple. Chili.

Polemonium Alliance.—§. Corolla reg., 5-merous, isostemonous; ova. 1-2-4-5- rarely ∞-celled, usually syncarpous; cells 1-2- rarely ∞-ovuled. Perisperm usually present. *Herbs*, rarely *Shrubs* or *Trees*. Lvs. exstip., usually alt., sometimes 0. 44 **Boraginææ.** 45. **Convolvulææ.** 46. **Polemoniææ.** 47. **Hydrophyllææ.**

Ord. 44. Boraginææ.—Infl. scorpioid. Style gynobasic or terminal. Carpels 2, each with 2 1-ovuled cells; ripening into 4 akaines or a 2-4-pyrened drupe. Perisperm 0 or scant. 75 gen., 1370 spec.; temp. and trop. regions, both worlds. Harmless; often emollient, medicinal. 4 Tribes:

Tribe 1. Style gynobasic. Akaines 4, rarely 2. Hispid herbs, rarely shrubs; harmless, often cordial, emollient. 58 gen., 688 spec.; chiefly in S. Eur., Middle Asia; rare in Am. 1. *Rochèlia* (only type here given with 2 akaines), small herbs. 2. *Cynoglòssum*, HOUNDSTONGUE, BEGGAR'S LICE, akaines prickly. Coarse weeds. 3. *Myosòtis*, FORGET-ME-NOT. Small herbs; fls. small, sky-blue or white with yellow eye. *M. palùstris*, prettiest spec. 4. *Alkàna*, *ALKANET*. Emollient herbs; fls. small, blue, purple, yellow, or white. One of the *Four Cordial Flowers*. *A. tinctoria*, rts. large, furnishing a red dye. 5. *Anchùsa*, BUGLOSS. Close to last. *A. crispa*, hairs, Fig. 106, 2. 6. *Symphytum*, COMFREY, ♀ bold herbs from rhiz. or tuber; fls. large, yellow, purple, blue. *S. officinale*, fl., vert. sec., Fig. 5, 2. 7. *Boràgo officinalis*, BORAGE. ☉, spreading, bristly; fls. without corolla-tube, blue or purple, handsome. One of the *Four Cordial Flowers*. **Tribe 2.** Style terminal. Akaines 4. 1. *Heliotròpium*, HÉLIOTROPE. ♀ herbs or undershrubs; fls. small, white or lilac. Many spec., chiefly trop. *H. peruviana*, finest; fls. vanilla-scented. Peru. **Tribe 3.** Style terminal, 2-lobed. Drupe 4-seeded. Shrubs or small trees; trop., both worlds. 1. *Tournefortia*, fls. like Heliotrope; shrubs, erect or twining; both worlds. *T. heliotropioides*, Buenos Ayres. 2. *Ehrètia*, fls. large, white. *E. buxifolia*, box-leaved shrubs. *E. serrata*, tree with fragrant fls., valuable wood. E. Ind. **Tribe 4.** Style terminal (rarely 0), twice-forked. Drupe 4-seeded. Shrubs or trees; both worlds. 1. *Cordia*. Fls. showy. 200 spec. *C. Mýxa*, tree, Asia. Cultivated in Egypt from immemorial time; wood made into mummy-cases. *C. Rùmphi*, tree, Asia; wood valuable, dark, mottled, musk-scented. *C. Gerascánthus*, tree, wood valuable, W. Ind.

Ord. 45. Convolvulacæ. MORNING-GLORIES. BINDWEEDS.—Characters of Alliance. Twiners, herbaceous or shrubby, rarely erect, often milky. 5 Tribes. **Tribe 1.** (Only tribe with sessile stigma.) Boll 1-celled. *Erycibe* Climbing shrubs, fls. showy, paniculate. 7 spec., trop. Asia. **Tribe 2.** Styles 2, boll 4-celled. Only gen., *Cuscuta* (*Cuscuta*, Continental accent), DODDER. Leafless, thread-like, amber-colored, twining parasites; fls. small, white. Common in hot and temp regions. Many spec. *C. Epilinum*, on Flax, Clover. Fig. 93; emb., Fig. 190, C. Eur. **Tribe 3.** Carpels 2-4; styles distinct, basilar. *Dichondra*, small prostrate herbs; fls. small; hot regions, both worlds. **Tribe 4.** Style simple. Boll 1-2-3-4-celled, 4-8-seeded. Usually twiners. 1. *Calystègia*, BRACED BINDWEED. Boll 1-celled, 4-seeded. Fls. large, showy, sol., involucrate. 14 spec., usually climbing. *C. sepium*, common. 2. *Convolvulus*. Boll 2-celled. ☉, ♀. Twining or trailing. *C. Cneòrum*, evergreen, shrubby; *C. tricolor* (*minor*), dwarf; *C. althæoides*, *C. italicus*, ♀, twining. S. Eur. 3. *Exogonium Purga*, similar, twiner; rt. is the Jalap of pharmacy. Fig. 87. Mex. 4. *Ipomœa*, boll 2-celled. **MORNING GLORIES.** Many fine species. 1. *pandurata*, WILD POTATO, fls. large, white, eye purple; rt. large. N. Y. to Ill., and Ga. 5. *Pharbitis*, similar, boll 3-celled. *P. hispida* (*Convolvulus major*), fls. of various colors; boll, Fig. 204. Eur. *P. Nil*, *purpurea*, showy. Am. species. 6. *Batatas*, boll 4-celled. 20 spec., twining; fls. large. *B. edulis*, SWEET POTATO. S. Am. 7. *Quamoclit*. Mex. name. Boll 4-celled. Fls. small, red or white, showy. ☉ twiners. Trop. Am., Asia. Q.

coccinea, BUSYBODY. Lvs. cordate, corolla-limb 5-angled. *Q. vulgaris*, CYPRESS QUAMOCLIT. Lvs. pinnatisect; corolla-limb 5-lobed. Mex. First run wild in S. States. 8. *Calonyction*. Boll 4-valved, 4-seeded. Herbaceous bold twiners, lvs. and fls. very large. 15 spec., trop. Asia, Am. C. *Bôna-Nôa*, MOON FLOWER, EVENING GLORY; corolla-tube 4' long, border 5' wide; vespertine; tropics. Tribe 5. Berry, 4-celled. Like last, but shrubby. 1. *Rivea*, fls. very often purple. 12 spec., trop., both worlds.

Ord. 46. *Polemoniaceæ*.—Characters of *Convolvulaceæ*. Boll 3-valved. 17 gen., 100 species; temp. regions, chiefly in Am. 1. *Cobæa*. 2, high-climbing by leaf-tendrils; lvs. pinnate; fls. large, sol., green, becoming violet. Sev. spec. Mex. C. *scandens*, best known; hair on sd., Fig. 106, 3. 2. *Polemonium*. 2. Erect; lvs. pinnate; fls. blue or white, panicle. P. *réptans*. 6'-10' high. Mid. States. P. *cæruleum*, JACOB'S LADDER, GREEK VALERIAN, 1°-3° high. Eur. 3. *Gilia*, STANDING CYPRESS. Herbs, erect; fls. and lvs. resembling *Quamoclit*. 65 spec. Kansas to Tex., Mex., Cal. 4. *Phlox*. 2 herbs, usually erect, 1°-4° high; lvs. simple, fls. showy, usually panicle. Many spec., N. Am. P. *stellaria* (*bifida*), STAE PHLOX. 10' high, turf; stems almost hair-like; lvs. small, linear; fls. large, lilac; tube curved, lobes deeply bifid. Rare, lovely species; local; in Mo., Ill., cedar glades about Laverne, Tenn.

Ord. 47. *Hydrophyllaceæ*.—Characters of *Polemoniaceæ*; but placentation parietal; boll 2-valved. 18 gen., 80 spec., chiefly in Am. Fls. usually blue; infl. scorpionoid. Herbs, usually small. 1. *Hydròlea*. Spiny or hispid marsh plants; sev. spec.; both worlds. The following American: 2. *Wigandia*, bristly foliage-plants; Brazil. 3. *Whitiàvia grandiflora*; Cal. 4. *Eutòca*, 5. *Phacelia*, more delicate; U. S. 6. *Cosmànthus*, corolla fringed; U. S. 7. *Nemòphila*, sev. spec.; Ark. to Cal. 8. *Hydrophyllum*, sev. spec.; forests, U. S.

Gentian Alliance.—§. Corolla mono- rarely sub-polypetalous, rarely 0. Sta. 2-4-5-10, epipetalous. Ova. usually syncarpous and 2-celled. Lvs. rarely alt. or stip. Herbs, Shrubs, Trees, with watery or milky juice, tonic, or poisonous. 48. *Gentianaceæ*. 49. *Loganiaceæ*. 50. *Asclepiadaceæ*. 51. *Apocynaceæ*. 52. *Salvadoraceæ*. 53. *Oleaceæ*.

Ord. 48. *Gentianaceæ*.—Corolla 5-4-6-8-merous, isostemonous; throat often with fringed ring. Carpels 2; boll 2-valved; sds. minute; perisperm copious. Ann. or perenn. Herbs or Shrubs. Lvs. exstip. 70 gen., 500 spec., both worlds. 2 Tribes. Tribe 1. Lvs. alt. Aquatic or marsh plants. 1. *Limnànthemum*; 2. *Villarsia*, both aquatic; 3. *Menyanthes*, in marshes; all with yellow or white fls.; throat usually fringed. Both worlds.

Tribe 2. Lvs. opp.; many gen. 1. *Ophelia elegans*, herb, fls. blue, throat naked. Ind. 2. *Crawfordia*. Twining herbs, fls. large. Nepal. 3. *Gentiana*, GENTIAN. Herbs. Corol. throat with teeth or folds, no fringe; lobes sometimes fimbriate (as in *G. crinata*, FRINGED G.) Lvs. ribbed. Many fine spec.; fls. blue or yellow in Alps; blue, Himalayas; red in Andes; blue, rarely white, U. S. *G. lutea*, tall; fls. yellow. Alps. Fig. 116. 4. *Lisianthus*. Shrubs or herbs; fls. long, pendent, often red; trop. Amer. 5. *Sabbatia*. Slender herbs. Corol. rotate, 5-12-merous, white or pink, corymbose. Many pretty spec. N. Am.

Ord. 49. Loganiaceæ.—Characters of Gentianaceæ; but lvs. stip., usually lanceolate; fr. sometime a drupe or berry. *Herbs, Shrubs, Trees.* 30 gen., 200 spec., trop., both worlds. 4 Tribes, several gen. in each. **Tribe 1. Berry.** 1. *Gaertnëra*, bushes or small trees. (Near Rubiaceæ also; but there the ova is adh.) 30 spec., W. Af. and islands, Malaysia. **Tribe 2. Berry.** 1. *Strýchnos*. Trees or climbing shrubs; fls. fragrant, sds. poisonous. Sev. spec., trop. Asia and Am. S. *Nîx-vómica*, tree; berry large, orange-like. S. E. Asia. Fig. 240. 2. *Desfontainea*. Evergreen shrubs; fls. scarlet, showy. Peru. **Tribe 3. Boll.** 1. *Logània*. Herbs or shrubs; inconspicuous. 16 spec., Australia, New Z. 2. *Spigèlia*, PINK-ROOT. Herbs. ☉, ♀. 30 spec., trop., sub-trop., Am.; rts. medicinal. S. *marilandica*, 1°-2° high; fls. showy, red without, yellow within. Penn., W. and S. **Tribe 4. Sds. winged.** *Norrisia*. Malayan shrubs.

Ord. 50. Asclepiadaceæ. MILKWEEDS.—Corol. reg., 5-merous, isostemonous; sta. with the filaments usually coherent into a tube around the ova., and furnished behind the anther with appendages forming a corona. Pollen-masses (pollinia) adherent to stigma. Ova. 2, distinct, styles appressed, united by a common 5-angled stigma. Fr. 2 follicles, or 1 by arrest. Sds. ∞, often comose. Perisperm rarely 0. Woody (rarely herbaceous) plants with milky, often poisonous, juice; often climbing; sometimes fleshy, leafless. Lvs. opp., rarely whorled or alt.; petioled, simple, entire. Fls. in umbels or panicles, rarely sol. 141 gen., 1000 species, chiefly trop., both worlds. 5 Sub-Orders; distinctions in pollinia and coronæ.

Sub-Ord. 1. Twining plants and fleshy, leafless herbs. Old World. 1. *Stapèlia*, fleshy, leafless; fls. large, star-shaped; handsome, but fetid. 100 spec., Cape of Good Hope. 2. *Höya*, twining, or creeping by adventitious rts.; lvs. fleshy, fls. umbelled. Many fine spec., trop. Asia. 3. *Stephanôtis*. Climbing shrubs; fls. large, fragrant, white, umbelled. Few spec., Madagascar. **Sub-Ord. 2.** Perenn. twiners, Am. 1. *Gonölobus*. Lvs. cordate, fls. rotate, dull-colored. 60 spec., N. Am. **Sub-Ord. 3.** Many gen. 1. *Asclèpias*. Erect herbs with rather small but showy umbelled fls. Many spec., Am., few in Asia. A. *ácida*, SOMA PLANT, sacred in India. A. *tuberösa*, BUTTERFLY WEED, U. S.; fls. orange. Fig. 172. A. *curasávica*, S. Am., fls. scarlet. A. *incarnàta*, fls. pink; sd., Fig. 195, A. Swamps, U. S. **Sub-Ord. 4.** Few gen. 1. *Secamöne*, 30 spec., ev. climbing or decumbent shrubs. S. Af., Ind., Australia. **Sub-Ord. 5.** Few gen. 1. *Períploca*, 6 species, twiners, ornamental; trop. Asia, Af.; one, P. *græca*, reaching to S. Eur.

Ord. 51. Apocynaceæ. DOGBANES.—Like Asclepiadaceæ; but pollen granular; anth. sometimes coherent; fls. large, showy, usually fragrant; carpels 2, sometimes 3-4; fr. follicle, boll, or berry. *Trees or Shrubs*, often climbing or perennial *Herbs*; milk usually poisonous; sometimes wholesome. 100 gen., 600 spec., intertrop., both worlds. 4 Tribes:

Tribe 1. Follicle. 1. *Plumièria*. Trees or shrubs; lvs. fleshy, tufted. Sev. spec. P. *rùbra*, RED JESSAMINE, FRANGIPÁNNI; fls. red, very fragrant. S. Am. 2. *Mandevillea* (*Echites*) *suavèolens*, CHILI JESSAMINE, POETS' J. Only spec.; tall twining shrub; fls. white, fragrant. Chili. 3. *Parechites*, similar, sev. spec.; fls. white, yellow, rose; Ind., China, Japan, Borneo. 4. *Gelsèmium* (better *Gelsèminum*; best *Gelsòminum*; see Etymons, I.). Only spec. G.

sempervirens, YELLOW JESSAMINE. Evergreen high twining shrub; fls. yellow, fragrant. Va. to Miss., S. to Gulf. 5. *Wrightia*, shrubs or climbing trees. *W. tinctoria*, PALAY. Climbing tree, wood ivory-like, valuable. S. Ind. Fig. 145. 6. *Nerium*. Erect shrubs. *N. Oleander*, OLEANDER; 10°-20° high; fls. fragrant, white, yellow, rose; sta. 168, A. Ind. 7. *Apocynum*, DOGBANE. Erect herbs; ♀; fls. pale. *A. cannabinum*, INDIAN HEMP, U. S. 8. *Vinca*, PERIWINKLE. Small, erect or trailing herbs; ♀; fls. blue, purple, white. Old World. Sev. spec. 9. *Tabernæmontana*. Shrubs or very tall trees; fr. and milk wholesome. Many spec., tropics. *T. utilis*, HÏA HÏA, tall Cow TREE, similar to *Galactodéndron*. Guiana. Tribe 2. Fr. 2 drupes, 1 usually abortive. 1. *Tanghinia venenifera*, TANGHIN, only spec. Tree. Sds. deadly poisonous. Madagascar. Tribe 3. Berry or boll. 1. *Landóphia*, S. Af.; and 2. *Willughbéia*, S. Asia; trees, shrubs; each with sev. climbing spec.; yielding Ind. Rubber. Berry orange-like, edible. 3. *Allamánda*. Boll 2-valved. Handsome climbing shrubs with gorgeous golden fls. Sev. spec., S. Am., chiefly Brazil. Tribe 4. Berry. 1. *Carissa*. Peduncles often reduced to spines. Shrubs; sev. spec., wood bitter, berries edible. Asia, Australia, Mauritius, Bourbon.

Ord. 52. *Salvadoracææ*. OUR SAVIGUR'S TREES.—Corol. 4-merous, sta. 4, epipet. Near to *Oleacææ*. Small *Trees* or *Shrubs*. 1. *Salvadóra pérsica*, OUR SAVIOUR'S TREE, MUSTARD TREE of Scripture. Berry small. Syria. Long considered monotypic; but 4 other species have been discovered, besides 2 other gen.: 2. *Monétia*, shrubs; berry as large as a pea; 3. *Dóbera*, trees; berry warty; all ranging through Af., Asia, E. Ind.

Ord. 53. *Oleacææ*. OLIVES.—Fls. ♂; rarely ♂ ♀, and apetalous. Sta. 2, epipet. Corolla 4-fid; in *Jasminacææ* 4-5-6-lobed. Fr. 1-2-celled; a berry, drupe, boll, or languette. *Shrubs* or *Trees*, often climbing. Lvs. simple or compound, opp. or alt. 20 gen., 150 spec., temp. and trop. regions, both worlds. 3 Sub-Orders:

Sub-Ord. 1.—Languette or boll. 1. *Fráxinus*, ASH. Fls. ♀ ♂ or ♂ ♀, apet. Lvs. imparipinnate. Fr. a languette. *Trees* or *Shrubs*; many species, both worlds. American, lfts. 7-9: *F. americana*, WHITE A., 60°-80° high. *F. pubescens*, RED A. Similar, 40°-60° high. *F. quadranguláta*, BLUE A., 50°-70° high. U. S. *F. excélsior*, 70°-80° high, lfts. 11-13. Eur. Fig. 8. Many varieties with weeping branches. 2. *Órnus*, FLOWERING A., MANNA A. Like *F.*, but petalous. *O. europaèa*, 20°-30° high. S. Eur. 3. *For-sýthia*. Languette. Shrubs, willow-like, hardy; lvs. simple; handsome yellow ♂ fls. preceding lvs. in spring. China, Japan. 4. *Syringa*, LILAC. Boll. 10°-20° high; fls. ♀, paniced, fragrant, purple or white. 6 spec., many varieties. S. E. Eur., E. Asia. Sub-Ord. 2. Drupe or berry. 1. *Ligústrum*, PRIVET. Shrubs or trees; like Lilac, except in fr. Berry 2-seeded. 21 spec. Japan, China, N. Ind. 2. *Chionánthus virginica*, FRINGE-TREE. Shrub or small tree; corolla white, lobes ligulate, 1' long; fls. ♀, in drooping, graceful panicles; lvs. decid., large, entire. Drupe blue. Penn., Southward. 3. *Osmánthus*. Evergreen shrubs; fls. ♂, very fragrant, white, red. China, Japan. 4. *Ólea*, OLIVE. Evergreen shrubs or trees, 20°-50° high, with valuable mottled wood. Fls. ♂, fragrant. Fr. an oily drupe. 30 spec., Asia, Af., Australia, New Z., U. S. *O. sativa*, CULTIVATED

OLIVE, 30° high, branchy; fls. white. Fig. 71. Asia. Many cultivated varieties. *O. americana*, AMERICAN OLIVE, DEVILWOOD. ♂ ♀. Trees, 20°-30° high; lvs. lanceolate, shining; fls. small, white, fragrant, racemed. Drupe small, purple. Va. to Fla. **Sub-Ord. 3.** Lvs. 1-3-5-7-foliolate. Fls. ♀, corolla 4-5-6-lobed. Berry or boll. 1. *Nyctánthes arbor-tristis*, INDIAN JASMINE, SOMNAMBULIST, SAD TREE. Boll. Shrub or small tree; fls. highly fragrant; white border with yellow eye and tube; very showy; but expanding only at evening and falling at sunrise. E. Ind. 2. *Jásmínium*, JASMIN, JESSAMINE. Berry. Erect or climbing shrubs; fls. white or yellow, very fragrant. Many spec., chiefly in Old World. *J. officinális*, fls. white, lfts. 7. E. Ind. *J. revolutum*, erect, bushy, fls. yellow, large, lfts. 3-7. China. *J. Sámbar*, 1-foliolate, fls. white, often double; E. Ind.

Ebony Alliance.—Fls. ♂ or diclinous. Corolla mono- or polypetalous. Sta. equal to or multiples of corolla-lobes. Ova. free (adh. in *Styracaceæ*), 2-∞-celled. Fr. a berry or drupe, rarely a boll. Perisperm copious, rarely scant. *Shrubs* or *Trees*; lvs. alt., exstip. 54. **Styracaceæ.** 55. **Cyrillaceæ.** 56. **Ebenaceæ.** 57. **Sapotaceæ.**

Ord. 54. Styracaceæ.—Lvs. simple. Sta. mono- or polyadelphous. Fls. ♂, usually white. 6 gen., 115 spec., trop., sub-trop., both worlds. 3 Tribes. **Tribe 1.** Sta. 5-10; corolla 5-fid. Ova. free, 3-celled. 1. *Pamphilia*. *Trees*, clothed with russet wool. Fls. small, clustered. Brazil. **Tribe 2.** Ova. adh. Sta. 1-seriate. 1. *Halésia*. SNOW-DROP TREE. Fls. 4-merous. Sta. 8-12. Corolla bell-shaped, 4-cleft or -petalled, snow-white, in pendulous showy clusters, adventitious, and appearing before the lvs. Drupe oblong, dry, pod-like, winged; 1-3-seeded. *H. tetráptera*, 10°-20° high; drupe 4-winged. Va., Ky., to Fla. *H. diptera*, fls. larger. Tree, 20°-50° high; drupe 2-winged. Car. to Fla., W. to Ark. 2 fine trees in the grounds of St. Cecilia Academy, Nashville, Tenn. 2. *Stýrax*. Fls. 5-merous; sta. 10; drupe 1-celled, 1-seeded. Fls. drooping, white, showy, racemed. Many spec. *S. grandiflora*, *S. pulverulenta*, *S. americana*, Va. to Fla. *S. officinále*, shrub, yields STORAX; Levant. *S. Benzoin*, tree, yields the resin BENZOIN, used as incense in Catholic churches. Sumatra, Borneo. **Tribe 3.** Corol. sub-polypetalous; sta. ∞, sometimes polyadelphous. Drupe 1-3-seeded. Only gen. *Sýmplocos*. Many spec., evergreen trees or shrubs; fls. fragrant, racemed or clustered; trop. Asia, Am. *S. tinctoria*, SWEETLEAF, 10°-20° high; fls. yellow, clustered; lvs. yield a yellow dye. Va. to Fla., La.

Ord. 55. Cyrillaceæ.—Fls. ♀, 4-5-merous, racemed; anthers with longitudinal or porous dehisc. Ova. free, 2-4-celled. Perisperm copious. Lvs. alt., entire, exstip. *Shrubs* (near *Ericaceæ* and *Pittosporaceæ*). 4 gen., 6 spec., N. and S. Am. 1. *Purdiaea*. Fls. 5-merous, sta. 10. Handsome evergreen; fls. pink, in drooping terminal racemes. Anth. with apical porous dehiscence. Fr. a 4-celled, 4-seeded nut. New Granada. 2. *Cliftónia ligustrina* (*Mylocárium ligustrinum*), TI-TI, BUCKWHEAT TREE. Fls. of 1. Evergreen, 6°-8° high; fls. white, fragrant, in terminal racemes. Drupe dry, 2-3-winged, resembling Buckwheat. Swamps. Ga., Fla., S. Ala. 3. *Cyrilla racemiflora*. Fls. of 1; sta. 5. 12°-15° high. Lvs. decid.; fls. white, small, racemed. Boll fleshy, 2-valved. Swamps, N. C. to Fla. 4. *Elliottia racemosa*. Fls. 4-merous, sta. 8. Boll 4-celled. Lvs. decid. 4°-6° high. S. Ga.

Ord. 56. Ebenaceæ.—Fls. ♀ ♂ by abortion, rarely ♂. Corol. 3-4-5-6-lobed; small; sta. equal to or some multiple of lobes. Ova. free, 3-∞-celled. Fr. a large berry, edible, usually few-seeded. *Trees* or *Shrubs*; wood dark or black, valuable. 5 gen., 256 spec. Both worlds, chiefly trop. 1. **Euclæa**, GUARRY. Low shrubs. Fls. white. 20 spec., S. Af., Abyssinia. 2. **Royèna**, similar, fls. ♂. 20 spec., S. Af. 3. **Diospýros**, EBONY, ♀ ♂; trees; rarely shrubs; 100 species, yielding the EBONY wood of commerce; 12 in Am.; 3 or 4 in Af.; the rest in the Mauritius and Asia. The finest wood is furnished by *D. reticulata*, Mauritius; *D. Ebenum*, Ceylon. Fig. 228. Many have delicious fruits; *D. Kâki*, DATE PLUM, or PERSIMMON; berry red, as large as a pear. China. *D. Lôtus*, LOTUS PLUM, 50° high; berry as large as a cherry. S. Eur. *D. virginiana*, PERSIMMON, PLAQUEMINE, 20°-60° high; berry 1½' in diam., orange-red. N. Y. to Ill., and S. 4. **Mâba**. Shrubs or trees, 20 spec; trop. Af. and Asia, Pacific Islands, Australia. 5. **Tétracelis**, large tree, fls. ♂. Madagascar.

Ord. 57. Sapotaceæ.—Fls. ♂, fragrant. Characters of Ebenaceæ, but with milky juice. Fr. a drupe or berry; often edible. Branchlets often reduced to spines. 21 gen., 212 species, chiefly trop., both worlds. 1. **Bumélia**. Fls. 5-merous, sta. 5, staminodes 5; fr. a drupe. Sev. spec., U. S. **B. ténax**, 20°-30° high, S. C. to Fla., La. **B. lycioides**, similar, Ky., N. C. to La. 2. **Isonândra**. 11 species, often lofty trees; S. Ind., Ceylon, Malaysia. 1. **Gútta**, GÚTTA PÉRCHA TREE, 60° high; milk is the Gutta Percha of commerce. Fig. 149. Borneo, Sumatra. 3. **Sideróxylon**, lofty trees, 20-30 species, both worlds; wood so hard it sinks in water; berries often delicious. 4. **Mimusops**, lofty trees, 30 spec., both worlds. **M. Eléngi**, fr. and fl. delicious. 5. **Bássia**, BUTTER TREE. Sev. spec.; sds. yield butter. W. Af., Bengal. 6. **Lucúma**, lofty trees, 30-40 spec., W. Ind., trop. Am. **L. mammôsa**, MARMALADE TREE; fr. large, delicious. 7. **Sapôta**. Trees, trop. Am., Australia. **S. Achras**, SAPODILLA; fr. delicious. W. Ind. 8. **Chrysophýllum**, STAR-APPLE. Fine trees; lvs. golden-haired beneath; berry with 10 radiating cells. W. Ind. **C. Cainito**, fr. as large as an apple, delicious.

Primrose Alliance.—Characters of last Alliance; but ova. 1-celled, placentation basal, free; *Herbs* or *Shrubs*, not milky; rarely *Trees*; lvs. sometimes opp.; fr. a drupe, berry, boll, pyxidium, rarely follicle; ova. adh. in *Maësa* (Myrsinaceæ), *Sámolus* (Primulaceæ). 58. **Myrsinaceæ**. 59. **Primulaceæ**. 60. **Plumbaginaceæ**. 61. **Plantaginaceæ**.

Ord. 58. Myrsinaceæ.—*Trees, Shrubs*. Fls. sometimes diclinous. Fr. a drupe or berry; sds. often edible, sometimes poisonous. 33 gen., 300 spec.; trop., both worlds; chiefly insular. 3 Tribes. **Tribe 1**. Fls. ♂, 5-merous; sta. 5, staminodes 5. 1. **Jacquinia**, handsome evergreen bushes; fls. vermilion, umbelled or racemed; berries (and often seeds.) bright yellow. Sev. spec., littoral, Fla. to Brazil. Lvs. and fr. poisonous. 2. **Theophrásta**. Handsome evergreen shrubs; lvs. long, spiny, holly-like, tufted; fls. ♀, racemed; berry ∞-seeded; sds. edible. Sev. spec. W. Ind. **T. Jussieuii**, PETIT COCO; sds. made into bread. **Tribe 2**. Ova. adh. Only gen. **Maësa**. Trees or shrubs; sev. spec.; fls. ♀, small, racemed. Af. Asia, Australia. **Tribe 3**. Berry 1-seeded. 1. **Ardisia**. 100 spec. Fine evergreen shrubs or small trees; fls. ♂, white or rose, in showy panicles; berries showy. Am., Ind., Ind.

Archipelago. 2. *Mýrsine*. Shrubs or small trees, usually evergreen; fls. ♀ ♂, small, clustered. Many spec., both worlds.

Ord. 59. *Primulaceæ*.—Like last; but *Herbs* with woody or tuberous rhiz. Fr. a boll or pyxidium. Fls. ♂, usually showy; umbelled, racemed, or sol. 30 gen., 250 spec.; temp. or cold regions, N. hemisphere. 4 Tribes. **Tribe 1.** Ova. half-adh. Only gen. *Sámolus*. 5 staminodes. Fls. white, racemed. Marsh plants, branching; lvs. alt. S. *Valerándi*, both worlds. **Tribe 2.** Aquatic. Only gen. *Hottônia*. Lvs. rad., pectinate, submerged; tufted; scape sol., long, terminating in a pyramid of white or purple fls. *H. infláta*, FEATHERFOIL. Swamps, Mass. to Fla. and La. *H. palústris*, WATER VIOLET, beautiful; fls. lilac and white; ditches, pools. Eur. **Tribe 3.** Pyxidium. 1. *Anagállis*, PIMPERNEL. ☉, ☿. Dwarf, trailing, lvs. opp.; fls. showy, axil. *A. arvensis*, fls. red; *A. latifolia*, fls. blue. N. Eur. *A. collina*, fls. larger, red. Barbary. **Tribe 4.** Boll, opening at top. Stem, with opp. lvs.; or stemless, lvs. from rhiz. or corm. 1. *Lysimáchia*. Fls. yellow. Sev. spec., both worlds. *L. Nummulária*, MONEYWORT; stems trailing; lvs. penny-shaped. Eur. *L. ciliáta*, ☿; erect, 2°–3° high; lvs. cordate; fls. large. Can., U. S. 2. *Trientalis*. St. low; lvs. and fls. at top. *T. americana*; fls. star-like, 7-merous, pedicelled. Woods, N. 3. *Cýclamen*. Lvs. rad., from a corm; round, showy; fls. 5-merous, nodding, lobes reflexed. Few spec. *Medit. States*. *C. europæum*, fls. long-peduncled. Fig. 245. 4. *Dodecátheon Meddia*, AMERICAN CYCLAMEN. Similar; but lvs. spatulate, rad. from a rhiz.; scape 8'–2° high, with an umbel of 12 or more slender-pedicelled, nodding, pink or white fls. 5. *Primula*. Rhiz., lvs., and infl. of last; but fl. lobes not reflexed; fls. usually yellow. Many spec., Old World. *P. Aurícula*, AURICULA; *P. vulgáris*, *P. scôtica*, PRIMROSE; *P. vèris*, COWSLIP; *P. elátior*, OXLIP; Fig. 5, 1; Fig. 189, D. Eur.

Ord. 60. *Plumbaginaceæ*.—Close to *Primulaceæ*; but sometimes *Shrubs*; ova. 1-celled, 1-ovuled; ov. suspended from a long funiculus erect from bottom of cell. Fls. ♂, 5-merous, calyx showy; on scapes, in unilateral spikes, panicles, or hds. 11 gen., 250 spec. Sea-shores, temp. regions. 2 Tribes. **Tribe 1.** Utricle or pyxidium. 1. *Acantholimon*, low, juniper-leaved, spiny herbs, on rocks; fls. pink, calyx white. 40 spec., showy; Levant. 2. *Státice*. Herbs; broad-leaved; scape branching; pedicles often alate. Many ornamental spec.; fls. lavender, white, pink, red. S. Eur., Canaries, Cent. Asia. S. *Limónium*, SEA-LAVENDER. 1°–2° high, fls. lavender color. Newfoundland to S. Car. 3. *Armèria*, THRIFT. Evergreen tufted herbs; lvs. linear; fls. pink, purple, white, in hds. Sev. spec. Eur. *A. vulgáris*, fls. pink. Ova., Fig. 195, D. **Tribe 2.** Boll; dehisc. apical. 1. *Plumbágo*, LEADWORT. Herbs or shrubs; fls. spiked; rts. acrid. Sev. spec. *P. capénsis*, shrub, scrambling; fls. lead-blue. S. Af. *P. coccínea*, fls. red. E. Ind. *P. cerúlea*, fl. blue. Chili.

Ord. 61. *Plantaginaceæ*.—Fls. ♂, ♀ ♂, ♂; usually 4-merous; spiked. *Herbs*, ☉, ☿. 3 gen. 1. *Bouguèria*. Small, ☿; lvs. white, linear, tufted from a fleshy rhiz.; fls. ♀ ♂ ♂, in common peduncled hds.; nut 1-seeded, bony. Peru. 2. *Littorèlla* Small, ☿, lvs. linear, fleshy, rad., tufted from a rhiz.; fls. ♂; ♀ sessile in the leaf-axils; ♂ on scapes 2'–3' high; nut as in last. Lake-shores, Eng. and Scot-

land. **3. Plantago.** Pyxidium 1-4-celled, 1- ∞ -seeded. ☉, ♀. Lvs. from rhiz.; rosulate, alt., or opp., fls. spicate. Many spec.; weeds. *P. major*, GREAT PLANTAIN; lvs. large, ribbed. Fig. 136. Eur. Naturalized, U. S. *P. virginica*, ♂ ♀. Small, spatulate lvs. Sands, S. States. Sev. other Am. species.

Heath Alliance.—Fls. ♂ (diclinous by arrest in some Epacridæ), 4-5-6-8-10-merous; sta. as many or twice as many as corolla-lobes; ova. 1- ∞ -celled, cells 1- ∞ -seeded; sds. minute. *Herbs, Shrubs, Trees.*

62. Lennoaceæ. 63. Diapensiaceæ. 64. Ericaceæ.

Ord. 62. Lennoaceæ.—Fleshy, leafless root-parasites resembling Monotrøpeæ; fls. 6-8-10-merous; sta. epipetalous; anth. 2-celled, dehisc. longitudinal. Ova. ∞ -celled; fr. fleshy, dehisc. irreg. 3 gen., 4 spec. **1. Ammobroma;** fls. covering the upper surface of a concave receptacle. Sonora. **2. Pholisma;** fls. 6-merous, spicate. Cal. **3. Lennoa;** fls. 8-merous, sta. 2-seriate. Mex.

Ord. 63. Diapensiaceæ.—Fls. 5-merous. Boll 3- rarely 4-celled; ∞ -seeded. *Undershrubs or Herbs.* 4 gen., 2 Tribes. **Tribe 1.** Stemless herbs from ♀ rhiz.; lvs. evergreen, petioled, dentate; scape tall, leafless. Staminodes 5, sta. 5, anth. 1-celled, dehiscing transversely. **1. Galax aphylla,** only spec.; scape white, 1^o-2^o high; fls. small, white, racemed. Woods, Va., S. **2. Shortia galacifolia.** Similar; scape 1- or few-flowered. Japan; Mts. of N. Car. **Tribe 2.** No staminodes, anth. 2-celled, dehisc. transverse. Fls. sol. Dwarf evergreens, stems tufted, lvs. small. **1. Diapensia.** Fls. white, peduncled. *D. lapponica*, Lapland, N. Eur., N. Asia, White Mts., N. H. *D. himalaica*, Himalaya Mts., Asia. **2. Pyxidantha barbata,** only spec.; prostrate, creeping; fls. sessile, white or rose. Pine barrens, N. J., southward.

Ord. 64. Ericaceæ.—5 Sub-Orders. **Sub-Ord. 1. Epacridæ.** AUSTRALIAN HEATHS. Fls. 5- rarely 4-merous. Anth. 1-celled. Drupe, with ∞ 1-seeded pyrenes; or boll, ∞ -seeded. Shrubs or small trees; lvs. alt., rarely opp. 32 gen., 336 spec. Australia, New Z., Ind. Archipelago. **Tribe 1.** Boll. Many gen., sometimes trees. **1. Epacris.** Shrubs, heath-like; fls. tubular, red, white, purple. Many ornamental spec. Australia, New Z. **Tribe 2.** Berry, cranberry-like, often edible. Numerous gen. **1. Styphelia. 2. Lissanthe.** Shrubs. Australia.

Sub-Ord. 2. Vacciniæ.—Ova. adh. Corolla-lobes 4-5-6; sta. twice as many, on an epigynous disk; anth. 2-celled, dehiscing by 2 pores at top. Berry or drupe, 4- ∞ -seeded. Branching shrubs or small trees, often evergreen. 15 gen. **1. Vaccinium, WHORTLEBERRY.** Berry, ∞ -seeded. Corol. 4-5-fid, urn- or bell-shaped, white or red-tinged; berries blue or black, edible. Shrubs or small trees; fond of mts. *V. arboreum*, TREE W. 8^o-15^o high, evergreen; fls. rose-white. N. C. to S. Ill., southward. *V. corymbosum*, 5^o-10^o high; swamps, Can. to Fla. *V. uliginosum*, 6'-18' high, lvs. decid. Gt. Brit., N. Eur. Sta., Fig. 168, F. *V. myrsinites*, 1^o-2^o high; fls. pink. N. C. to Fla. *V. pennsylvanicum*, 6'-18' high, fls. red-white. Penn. to N. Ill., North. **2. Gaylussacia, BLUEBERRY.** Corol. 5-merous. Drupe with 10 pyrenes; blue or black, edible; fls. red or white; lvs. often terminating in a spine. *G. resinosa*, 1^o-3^o high; berries black. *G. frondosa*, 3^o-6^o high, berries blue; all from N. Eng. to Ky., south. *G. brachycera (buxifolia)*, BOX-WHORTLE-

BERRY. Box-like, 1° high; fls. white, red-tinged, racemed. Mts. Va. **3. Macleania.** Corol. 5-merous, red or yellow. Handsome shrubs. Peru. **4. Oxycoccus,** CRANBERRY. Corol. 4-merous, berries red, acid. *O. palustris*, st. creeping; Alpine bogs, N. Asia, N. Eur., N. Am. above lat. 42°. *O. macrocarpus*, st. prostrate; peat bogs. Va. to Wis., North. **5. Chiogenes hispídula,** CREEPING SNOW-BERRY. Corol. 4-merous; st. creeping, evergreen; berries white. Bogs N. Am., north of lat. 42°.

Sub-Ord. 3. Pyrolææ.—Ova. free. Corol. 5-merous. Boll ∞-seeded. Evergreen herbs. 6 gen., 20 spec. N. hemisphere. **1. Chimaphila,** PIPSISSEWA, PRINCE'S PINE. 3'-10' high, fls. wax-like, flesh-colored, fragrant, umbelled. Woods, Siberia, N. Eur., N. Am. **C. umbellata,** 4-7 fls. N. States, Can. **C. maculata,** 1-5 fls., lvs. spotted. Can. to Car., Tenn. **2. Pyrola,** WINTERGREEN. Fls. racemed, white or purple; lvs. rad. Several spec. in U. S. **P. rotundifolia.** Scape 6'-12' high; fls. large, white, nodding, fragrant. Can. to Car., W. to Wis.

Sub-Ord. 4. Monotrœæ.—Ova. free. Corol. 4-5-merous. Boll ∞-seeded. Leafless root-parasites, never green; small. 6 gen., 11 spec. N. hemisphere. **1. Newberrya congesta,** fls. capitate. N. Pacific States. **2. Schweinitzia odorata,** fls. capitate, violet-scented. Md. to N. C. **3. Monotropa.** 6 spec.; both worlds. **M. Hypopitys,** PINE SAP; fls. racemed. Can. to Car., W. to Wis. **M. uniflora,** INDIAN PIPE; clay color, fl. large, terminal, nodding. Can., U. S. common.

Sub-Ord. 5. Ericinææ.—Ova. free. Corol. 4-5-merous. Anth. 2-celled; cells sepa. at base or top; dehisc. porous. Fr. ∞-seeded, sds. minute; boll, berry, or drupe. . 50 gen., 900 spec. 4 Tribes:

Tribe 1. Rhododéndrons. Boll. Corol. 5-merous, sometimes irreg.; decid. **1. Leiophyllum buxifolium,** SAND MYRTLE. Only spec.; evergreen, 6'-10' high; fls. white, umbelled. N. J., mts. of Va, Tenn., N. C. **2. Lédum,** low shrubs. N. hemisphere. **L. latifolium,** LABRADOR TEA, 2°-5° high; lvs. ferruginous, fls. white, racemed. Mt. bogs, Penn. to Brit. Am. **3. Befária (Bejária),** Handsome evergreen shrubs, fls. large, showy. Peru, Mex. Sev. spec.; one, **B. racemosa,** in E. Ga., Fla., and adjacent islands; 2°-4° high, fls. white, red-tinged. **4. Rhodora canadensis,** 2°-3° high; fls. irreg., large, pink. Can. to Penn. **5. Rhododéndron.** Fls. irreg., large, red or white, often fragrant. Many spec., usually evergreen. N. Am., Eur., Asia, finest and most abundant in India. **R. lapponicum,** 5' high. Lapland. **R. Rollissonii,** 30° high, 4° in girth. Ceylon. **R. Falcòneri,** 50° high, lvs. 19' long. **R. Dalhousiæ,** straggling, 8° high, fls. white, fragrant; epiphytal on limbs of large trees. Himàlayas, 9000 ft. above sea. **R. catawbiense,** 3°-6° high, fls. purple. Va. mts., S. **R. maximum,** 6°-20° high, lvs. 10' long, fls. pale rose or white, spotted with red or yellow. Va. mts. to Maine and Can. **6. Azàlea.** Lvs. decid.; fls. irreg., large, white, or of various showy colors; corol. funnel-shaped, lobes spreading. 20 spec., N. Am., Ásia. **A. arborescens,** 10°-20° high, fls. rose. Mts., Penn. to Ga. **A. calendulæcea,** fls. yellow or crimson. Penn. to Ohio and Ga. **A. nudiflora,** 5°-10° high; fls. before lvs.; white, pink, yellow, purple, fragrant, S. **A. viscosa,** 4°-10° high; fls. with lvs.; white or rose, fragrant. Mass. to Ill., South. **7. Loiseleuria procumbens,** ALPINE AZÀLEA. Only spec.; evergreen, 3'-8' high, fls. small, white or pink. N. Asia, N.

Eur., Scotch Highlands, White Mts., N. H. 8. *Kálmia*. Corol. wheel-shaped, 5-merous; sta. with long filaments; anth. separately lodged in 10 sacs in corolla-tube. Fls. white or red. *K. hirsûta*, 1° high, fls. pink. E. Va., S. *K. angustifolia*, 2°-3° high; fls. purple. Can. to Car., W. to Ky. *K. latifolia*, MOUNTAIN LAUREL, fls. large, profuse, in corymbs; white, tinged with red; lvs. 3' long, laurel-like. 4°-20° high. Maine to Ohio, Ky., S. to Fla. 9. *Menziëria ferruginea*, 4° high; lvs. decid.; fls. 4-merous, purple. Mts. Va., Penn., N. W. 10. *Phyllodoce taxifolia*, fls. similar; evergreen, heath-like; stems 10' long. Mts. N. H., Maine, N. Tribe 2. Heaths, evergreens. Boll. Fls. 4-merous; corol. persist. Sev. gen., Old World. Types: 1. *Callûna vulgaris*, LING, HEATHER. Sepals large, colored; corolla smaller, spreading; stems usually 1° high; sometimes 4°. Fls. racemed, honey-bearing; purple, red, white. Abundant all over Eur., especially in the N.; found in Iceland, Greenland, Kamtschatka, Nova Scotia, Newfoundland, Maine, Mass. Fig. 72, 3. 2. *Erica*, HEATH. Calyx green, smaller than corolla, lvs. needle-shaped; fls. red, purple, white, carneous. Eur., S. Af. *E. cinërea*, lvs. 3 in a whorl; fls. purple. 6'-1° high. Cent. Eur.; abounding and beautiful in Gt. Britain. Fig. 72, 2. *E. Tétralix*, lvs. 4 in a whorl; fls. in terminal hds., red, white, carneous. Bogs, N. Eur.; plentiful in Gt. Brit. 6'-2° high. Fig. 72, 1. *E. arborea*, 10°-20° high, fls. white. S. Eur. Many fine Cape spec. (S. Af.). Tribe 3. *Andrómédas*. Corol. 5-merous; decid. Lvs. often decid. Shrubs or trees, many spec. Mts. N. Am., Eur., Asia; fls. white or red. Nearly 20 spec. (including *Zenöbia*) in U. S. 1. *Andróméda floribûnda*, evergreen, 2°-10° high, fls. white, paniced. Mts. Va. to Ga. *A. nitida*, evergreen, 3°-6° high; fls. rose, fragrant. N. C. to Fla. 2. *Oxydéndron arbóreum*, only spec., SORREL TREE, 40°-50° high, straight, lvs. tinted, acidulous; fls. urceolate, white, in panicles of spicate racemes. Penn. to Ohio, S. to Fla. 3. *Cléthra*. Shrubs, trees. N. and trop. Am.; fls. white, racemed. *C. acuminâta*, 10°-18° high. Mts., along streams, Ky., Va., S. *C. alnifolia*, 2°-8° high, fls. fragrant. Swamps, Can. to Ga. 4. *Gaulthëria*. Evergreen shrubs or small trees; many spec. N. and S. Am., Asia, Java, Tasmania, New Z. Lvs. leathery; fls. white, scarlet, rose; calyx accrescent, berry-like, enclosing the boll. *G. procumbens*, CREEPING WINTERGREEN, spreading, rooting; berries red. Only spec. in U. S. 5. *Epigæa repens*, TRAILING ARBUTUS, evergreen, stem 10'-15' long, fls. white, red-tinged, fragrant. Newfoundland to Penn. and Ky. Tribe 4. *Arbutus*. Evergreens. Berry or drupe. 1. *Arctostaphylos*. Many spec., both worlds. Procumbent shrubs; fls. white, racemed or clustered. *A. ûva-ûrsti*, BEARBERRY. Drupe red. N. J. to Wis. N.; N. Eur. 2. *Arbutus*. 25 spec., trees or shrubs; fls. white or red, paniced. S. Eur., Canaries, Chili, N. Am. *A. ûnedo*, STRAWBERRY-TREE, 20°-30° high; berry strawberry-like. W. Ireland, S. Eur., Asia.

Subdivision II.—Ovary usually adherent.

Campánula Alliance.—Fls. usually irreg.; rarely diclinous or in involucrate hds. Corol. 4-5-merous, sta. 2 or 5, anthers (and sometimes filament) coherent in a column around the style. Ova. 2-6-rarely 1-celled. Perisperm present. Lvs. simple, exstip. 65. **Lobeliæcæ.** 66. **Campanulæcæ.** 67. **Goodeniæcæ** (ova. free in *Brunönia*). 68. **Stylidiæcæ.**

Ord. 65. Lobeliaceæ.—Fls. ♂, rarely ♀ ♂, racemed, spiked, rarely in a corymb or hd.; 1-2-labiate, rarely with 5 free petals. Sta. 5. Berry or boll 2-3-1-celled, cells ∞-seeded. *Herbs*, rarely *Shrubs*, 29 gen., nearly 400 spec.; chiefly trop., both worlds. 1. *Lobelia*. Boll. Corol. 2-labiate, tube split. *Herbs*. Many spec., abundant in Am., found in Old World; fls. showy, red or blue. *L. cardinalis*, 2°-4° high, fls. scarlet. Can. to Car., W. to Ill. *L. fulgens*, similar, but finer. Mex. Many blue-flowered spec. in U. S. *L. inflata*, erect, 10'-15' high, medicinal. Can., U. S. *L. Gattingeri*, delicate, 6'-20' high, fls. deep blue. Mid. Tenn. 2. *Downingia elegans*, similar, boll longer, 1-celled. ☉. Cal.

Ord. 66. Campanulaceæ.—Corol. reg., campanulate, 5-merous. Sta. 5. Boll 2-8-celled, cells ∞-seeded. *Herbs*, usually milky. 29 gen., 540 spec. N. hemisphere, S. Af. 1. *Campanula*. Many fine spec., cosmop. *C. hederacea*, FLOWER OF THE FOUNTAIN, delicate, ivy-leaved; fls. blue. Border of streams, West Eng. *C. rotundifolia*, HARE-BELL, BLUE-BELL. ♀. 5'-12' high. Fig. 144. Eur., Am. *C. Medium*, CANTERBURY BELL, (2). 2°-4° high, rough; fls. 2' long, of various colors. Eur. 2. *Platycodon*. Low shrubs; fls. large, broadly open, blue. Sev. spec. N. Asia. 3. *Specularia*, VENUS'S MIRROR. Fls. rotate, resembling a concave mirror; purple, blue, white. *Herbs*. Eur., Asia, Am. *S. perfoliata*, 6'-20' high, fls. blue. Common, U. S.

Ord. 67. Goodeniaceæ.—Corol. 5-merous, irreg. Sta. 5. Ova. 2-4-1-celled. Stig. indusiate. Drupe, akaine, boll, or utricle. *Herbs*, rarely *Shrubs*. 24 gen., 200 spec. Australasia chiefly; few in S. Am. 1. *Goodenia*. 2-4-celled. *Herbs* or *Shrubs*; lvs. silky, fls. usually yellow. Chiefly in Australia. *G. repens*, S. Am. 2. *Brunonia australis*, only spec. ♀ herb, nearly stemless; lvs. rad.; fls. nearly reg., blue, fasciated in an involucrate hd.; calyx with plumose segments. Ova. free; fr. a 1-seeded utricle. Australia.

Ord. 68. Stylidiaceæ.—Corol. irreg., 5-merous. Sta. 2, filaments gynandrous with style, forming an erect or bent column; anthers embracing stigma. Fls. spiked, racemed, or corymbose. Boll 1-2-celled, ∞-seeded. *Herbs*. ☉, ♀. 4 or 5 gen. S. hemisphere. 1. *Stylidium*, largest gen. Australia, E. Ind., China. 2. *Förstera*. Australia, New Z., Fuegia.

Aster Alliance.—Fls. reg. or irreg.; if diclinous, usually in involucrate hds. Corol. 5-4-fid; sta. 5-4, rarely 2-3. Ova. 1-celled, 1-ovuled; or if 2-3-celled, only 1 cell ovuled. Calyx-limb papose or 0. Lvs. exstip. 69. **Compositæ** (phosphorescent). 70. **Dipsacæ**. 71. **Calyceracæ**. 72. **Valerianacæ**.

Ord. 69. Compositæ.—Fls. diclinous or ♂. Corol. reg. or irreg.; 5-4-fid; sta. 5-4; anth. usually syngenesious. Ova. 1-celled, 1-ovuled; fr. an akaine, usually crowned by the calyx-limb, which is cup-shaped, toothed, or papose. Infl. mixed (Lesson XX.). Fls. (flts.) in racemose (indef.) hds., on a broadened receptacle or common torus; hds. usually ∞-flowered, rarely few- or 1-flowered; sol., or with cymose (def.) infl. Lvs. often dissected, rarely compound. *Herbs*, *Shrubs*, rarely *Trees*, with bitter, often milky juice. 940 gen., 9100 spec., nearly equally divided between Old and New Worlds; making nearly $\frac{1}{10}$ of the Vegetal Kingdom; some useful, many weeds; all interesting. 13 Tribes, in 3 Sections. Types only given.

Section 1. Ligulifloræ.—Hds. homogamous, fls. all ♂. Flts. ligulate. **Tribe 1. Milky.** 1. *Lactuca*. ☉ ②. St. leafy; hds. small, panicle; flts. of various colors. *L. sativa*, GARDEN LETTUCE, fls. yellow. ☉. **Eur.** 2. *Taraxacum dens-leonis*, DANDELION. Stemless, hd. sol., peduncled, large; flts. yellow. N. hemisphere. Fig. 142. 3. *Tragopogon porrifolius*, SALSIFY, OYSTER-PLANT. ②. 2°-4° high; hds. sol., large, peduncled; flts. purple; rt. edible. **Eur.** 4. *Cichorium Intybus*, CHICORY. ♀. 2°-3° high; hds. large, flts. sky-blue; rt. used to adulterate coffee. **Eur.** 5. *Catananche cerulea*. ☉. 2°-3° high; hds. large, sol., flts. blue. Flt., Fig. 167, B. S. **Eur.** *C. lutea*, flts. yellow, Candia.

Section 2. Labiatæfloræ.—Hds. homogamous or heterogamous (of sepa. sexes), rayed or not. Flts. bilabiate or deeply 5-fid. **Tribe 2.** 1. *Chaptalia tomentosa*. Hds. heterogamous, radiate; ray flts. pink or white; disk flts. yellow. Stemless, ♀; hds. sol., long-peduncled. N. C. to Fla. and La. 2. *Mutisia*. Hds. rayed, sol., long-peduncled; flts. bright red, purple, pink, or yellow. 30 spec. Undershrubs or climbers; lvs. often terminating in a tendril. Very ornamental. S. Am., chiefly in Chili. 3. *Barnadèsia*. Spiny shrubs; lvs. entire; hds. silky; flts. and involucre often rose-colored, or purple. 9 spec., trop. Am. 4. *Farfugium grande*. Red. Lvs. large, reniform, variegated; ornamental. Japan.

Section 3. Tubulifloræ.—Disk flts. tubular. Hds. homogamous or heterogamous. Ray flts (if present) ♂, ♀, or neuter; if absent, the hds. of tubular flts. are called *discoid*. This Section includes the 11 remaining Tribes. **Tribe 3.** Hds. homogamous; flts. tubular. Lvs. usually spiny. 1. *Carthamus tinctorius*, SAFFLOWER; 2°-3° high; flts. yellow; furnishing fine pink, rose, scarlet, and crimson dyes; powdered, and mixed with talc, they form *Rouge*. Asia. 2. *Centaurea*. Flts. tubular. Many spec., blue, yellow, purple. *C. Cyanus*, BLUEBOTTLE, CORNFLOWER; hds. showy, blue, outer row imitating rays. **Eur.** 3. *Cnicus benedictus*, BLESSED THISTLE. ☉. 2° high; flts. tubular, yellow. **Levant.** 4. *Arctium Lappa*, BURDOCK; ②. Involucre globose, spiny; hds. panicle; flts. bright pink. Lvs. very large, undulate. **Eur.** 5. *Onopordon*. Hds. large, purple; flts. tubular. Sev. fine spec. *O. Acanthium*, COTTON THISTLE. **Eur.** 6. *Silybum Marianum*, OUR LADY'S THISTLE. ☉ ②. 4° high. Lvs. large, pinnatifid, mottled with white; caused, says the old legend, by a drop of the Blessed Virgin's milk. Fls. purple. **Eur.** 7. *Carduus*, PLUME THISTLE. 100 spec., several ornamental. *C. lanceolatus*, SCOTCH T. ②. 3°-4° high. Lvs. pinnatifid, spiny; hds. large, plume-like; flts. purple. 8. *Cynara*. Many species, often showy. *C. Scolymus*, ARTICHOKE. ♀. Lvs. large, 3°-4° long, pinnatifid; flowering stem erect, 4°-6° high; hd. sol., terminal, globular; scales of involucre large, fleshy, spiny-tipped, enveloping the purple flts.; hd. 4'-6' in diameter, showy; gathered before opening, and boiled as a vegetable; bracts and disk very delicate and sweet. Fig. 214. **Medit. States.** Common in S. gardens, U. S. **Tribe 4.** Hds. usually rayed. 1. *Gazania*. Usually stemless. Lvs. pinnatisect, canescent; hds. sol., peduncled; 3' in diam.; rays yellow, disk dark orange; 40 spec. S. Af. 2. *Arctotis*. ♀. Caulescent. Lvs. entire or pinnatifid, cinereous; hds. often 4' in diam., ray deep orange, disk brown. Cape of Good Hope. **Tribe 5.** Hds. rayed. 1. *Calén-*

dula, MARI GOLD (St. Mary's gold). ☉, ♀. Sev. spec. Medit. shores; hds. large, yellow or orange, with strong but pleasant scent. *C. officinalis*, best known. Fig. 143. **Tribe 6.** Hds. heterogamous or homogamous. **1. Othónna.** Disk fts. ♂, ray fts. ♀; hds. sol., peduncled; yellow, rarely blue. 50 spec., herbs, shrubs; lvs. sometimes succulent. Cape Colony. One, *O. cheirifolia*, Af. shore of Medit. **2. Senécio.** Pappus woolly; fts. yellow, crimson, purple, blue; lvs. often cinereous. 600 spec., herbs, shrubs; often showy. Both worlds. *S. Cinerària*, DUSTY MILLER, lvs. cinereous. S. Eur. *S. scàndens*, miscalled GERMAN IVY; climbing, lvs. ivy-like. Cape of Good Hope. *S. vulgàris*, GROUNDSEL; erect; weed. Ov., Fig. 180, B. U. S. **3. Arnica.** Pappus setose, hds. yellow. *A. montàna*, rt. and lvs. medicinal. N. Eur.; N. U. S., Pacific Slope. Sev. other Am. species. **Tribe 7.** Hds. of last; usually corymbose. Pappus 0 or coroniform. Disk fts. usually yellow; ray same, or different color. **1. Artemisia.** Shrubs or herbs; strong-scented, bitter; hds. small; lvs. usually dissected, often gray. Many spec., both worlds. *A. Absinthum*, WORMWOOD, ABSINTHE. ♀. 2°-4° high. Eur. *A. Abròtanum*, SOUTHERNWOOD, OLD MAN. ♀. 2°-4° high. S. Eur. *A. Dracunculus*, TARRAGON. ♀. Eur. *A. tridentàta*, SAGE-BRUSH. Shrub, 1°-6° high, gray, branched. This, with other species (TUMBLEWEEDS), covering the great desert plains of the West. U. S. **2. Tanacétum**, TANSY; **3. Anthemis nobilis**, *arvènse*, *tinctòria*, CHAMOMILE; *A. Còtula*, DOG-FENNEL, similar, but ill-scented; **4. Achillea millefòdium**, YARROW, MILFOIL; lvs. hoary; **5. Pyrèthrum Parthènum**, FEVERFEW; all common, from Eur. **6. Chrysanthemum coronàrium**, ☉, fls. large, yellow or white; N. Af. *C. indicum*, *C. ròseum*, ♀; hds. large, double, of various colors; Asia. *C. Leucanthemum*, OX-EYE DAISY; wild; from Eur. **Tribe 8.** Hds. of last. Akaines usually crowned with paleæ or bristles. **1. Gaillardia**, hds. sol., peduncled; disk purple. *G. lanceolàta*, ☉, ♀; rays yellow. S. C., S. *G. pulchèlla*, ☉, rays large, crimson, yellow-tipped; La., W. *G. aristàta*, rays large, yellow; Missouri, W. **2. Tagètes**, AMERICAN (miscalled AF. and FRENCH) MARI GOLDS. ☉. Strong-scented, 1°-2° high; hds. showy; rays yellow or orange, striped or mottled with purple. Sev. spec. Mex., S. Am. **Tribe 9.** Hds. of last. Akaines naked or crowned with 2-4 awns. Disk usually (sometimes ray) yellow. **1. Bidens**, SPANISH-NEEDLES. ☉, ②, ♀. Pests; fts. inconspicuous; akaines with barbed awns. Sev. spec., both worlds. **2. Dàhlia.** Akaines naked. ♀. Bold-growing; hds. large; wild, with disk yellow, ray crimson; 2 or 3 spec., Mex. 5000 ft. above sea-level. Many fine garden varieties, double, fts. quilled. **3. Heliánthus**, SUNFLOWER. Akaines naked. ☉, ♀. Coarse, tall-growing; hds. large; rays yellow, disk yellow, purple, or brown. Many spec., U. S. *H. ànnuus*, GREAT S. ☉. 10°-15° high; hds. 6'-10' in diam. S. States, S. Am. *H. tuberòsus*, JERUSALEM ARTICHOKE. ♀. 5°-7° high; rts. tuber-bearing. Fig. 95. Brazil. **4. Flourénsia.** Hds. similar to Heliánthus, but style-awns different. Resinous shrubs; 4 spec., New Mex., Chili. *F. thurífèra*, INCENSE TREE, MARAVÍLLA, 4°-6° high; fts. 2' in diam. Resin of lvs. burnt as incense in Catholic churches. **5. Rudbéckia**, CONE-FLOWER; hds. of Heliánthus, but disk conical. ♀ herbs, bold-growing. Many fine spec., U. S. **6. Ximinèsia.** Disk-akaines winged, 2-awned. *X. enceloides*, 2° high;

hds. yellow, corymbed, showy. ☉. Tex., Mex. 7. **Coreópsis**, TICK-SEED. ☉, ♀. Akaines bug-like, 2-awned. Disk dark, or yellow; rays yellow, often with dark spot at base. Many fine spec.; hds. showy. S. and S. W., U. S. 8. **Zinnia**. ☉. Akaines 0 or 2-awned. **Z. élegans**. Disk purple, ray scarlet, crimson, purple, white; hds. large, showy. Mex. **Z. multiflora**, smaller; ray scarlet. Ga., Fla., to Texas. 9. **Ambrósia**. Akaine naked. Hds. ♂. ♂ fts. 5-20, in a top-shaped involucre; hds. in spikes or racemes. ♀ fts. sol., apetalous, enclosed in an akaine-like involucre; in sessile clusters below ♂ hds. Coarse, resembling *Artemisia*. **A. artemisiæfolia**, BITTERWEED, HOGWEED. U. S. **A. tenuifolia**, covering the Pampas S. of Buenos Ayres. **A. maritima**, TRUE AMBRÓSIA; sweet-scented, with aromatic taste. Italy, Levant. **Tribe 10.** Hds. of last. Pappus 0 or bristly. 1. **Ínula**. Ray fts. ♀. Sev. species, Eur., Asia. 1. **Helénium**, ELECCAMPANE. ♀. 3°-5° high. Hds. large, sol., yellow. Eur. 2. **Helichrysum**, IMMORTÉLLES. Herbs or shrubs; involucre bracts colored, persistent, showy. **H. orientale**, CRETE, FRENCH IMMORTÉLLE. Many fine Cape and Australian spec., various colors. 3. **Rhodánthe**, 4. **Ammóbium**, AUSTRALIAN IMMORTÉLLES. 5. **Antennária margaritæcea**, **plantaginifolia**, ♀, AM. IMMORTÉLLES. 6. **Gnaphálum**, EVERLASTINGS, CAPE-FLOWERS. Lvs. white-cottony; hds. persistent. Cape species fine. **G. polycéphalum**, COMMON EVERLASTING. ☉. 1°-2° high, branched. Can., U. S. **G. leontopódium**, EDELWEISS; 6'-10' high; involucre lvs. lanceolate, white, velvety, flower-like around the small clustered hds. Alps. 7. **Húmea élegans**. (2). Balsam-scented; stem unbranched, 4°-8° high, terminating in a large grass-like panicle of abundant drooping, minute, rose-colored hds., each hd. with 4 ♂ fts.; very handsome. Australia. **Tribe 11.** Hds. of last. Disk usually yellow. Style-awns compressed, usually appendaged. 1. **Bácccharis**. ♀ ♂. Hds. small, ∞-flowered, white; pappus of female hds. long, silky, copious, showy. Herbs, shrubs, or small trees; often resinous, with shining lvs.; or leafless; or with minute lvs. and winged, leaf-like stems. Am.; from U. S. to extreme S. of S. Am. **B. halimifolia**, GROUNDSEL TREE. 8°-12° high; smooth, scurfy; lvs. spatulate; ♀ hds. in large, loose, showy panicles. Mass. to Fla., W. to La. Numerous species, U. S., Atlantic to Pacific. **B. trinèrva**, stems winged, medicinal; Brazil. 2. **Erigeron**, FLEABANE. Hds. aster-like; disk yellow; ray fts. 30-200, pink, purple, or white. Many spec., pretty weeds. **E. philadélficum**. 2° high, fts. pink; common. **E. speciosum**, more showy, Oregon. 3. **Áster**. Disk yellow; ray blue, purple, white, never yellow; ray fts. 6-100, star-like; hds. paniced or corymbed. 200 species; few in Eur., Asia, S. Am.; abundant in N. Am. Herbs, ♀, rarely ☉; 1°-4° high. 1. **A. sericeus**, 1°-2° high, silky; fts. violet-blue. Wis., Iowa, to Miss. **A. novæ-angliæ**, 4°-6° high, hds. large, deep purple, paniced. N. Eng. to Ga., W. **A. carolinianus**, slender, 6°-13° high, hds. rose-purple, large, scattered. S. C. to Fla. 4. **Eurybia**, DAISY TREES. Hds. similar to Aster. Shrubs or trees; 60 spec., Australia, Tasmania, New Z. **E. argophylla**, SILVER-LEAVED MUSK TREE. Musk-scented, 25°-30° high; 3° in girth; wood valuable; Tasmania. 5. **Béllis**, DAISY, MARGUERITE. Pappus 0. Caulescent. Low herbs with sol. peduncled, aster-like hds. **B. integrifolia**, AMERICAN DAISY; ☉, (2). St. spreading, 4'-10' long; ray pale blue-purple.

Ky., S. W. **B. perennis**, ENGLISH DAISY, EASTER D. ☐. Stemless; hd. white, purple, or "crimson-tipped;" varieties double, pink or white, with quilled fls. Eur. **6. Callistephus**. Pappus setose, 2-seriate, forming a crown. ☉. Erect branching stems; hds. large, daisy-like, sol., terminating the branches. China. **C. sinensis**, CHINA ASTER, REINE MARGUERITE; ray dark purple; disk yellow. 18' high. Varieties with double fls., pink, white, blue, red, never yellow.

7. Solidago. Pappus setose, 1-seriate. Hds. small, in paniced (often 1-sided) racemes, corymbs, clusters; rays few, yellow, rarely white. ☐ herbs; st. rod-like, or branching. Many spec., both worlds. **S. Virgàurea**, TRUE GOLDEN ROD, 1°-2° high in woods and thickets; 6'-8' high on sea-cliffs; handsome. Gt. Brit. Numerous showy but coarser Am. species: **S. speciosa**, 2°-6° high, panicle large, thyrsoïd, Mass. to Ohio, Ga; **S. gigantea**, 4°-7° high, large loose-paniced racemes, Can., U. S.; **S. bicolor**, 2° high; hds. cream-colored or white, clustered, Can., N., Mid., W. States; **S. tenuifolia**, slender, hds. corymbed, sea-coast, Mass. to La. **Tribe 12.** Hds. homógamous; fls. all tubular; rarely pale ochreous; never yellow. Pappus often setose. **1. Liàtris**. Hds. of several or many small fls. rose-purple, showy. ☐ herbs, wand-like, simple, usually from a button-like corm or tuber; hds. spiked, racemed, or paniced. Many spec., all beautiful; N. Am. **L. elegans**, 2° high; hds. 4-5-flowered, spiked. Va., S. **L. squarròsa**, RATTLESNAKE'S MASTER, 1°-3° high, leafy; hds. larger, 1' long, 20-40-flowered, racemed. N. Y., Penn., W. and S. Corm an antidote for snake-bites. **L. scariòva**, GAY FEATHER, similar, 4°-5° high. Can. to Ga., La. **2. Mikània**. Near Eupatòrium; but hd. always 4-flowered, stems usually climbing; often woody; rarely erect undershrubs. More than 100 spec.; 3 or 4 in Af., trop. Asia; the rest in trop. Am.; one, **M. scàndens**, smooth, elegant climber, with small corymbs of white or pink fragrant hds.; Mass. to Ga. and La.; perhaps identical with **M. volubilis**, E. Ind., and **M. capénsis**, S. Af. **3. Eupatòrium**. Hds. small, of 3-5-8-12-15-30 fls., purple, pink, or white, corymbose, paniced. ☐, herbaceous or woody, erect. Many spec., chiefly Am.; often aromatic. **E. feniculàceum**, FENNEL EUPATORIUM; hds. 3-5 fls., 3°-10° high; panicle large, comp.; fls. ochreous. Va. to Fla. **E. perfoliàtum**, THOROUGHWORT, BONESET. Medicinal. 1°-5° high; lvs. perfoliate-connate; hds. white, corymbed. Can., U. S. **E. ageratòides**, 2°-3° high, hds. 8-30 fls., white, corymbed, Can., U. S.; **E. aromàticum**, more slender, similar, fragrant; Mass. to La. **E. incarnàtum**, diffuse; fls. pale purple; N. C. to Fla. **4. Stèvia**. ☐, herbaceous or woody; hds. small, with few fls., white, pink, purple, corymbed. Sev. pretty spec.; trop. Am. **5. Ageràtum**. ☉, ☐. Hds. small, white or sky-blue, corymbed. Sev. pretty spec.; Mex. **6. Conoclinium**. ☐ herbs. Near Ageràtum, but disk conical. ☐ herbs, 1°-3° high. 10 spec., trop., sub-trop. Am.; all closely resembling **C. celestinum**, MIST FLOWER; hds. of small, blue-purple (or sky-blue) fls., in flat corymbs; fragrant. Penn. to Ill., S. **Tribe 13.** Hds. homógamous; fls. all tubular, never yellow. Pappus usually setose; sometimes paleaceous. **1. Stokèsia cyànea**. Pappus paleaceous, decid. ☐ herb. 2° high, downy; hds. large, blue; outer fls. with spreading palmate border, imitating rays; resembling Centaùrea; but style-awns long, hirtellous; and involucre leafy, spiny. S. C., Ga., La.

2. Vernonia. ☉, ♀ herbs; erect or climbing shrubs, sometimes small trees. 400 spec., both worlds, warm regions, chiefly Am. Hds. with few or many fls., red- or rose-purple or blue, in term. cymes or panicles. Many spec. in U. S.; all ♀ herbs. *V. noveboracensis*, IRONWEED; rts. cord-like, strong, nearly ineradicable. Coarse, 5°-6° high, branching at top; hds. red-purple, showy. Common. U. S.

Ord. 70. Dipsacæ.—Hds. of Compósitæ, but fls. ♂. Corol. irreg., 3-4-fid or 2-labiate. Sta. ♀, often unequal, rarely 2-3, epipetalous; free, or filaments rarely diadelphous. Ova. 1-celled, 1-ovuled; sometimes free. Fr. a utricle. *Herbs* or *Undershrubs*. ☉, ♀. Lvs. opp. or whorled. 6 gen., 170 spec., Medit. States, S. Af. **1. Scabiōsa.** ♀ herbs; fls. in large hds. *S. succisa*, DEVIL'S BIT. 1° high; fls. violet; rt. præmorse, medicinal. Eur. *S. atropurpurea*, MOURNING BRIDE, 2°-4° high, hds. dark purple. **2. Dipsacus, TEASEL.** ☉. Whole plant (especially hds.) prickly. *D. sylvestris*, 4°-6° high, hds. large. Eur., Asia. *D. fullōnum*, a variety, FULLER'S T.; hds. used to raise the nap on cloth. Fig. 105.

Ord. 71. Calyceracæ.—Characters of Compósitæ; but filaments monadelphous; anthers syngenesious at base; corol. marcescent. Small, ☉ ♀ herbs. 8 gen., 20 spec., S. Am., Brazil to Magalhaens; chiefly in Chili. **1. Calycera.** **2. Boöpis.** Chili.

Ord. 72. Valerianacæ.—Characters of Dipsacæ; but filaments free; sta. 5-4-3-1; ova. 3-celled; fls. usually corymbose or panicked. Fr. dry, indehisc., 3-1-celled, always 1-seeded. *Herbs*. ☉, with scentless rts., or ♀, with scented rhiz. 12 gen., 150 spec., temp. climates, mts. of N. hemisphere and S. Am. **1. Valeriana.** Rhiz.; fls. in term. panicles or hds.; white or red; calyx plumose, persistent. Many fine species, both worlds. *V. officinalis*, rhiz. medicinal; Eur. **2. Centranthus.** Similar to 1, but corol. spurred; fls. in corymbose panicles, unilaterally arranged. ☉ ♀. S. Eur. *C. ruber*, JUPITER'S BEARD; fls. red. **3. Nardostachys.** Corol. reg., spurless; calyx 5-cleft, leafy; fls. corymbose. Rhiz. very fragrant. *N. Jatamānsi*, NARD, SPIKENARD of Scripture; rhiz. sending up many fl.-stems. E. Ind.

Honeysuckle Alliance.—Fls. ♂, rarely diclinous. Corol. reg. or irreg., tubular, 2-4-5-6-merous, isostemonous. Calyx never pap-pose. Sta. epipetalous. Ova. 2-∞-celled; cells 1-∞-ovuled. Infl. various. Boll, drupe, or berry. Lvs. opp., usually stip. *Shrubs* or *Trees*, rarely *Herbs*. Many beautiful and valuable spec. **73. Rubiacæ.** **74. Caprifoliacæ.**

Ord. 73. Rubiacæ.—Characters of Alliance. 330 gen., 2800 spec. Both worlds; many trop. 25 Tribes, in 3 Sections. Types given.

1. Ovules sol. in each cell. Fr. 1-2-4-5-celled; dry or fleshy.

Tribe 1. Herbs. Lvs. and stip. similar, whorled. Fls. 4-5-merous.

1. Asperula. St. square; fls. white, pink, blue, or yellow. Sev. pretty spec. Eur. *A. odorata*, SWEET WOODRUFF, WOODROWEL; fls. white, in peduncled clusters; lvs. and fls. fragrant. Fig. 110. Eur. **2. Crucianella.** Sev. spec., Eur., Asia. *C. stylōsa*, fls. pink; Persia. **3. Galium, CLEAVERS, OUR LADY'S BEDSTRAW;** st. square; lvs. with prickly hairs; fls. white; fr. often red; stems straggling, straw-like;

used as a bed by Virgin Mary, says the legend. 160 spec., cosmop.

4. Rùbia, Madder. Close to *Galium*, but fls. 5-merous. Rts. yield the red dye *Madder*. Sev. spec., Eur., Asia. **Tribe 2.** Herbs or small shrubs. Stip. setose. **1. Spermacòce.** Fls. 4-merous. Chiefly trop. **S. glàbra**, fls. white, W.; **S. Chapmanii**, Md. to Fla. **Tribe 3.** Fr. usually a berry. **1. Mìtchella rèpens**, PARTRIDGE BERRY, small, prostrate evergreen; fls. 5-6-merous, twin; white, red-tinged, fragrant; berries twin, red. U. S., Can. **Tribe 4.** Ova. 2-5-celled. **1. Hamiltònia.** Indian shrubs; sev. spec.; fls. fragrant, 5-merous, often white. **Tribe 5.** Fr. indehisc. **1. Cephàelis Ipecacuànha.** $\frac{1}{2}$ herb. Fls. 5-merous; berry 2-seeded; rts. furnish *Ipecac.* Fig. 90. Brazil. **Tribe 6.** Ova. 1-celled. **1. Coussàrea.** Ev. trees, shrubs; S. Am. **Tribe 7.** Calyces united. **1. Morinda.** Small trees or shrubs, sometimes climbing. 30 spec.; rts. and bark yield fine red dyes; trop. Asia, Af. **Tribe 8.** Corolla contorted. **1. Coffèa.** Fls. 4-5-merous; berry 2-seeded. 50-60 spec., shrubs, small trees; trop. both worlds, chiefly in Am. **C. aràbica**, 6°-20° high; fls. white; berries red; sds. the *Coffee* of commerce. Fig. 147. Native of *Coffea*, Af.; many cultivated varieties. **Tribe 9.** Corolla valvate. **1. Vanguèria.** Fls. 5-merous. Drupe as large as an apple, often edible. Ev. shrubs, Madagascar, Ind. **Tribe 10.** Corolla contorted. **1. Albèrta.** Monotypic, shrub or small tree; lvs. glossy, stip. cup-like, fls. 5-merous, purplish, silky, in branched panicles; calyx with 2 of the lobes much larger than the others. Cape of Good Hope. **Tribe 11.** Corolla valvate or imbricate. **1. Chiocòcca.** Fls. 5-merous, yellow; berry 2-seeded, white. Shrubs; rts. emetic. Brazil. **Tribe 12.** Sds. compressed. **1. Knòxia.** Fls. 4-merous, pink or white; boll 2-celled, cells separating. Undershrubs; Ind. **Tribe 13.** Sds. pendulous. **1. Guettàrda.** Fls. 4-9-merous; drupe 4-9-pyrened. Shrubs or small trees; trop. Am., Asia.

2. Ovules twin in each cell.

Tribe 14. Drupe. **1. Retiniphýllum.** Ev. shrubs; fls. white. S. Am. **Tribe 15.** Boll. **1. Cruickshànkia.** Fls. 4-merous, yellow; calyx with 1 lobe enlarged. Herbs; st. wavy, branched. Chili.

3. Ovules indefinite.

A. Fr. fleshy or coriaceous, indehiscent.

Tribe 16. Corolla contorted. Sds. various. **1. Gardènia**, CAPE JESSAMINE. Fls. 5-9-merous, large, white or yellow, fragrant; berry 5-celled, ∞ -seeded. Trees or shrubs; sev. spec.; often spiny. Cape of Good Hope, Asia; wood valuable, often resinous, fragrant. **G. flòrida**, 6°-10° high, evergreen; E. Asia; hardy in S. gardens, U. S. **2. Genipa**, GENIPAP. Close to *Gardènia*; fls. smaller. Trees. Sev. spec.; berries as large as an orange, edible; trop. Am. **Tribe 17.** Corolla valvate. Sds. ∞ , large, compressed. **1. Pentagònia.** Lvs. large, often pinnate-lobed; stip. large; fls. large, 5-6-merous, yellow, red, or greenish; calyx spathe-like. Berry often edible. 8 spec., shrubs, one climbing; trop. Am. **Tribe 18.** Sds. ∞ , minute. **1. Hamèlia.** Fls. 5-merous, orange-colored; showy; berry 5-celled. Shrubs; trop. Am. **Tribe 19.** Sds. ∞ , minute. Corolla valvate. **1. Mussaènda** (Cingalese name). Fls. 5-merous, usually orange-col-

ored; 1 lobe of calyx enlarged, white; berry 2-celled. Shrubs; trop., both worlds, few in Am.

B. Fr. dry, dehiscent or not.

Tribe 20. Boll 2-4-celled. Sds. ∞ . Herbs; rarely small shrubs.

1. Houstônia (Hedyotis). Fls. 4-merous, small, white, scarlet, blue, or purple. Elegant small herbs or undershrubs. *H. umbellata*, CHAY-ROOT; rts. furnish dye. Ind. *H. cerulea*, minute, delicate. 3'-5' high, ②; peduncle 1-flowered; corolla blue, with yellow eye. Common, U. S. *H. rotundifolia*, ④, prostrate, creeping; fls. white. Sands, N. C., S. *H. purpurea*, QUAKER LADIES; erect, ④; 5'-20' high, leafy; fls. lavender-colored or white, in cymes. Common, U. S.

2. Pêntas. Fls. 5-merous. Shrubs; trop. W. Af. *P. carnea*, lvs. broad, fls. pink, in terminal tufts. **Tribe 21.** Corolla imb. or contorted.

1. Rondelêtia. Fls. 4-5-merous, capitate. Shrubs or trees with showy, fragrant fls.; trop. Am. **Tribe 22.** Corolla lobes valvate. Boll 2-celled.

1. Pinckneya. Fls. 5-merous, in axil. tufts; 1 lobe of calyx enlarged, colored. *P. pubens*, GEORGIA BARK; only known spec.; fls. purple; bark used as *Quinine*. S., U. S. **Tribe 23.** Corolla 2-labiate. Sds. broadly winged.

1. Henriquêzia. Fls. 5-merous, large, pink or white (resembling *Bignônia*), in terminal panicles. Handsome trees, Brazil, Venezuela. **2. Platycarpum**, similar; very tall; timber valuable. Venezuela. **Tribe 24.** Corolla reg.; sds. winged.

1. Bouvardia. Fls. 4-merous, corymbose, red, yellow, white; often fragrant. Shrubs; sev. spec.; Mex. **2. Manettia.** Fls. 4-5-merous, scarlet or pink; peduncled; sol. or clustered.

Climbing undershrubs; sev. spec.; trop. Am. **3. Cinchona**, QUININE TREES. Fls. 5-merous, white or pink, very fragrant, paniced. Evergreen trees or shrubs; many spec.; bark yields the *quinine* of pharmacy; trop. valleys of Andes Mts. *C. Calisaya* yields the best *quinine*.

4. Cascarilla. Close to *Cinchona*, but without the *quinine* principle. Shrubs; sev. spec.; Peru, Brazil. **Tribe 25.** Fls. in close hds. **1. Cephalanthus occidentalis**, BUTTON BUSH. Fls. 4-merous, white; hds. 1' in diam.; fr. separating into 2-4-1-seeded carpels. Shrub, 6°-15° high. Shores of streams, Can. and U. S. **2. Sarcocephalus esculentus**, NEGRO PEACH. Fls. pink; fusing and ripening into a multiple, peach-like fr. Climbing shrub, Sierra Leone.

Ord. 74. Caprifoliaceæ.—Characters of Alliance (except fls. in *Adoxa*, which see). Fr. a berry. 16 gen., 230 spec.; N. hemisphere. 2 Sub-Orders. **Sub-Ord. 1.** Corolla reg.; stigmas 8. **1. Adoxa Moschatellina**, MOSCHATËL; only spec. Fls. musk-scented, pale green, in hds. at the tops of short leaf-stems; cent. fls. 4-merous, sta. 8; outer fls. 5-merous, sta. 10. Lvs. ternately divided. Low herbs, from ④ rhiz. Gt. Brit. **2. Sambucus**, ELDER. Fls. 5-merous; usually white, in racemes or cymes; fragrant; lvs. pinnate. Herbs, shrubs, trees. *S. racemosa*, shrub; berries scarlet, racemed; S. Eur. *S. pubens*, 6° high; berries red, paniced. *S. canadensis*, 6°-15° high; fls. fragrant, in broad cymes; berries blue-black; U. S. *S. nigra*, similar, but larger; 30° high, stout, branching; fls. cream-colored, berries jet-black; wood valuable; cells, Figs. 217, A; 215, A; Eur., N. Af., Asia. **3. Viburnum.** Fls. 5-merous, in cymes; drupe 1-seeded. **V. Tinus**, LAURESTINE, fls. pink or white, winter-blooming;

berries dark blue; evergreen trees, making forests, in Corsica; shrubs elsewhere. **V. Opulus**, GUelder ROSE, SNOWBALL; 6°-12° high; lvs. decid.; fls. small, white, in cymes, outer neutral, enlarged; berries red. Both worlds. Cultivated form with all the fls. neutral. **V. prunifolium**, BLACK HAW. 10°-20° high; fls. white, cymose; drupes black, edible. N. Y. to Ga., W. Sev. other spec. in U. S. **Sub-Ord. 2.** Corolla reg. or irreg.; style simple. **1. Diervilla** (*Weigelia*). Fls. 5-merous, almost reg., funnel-shaped, large, clustered. Shrubs. **D. trifida**, fls. yellow, 1°-4° high, N.; **D. sessilifolia**, similar, Alleghenies, S.; **D. japonica**, fls. pink, profuse, 2°-5° high, Japan. **2. Lonicera**. Shrubs, twining, or sometimes erect. Many fine spec., both worlds. **L. sempervirens**, TRUMPET HONEYSUCKLE; fls. reg., trumpet-shaped, scarlet or yellow; berries red; N. Y., S. States, where it is evergreen. **L. Caprifolium**, twining, lvs. decid.; fls. irreg., pink; berries yellow; Eur., Asia. **L. grata**, SWEET H.; twining, evergreen; fls. white, with pink tube, very fragrant; Mid. and S. States. **L. Periclymenum**, WOODBINE; lvs. decid.; twining; fls. irreg., red or yellow, fragrant; berries red; Eur. **L. nigra**, BLACK H.; erect; 2°-4° high; lvs. decid.; peduncles 2-flowered; fls. reddish; berries black; Mid. Eur. Fig. 107. **3. Symphoricarpus**. Fls. 4-5-merous, small, pink, clustered. Shrubs, N. Am., Mex. **S. racemosus**, SNOWBERRY; 2°-4° high; berries large, white; N. Y., Can., W. **S. montana**, straggling; 2°-3° high; berries white; mts., New Mex., Colorado, Cal. **S. vulgaris**, CORAL-BERRY; 2°-3° high; berries dark red; Penn. to Iowa, S. States. **4. Linnaea borealis**, TWIN-FLOWER, only spec.; creeping and rooting, small evergreen; fls. twin, pink, fragrant; berries dry, 1-seeded. N. Eur., Asia; N. Am., lat. 39° to Arctic Ocean.

DIVISION III.—*Polypetalæ*. 3 Subdivisions {
 1. Calycifloræ.
 2. Discifloræ.
 3. Thalamifloræ.

Flowers usually dichlamydeous. Petals usually separate.

Subdivision I.—Calycifloræ. *Calyx* usually conspicuous; sepals usually connate. Ova. frequently adh. Petals 1-seriate, epig. or perig. Torus adnate to base of calyx, rarely raised into a gynophore. Sta. perig., usually inserted on or beneath the outer margin of the torus. Most useful of the 3 Subdivisions.

Umbel Alliance.—Fls. reg., usually ♂. Corolla 2-4-5-10-merous, sometimes 0. Sta. usually def.; styles free or connate at base. Ova. 1-2-∞-celled. Ov. sol., pend.; coats confluent with nucellus. Emb. usually minute. Perisperm present. **75. Cornaceæ.** **76. Araliaceæ.** **77. Umbelliferae.**

Ord. 75. Cornaceæ.—♂ or ♀ ♂; often apert. Drupe, berry, pome. *Trees or Shrubs*; lvs. exstip., simple, usually opp. 10 gen., 40 spec., temp. regions, both worlds. 3 Sections:

A. ♀ ♂. Lvs. alt. 1. Nýssa. Fls. apert., 2-5-merous; sta. 5-10-12. Drupe 1-seeded, plum-like. *Trees*, N. Am. 4 spec. **N. capitata** (*candicans*), OGEECHEE LIME. ♂ fls. capitate, ♀ sol.; drupe dark red, edible. 20°-30° high. River-banks near coasts, S. **N. uniflora** (*denticulata*, *tomentosa*, *anguliflora*, *grandidentata*), GREAT TÛPELO. ♀ fl. sol.; drupe blue. Lvs. sometimes angulate-dentate. 70°-80° high. Swamps, S. **N. aquatica** (*biflora*), POND TÛPELO.

♀ fls. twin; drupe blue. 30°-70° high (or a shrub in pine-barrens). Ponds, swamps, N. C. to Fla., W. *N. multiflora* (*sylvatica*, *villôsa*), PEPPERIDGE, SOUR GUM, UPLAND TUPELO. ♀ fls. 3-8, clustered. Drupe dark blue. 30°-60° high. Wood with interlacing fibres, impossible to split. Rich woods, dry or damp; Mass. to Ill., S. Lvs. bright crimson in autumn. *B. Fls.* ♀ ♂. *Lvs. opp.* 1. *Garrya*. Petals 0. ♂ 4-merous; ♀ 2-merous; both in showy, drooping catkins. Berry 2-seeded, haw-like. Evergreen shrubs; few spec., Cal., Mex., W. Ind. *G. elliptica*, fls. green, Cal. *G. foëmina*, fls. yellow, N. W. Am. *G. laurifolia*, fls. white, Mex. 2. *Aucuba*. Corol. 4-merous; fls. purple, small, paniced. Berry 1-seeded, bright red or yellow; lvs. often mottled. Evergreen bushes, sev. spec.; Hîmalayas, Japan. *C. Fls.* ♂, *dichlamyd.*, 4-merous. 1. *Benthâmia*. Fls. 4-merous, fleshy, capitate. Drupes small, forming together a multiple, large, red, edible berry, mulberry-like. Trees, small, resembling *Cornus florida*. *B. fragifera*, N. Ind. *B. japonica*, Japan. 2. *Cornus*. Fls. clustered. Drupe 2-seeded. Small trees or shrubs, rarely herbs. Lvs. usually opp. *C. florida*, FLOWERING CORNELL, DOGWOOD. 20°-35° high; fl. cluster with an involucre of 4 white, petal-like bracts. Drupes small, scarlet. U. S. *C. canadensis*, BUNCH-BERRY. Fls. and fr. near last, but stems 5'-7' high, ☉, from a ♀ rhizome. N. U. S., Can. *C. mâs*, MALE CORNELL, CORNELIAN CHERRY, DOGWOOD. Fls. and fr. of last, but involucre small, and drupes larger. Fls. ♂ in the young trees; hence the specific name. 12°-20° high. Eur., W. Asia. The following have white fls. in flat, open cymes, without involucre: *C. sanguinea*, BLOODY CORNELL, FEMALE C. Fls. ill-scented; fruit dark purple. Branches (and lvs. in autumn) dark red. 4°-15° high. Eur., N. Af. *C. alba* (*stolonifera*), RED OSIER C. Fls. and fr. white; branches and shoots of a finer red than the last. 4°-10° high. Siberia; Can. to Va., W. to Cal. *C. asperifolia*, 8°-12° high; drupes pale blue. Ill., Fla., and S. W. *C. sericea*, drupes pale blue. 6°-10° high. Can., U. S. *C. paniculata*, cymes paniced, showy; drupes white. 10° high. U. S., Can. *C. alternifolia*, only spec. with alt. lvs.; drupes dark blue. 15°-20° high, branching widely. U. S., Can. 2. *Curtisia faginea*, ASSAGAY TREE. Lvs. opp. Fls. small, 4-merous; drupes small, 4-5-celled. Large, fine tree, 80° high; wood made into assagays (javelins) by the natives. Cape of Good Hope. 3. *Alangium*. Lvs. alt. Fls. purple, 5-6-merous; sta. 2-4 times as many as petals; drupe 1-seeded. Tall, fine trees; rts. aromatic, wood beautiful, valuable. 2 spec. *A. decapetalum*, *A. hexapetalum*. E. Ind.

Ord. 76. Araliaceæ.—Fls. ♂, rarely diclinous by arrest. Petals 5-10 or more. Sta. equal to or 2-3 times their number. Ova. of 2-15 1-ovuled cells. Berry fleshy or dry. *Shrubs, Trees, rarely Herbs*; sometimes spiny. Lvs. exstip. 22 gen., 160 spec. 5 Tribes; distinctions in aest. and number of stamens.

1. *Plerandra*. Fls. 5-merous, ♀ ♂ ♂, umbelled. Fr. a drupe. Lvs. digitate. Trees, Feejee Islands. 2. *Hedera Helix*, IVY. Evergreen creeper; fls. 5-merous, yellowish, umbelled; berry 5-celled, small, dark. Eur. Fig. 92; hairs, Fig. 106, 4. 3. *Cussonia*. Fls. 5-7-merous, greenish; spiked or paniced; berry 2-3-seeded. Lvs. digitate. Shrubs, Cape of Good Hope, New Z. 4. *Dendropanax*. Fls. and fr. of *Hedera*; but lvs. entire. Trees, trop. Am., Asia. 5.

Helwingia ruscifolia. Fls. diclinous, apert., 3-4-merous, small, clustered on the midribs of the entire alt. lvs. Drupe small. Low shrub. Japan. **6. Fatsia.** Fls. ♂ or ♀ ♂ ♂, 4-6-merous, small; umbels paniculate. Drupe small. **F. papyrifera,** RICE-PAPER TREE. Lvs. 5-7-lobed, 1° long; panicles terminal, drooping, 1°-3° long. Pith the valuable *Rice-paper* of commerce. Tree 20°-30° high. Fig. 225. Swampy forests of Formosa Island. **7. Panax.** Fls. umbelled; lvs. palmate, petioles sheathing. Herbs, shrubs, trees, N. Asia, Am. **P. Schinseng,** GINSENG. ♀ herb; rt. fleshy, medicinal. China. **P. quinquefolium,** AMERICAN G.; similar; berries scarlet. Can., U. S. **8. Aralia.** Fls. ♀ ♂ ♂, 5-merous, small, whitish, umbelled; drupe 5-10-seeded. Lvs. various; simple, oftener compound. Trees, shrubs, herbs, both worlds. **A. spinosa,** SPINY A., TEAR-BLANKET, DEVIL'S WALKING-STICK, HERCULES'S CLUB. Stem palm-like, 10°-30° high, armed with spines; crowned at top with immense, spreading, 2-3-pinnate lvs. 4°-6° long, and an umbellate panicle larger still. Drupes dark. Penn., Ohio, to Gulf of Mex. **A. nudicaulis,** AMERICAN SASSAPARILLA. Rts. aromatic, long, slender, horizontal, used as the true Sarsaparilla (*Smilax S*); stems 1° high, naked, crowned with 3-7 umbels; lf. sol., radical, ternate-quinate. Drupes blaek. Can. to Fla., S. and W. Sev. other Am. spec.

Ord. 77. Umbelliferae.—Fls. ♂, rarely diclinous by arrest; small, 5-merous, umbellate, rarely capitate; white, yellow, rarely pink or blue; calyx often nearly 0; petals usually inflexed. Carpels 2; fr. 2 mericarps, forming a cremocarp (Lesson XXIV.). *Herbs,* rarely *Shrubs*; often strong-scented; stem fistular or pithy. Lvs. alt.; petiole dilated at base; blade usually cut; rarely entire. A very natural Order. 309 gen., 1500 spec.; northern parts of N. hemisphere, rare in S. hemisphere, few in tropics. 9 Tribes, in 3 Sections; tribal distinctions in fruit.

Section 1.—Umbels compound. Furrows thickened over vittæ.

Tribe 1. 1. Thapsia. Lvs. 3-pinnate, dissected. Rts. medicinal, sometimes poisonous ♀ herbs. Sev. spec., S. Eur., Asia. **T. Sulphion,** ASADÚLCIS, gum-resinous. Levant. **Tribe 2. 1. Daucus Carota,** CARROT. ②. Lvs. pinnatisect; rt. fleshy, yellow, edible. Eur. **2. Cuminum Cuminum,** CÚMIN. ②. Fennel-like. Sds. aromatic. Egypt, Asia. **3. Coriándrum sativum** (only spec.), CORIÁNDER. ☉; 18' high, lower lvs. pinnatifid, upper pinnatisect. Sds. fetid, becoming aromatic when dry. S. Eur., Levant.

Section 2.—Umbels compound. Primary ridges only conspicuous.

Tribe 3. 1. Pastinaca sativa, PARSNIP. ②. Lvs. pinnate, large; fls. yellow. Rt. fleshy, cream-white, edible. Eur. **2. Narthex Asafoetida.** ♀, tall; rts. furnish the drug *Asafoetida*. Thibet, Persia. **3. Férule,** sev. spec., Old World. **F. communis,** GIANT FENNEL. ♀, 15° high; pith used as tinder. **Medit. States. 4. Opópanax Chiròanium.** ♀, 6°-7° high; yields a milky, medicinal gum-resin. S. Eur. **5. Heracleum,** COW PARSNIP. ♀, coarse, bold-growing; fls. white, lvs. comp. Many spec. **H. giganteum,** 12°-20° high, 1° in girth. Siberia. **H. lanatum,** 4°-8° high, rt. edible. N., U. S. **Tribe 4. 1. Angélica sylvestris,** ♀, 5°-6° high, fragrant; large, comp. lvs.; large umbels of fls., white, pink-tinged. Eur. Gigantic, tree-like spec. in Kamtschatka. **A. Curtisii,** 3° high, ♀. Characters of type. Mts., N. C., E. Tenn., Va. **2. Archangélica officinalis,**

GARDEN ANGÉLICA, ②, 3°-6° high, very aromatic; stalks candied by confectioners. N. Eur. *A. atropurpurea*, 4°-6° high. N. and W., U. S. *A. hirsuta*, 2°-5° high. N. Y. to Mich., S. to Gulf. Other American species. 3. *Crithmum maritimum*, SAMPHIRE (HERBE DE ST. PIERRE) ROCK-CRESS. Aromatic, spicy; lvs. blue-green, fleshy, used as a pickle. Marine rocks, Eur., Canaries. 4. *Æthusa Cynapium*, FOOL'S PARSLEY. ①. Resembles true parsley, but worthless. Fig. 139, 1. Eur. 5. *Foeniculum vulgare officinale*, FENNEL. ②. Lvs. dissected. Aromatic; fls. yellow. Fr., Fig. 174, E. Eur., W. Asia Tribe 5. 1. *Carum Carui*, CARAWAY. Lvs. of last; sds aromatic. Eur. 2. *Petroselinum sativum*, PARSLEY. Well-known herb. Fig. 139, 2. Sardinia. 3. *Apium graveolens*, CELERY. ②. Stalks edible, fragrant. Sev. garden varieties. Eur. 4. *Cicuta maculata*, WATER HEMLOCK. ②, 6° high, showy fls. white; aromatic, but very poisonous. Common, U. S. *C. virosa*, similar, smaller, Eur. 5. *Bupleurum*, HARE'S EAR. Involucre showy. Sev. spec. ② or ev. shrubs, 3°-6° high, showy. Eur., Asia, Af. Tribe 6. 1. *Echinophora tenuifolia*, ② rigid, spiny, fls. white; S. Italy. *E. trichophylla*, similar, Levant.

Section 3.—Umbels simple, or regularly (rarely irregularly) compound. Vittæ 0. Tribe 7. 1. *Astrántia*. ②; rts. black, aromatic; rad. lvs. palmilobed; stem lvs. few, small, sessile. Umbels with leafy involucre; fls. pink or white; umbellets with showy, petal-like lvs. Ornamental. 12 spec., Eur., W. Asia. 2. *Eryngium*. ②. ②. Lvs. bristly or spiny. Fls. in hds. Many spec., both worlds; all ornamental. *E. maritimum*, SEA-HOLLY. ②; lvs. spiny; fl. hds. thistle-like, blue; rt. fleshy, edible. Sea-shore, Gt. Brit. *E. amethystinum*, hds., bracts, and stems bright blue, Styria. *E. alpinum*, smaller, more brilliant, Switzerland. *E. virginianum*, 2°-3° high; hds. blue. N. J. to Fla., W. to Tex. Sev. other Am. spec. Tribe 8. 1. *Hérmas*, stunted-looking; fls. green. 3 spec., Cape of Good Hope. 2. *Bowlésia ténera*, minute, curious; fls. green. Mt. Video. Tribe 9. 1. *Hydrocótyle*. ②, low, smooth marsh or aquatic herbs; fls. umbelled. *H. vulgaris*, PENNYWORT. Lvs. peltate, rhiz. creeping. Bogs, Gt. Brit. *H. umbellata*, *H. interrúpta*, similar; coasts and rivers, Mass., S.

Fig.-Marigold Alliance.—Fls. reg. or sub-irreg. Ova. syncarpous, adh., or free, 1-2-∞-celled. (Allied also to Pink and Goose-foot Alliances). 78. *Ficoideæ*. 79. *Cactáceæ*.

Ord. 78. *Ficoideæ* (*Mesembryacæ*).—Fls. usually cymose, reg.; rarely diclinous. Fr. various. *Herbs*, rarely *Shrubs*; usually unimportant weeds. Hot, dry regions, both worlds. About 20 gen.; over 450 spec. 3 Tribes:

Tribe 1. 1. *Mollùgo*, CARPET-WEED. Petals 0. Calyx 5-fid; sta. 5-3-10. Low, spreading; small lvs. (opp.) and fls.; boll 3-celled, ∞-seeded. Sev. spec., both worlds. *M. verticillata*, ①. Common, U. S. Tribe 2. 1. *Sesùvium*. Petals 0. Ova. free; pyxidium 3-5-celled, ∞-seeded. Smooth, succulent herbs; lvs. opp., fl. usually sol.; calyx 5-parted, colored inside. 6 spec., both worlds. *S. Portulacástrum*, sandy sea-coast, N. J. to Fla. Tribe 3. Ova. adh. 1. *Tetragònia*. Petals 0. Calyx 4-lobed; sta. 4-12; styles 3-8. Drupe 4-cornered, horned, 8-celled; cells 1-seeded. Littoral herbs or shrubs; lvs. fleshy. Sev. spec., S. hemisphere; except *T. expansa*, NEW ZEA-

LAND SPINACH, ☉, edible, which is found in Japan as well as New Z. and S. Am. 2. *Mesembryanthemum*. Fls. ♀, reg.; calyx 5-2-8-partite; petals ∞, linear, of various colors, usually opening at noon; sta ∞; ova. adh., 4-20-carpelled; stig. 4-20, cristate. Boll fleshy, becoming dry and dehisc.; sds. ∞. Succulent plants, with showy lvs. and fls. Nearly 400 spec., hot, sandy plains, Old World, chiefly at Cape of G. Hope. *M. crystallinum*, ICE-PLANT. ☉, ②; lvs. broad; whole plant covered with glittering, watery pustules. Canaries, Greece, Cape of G. H. *M. dolabriforme*, FIG-MARIGOLD, woody-stemmed; fls. yellow; *M. spectabile*, similar fls. pink; Cape of G. H.

Ord. 79. *Cactaceæ*.—Fls. ♀. Sepals and petals ∞. Sta. ∞. Ova. adh. Berry 1-celled, ∞-seeded, smooth, or with spines or bristles, from whose axils branches are often developed. *Shrubs* or *Trees* with watery or milky juice; stem fleshy; lvs. usually 0, indicated only by a cushion under the bud. Fls. large, usually sol.; showy, evanescent. 18 gen., 800 spec., all American. 2 Tribes:

Tribe 1. Calyx-tube not produced beyond the ovary. St. branched, jointed. 1. *Pereskia*. 12 species, several with woody stems and developed lvs. *P. aculeata*, BARBADOES GOOSEBERRY TREE. 15°-18° high, st. woody, spiny; branches trailing; lvs. oblong, elliptical; fls. large, white, clustered; berries yellow, edible. W. Ind. 2. *Opuntia*, PRICKLY-PEAR. St. and branches usually thick, flat, leaf-like in form; lvs. rudimentary, one under each tuft of bristles or spines on the branches; fls. yellow or orange-red, satiny in texture fr. pear-shaped; spiny. 150 species, chiefly trop. *O. brasiliensis*, tree-like, leafless, 10°-15° high, branches short, flat; pear edible. Brazil. *O. Tuna*, similar, 20°-25° high, pears very sweet. Trop. Am.; cultivated round the world. *O. Rafinesquii*, low, spreading, jointed; branches 4'-8' long, broad, flat, spiny-bristly; fls. yellow, red in centre. W. and S., U. S. *O. vulgaris*, similar, branches smaller, spines few, pear smooth, edible. Common. U. S. 2. *Nopalea*. Similar, but main stem taller, and red fls. not so wide open. N. (*Opuntia*) *cochinillifera* (or *coccinellifera*), COCHINEAL CACTUS; st 8°-10° high; supports the Cochineal insect. Mex., W. Ind. Fig. 102. **Tribe 2.** Calyx produced beyond ova. St. rarely leafy. 1. *Cereus*. Many fine spec.; stems columnar; trees or climbers, or low, trailing; often night-blooming. *C. giganteus*, 60° high, branches columnar, erect; New Mex. *C. grandiflora*, st. climbing, rooting, fls. night-blooming. W. Ind. 2. *Echinocactus*, HEDGEHOG CACTUS. Sev. spec., S. W., U. S., Brazil. 3. *Melocactus*, MELON C. St. melon-shaped. W. Ind. 4. *Mamillaria*, NIPPLE CACTUS; st. 1°-5° high, with nipple-like tubercles. Sev. spec., Nebraska, Texas, Mex.

Passion-flower Alliance.—Fls. usually reg.; ♀ or declinous. Ova. usually adh., syncarpous, 1-celled; placentas parietal; sometimes 3- or more-celled by the produced placentas. Styles distinct or connate. 80. *Datiacææ*. 81. *Begoniææ*. 82. *Cucurbitacææ*. 83. *Passifloracææ*. 84. *Turneracææ*. 85. *Loasacææ*. 86. *Samydacææ*.

Ord. 80. *Datiacææ*.—Fls. ♂ ♀, rarely ♀ or ♂ ♀ ♀; small, greenish. Corolla 0. Ova. adh. Calyx 3-9-fid; sta. 3-15. Boll 1-celled, ∞-seeded. *Herbs* or *Trees*; lvs. pinnate, or palminerved; exstip. 3 gen., 4 spec. 1. *Tetrámeles Horsfieldii*, only spec. ♂ ♀. Large tree; lvs. sometimes lobed; fls. spicate; Ind., Java. 2. *Octómeles*,

one spec., Malaysia. 3. *Datisca*. ☉ herbs. *D. glomerata*, fls. ♀; lvs. 3-partite, central lobe pinnatifid; fls. in axil. hds. Cal. *D. canabina*, fls. ♂ ♀; reproducing often by parthenogenesis; lvs. pinnate; fls. racemed. W. Asia, Nepal.

Ord. 81. Begoniaceæ.—Fls. ♂, cymose; ♂ in the middle, ♀ at circumference. ♂ calyx large, 2-leaved; petals (inner sepals of some authors) small, 2-3-7 or 0; sta. ∞, distinct or monadelphous. ♀ calyx and corol. nearly alike, 2-3-4-5-6-8-merous; ova. adh.; styles usually 3; boll (rarely berry) usually 3-celled, 3-winged; sds. ∞. *Herbs* with fleshy rhiz.; or *Undershrubs* or *Shrubs* with acid juice; lvs. inequilateral; stip. 42 gen.; 400 spec.; trop., both worlds, chiefly Am. 1. *Hillebrändia sandwicensis*, succulent herb; peduncle 1° high; fls. in a dichotomous, paniced cyme; ova. half-free, open above; establishing the affinity with Saxifragaceæ. Sandwich Islands. 2. *Begonia*, ♀, herbaceous, with showy lvs and fls. 350 species, trop., both worlds, chiefly in New World; propagating readily from lvs. 3. *Casparya*, climbing; boll triangular, 3-horned. 3 spec., Peru.

Ord. 82. Cucurbitaceæ.—Fls. ♂ or ♂ ♀, rarely ♀; white or yellow, rarely red; 5-merous; sta. 5; one, or all, often 1-celled; filaments rarely distinct, usually monadelphous; anthers usually sinuous. Ova. adh., 3-5-rarely, carpelled. Berry fleshy (rarely dry), indehiscent, rarely dehiscent. *Herbs* or *Undershrubs*, climbing by tendrils; rarely erect. Lvs. palminerved, palmilobed, cordate. 70 gen., 840 spec.; both worlds; chiefly in Ind., S. Am. 8 Tribes:

Tribe 1. Fr. large, indehisc. Sds. large. 1. *Fevillea*. ♀, herbaceous, stem rather woody; climbing the tallest trees; gourd round, rind woody; sds. oily; strung and used as candles, especially in Catholic processions. Sev. spec. W. Ind., Peru **Tribe 2.** Fr. 1-celled, opening at top by 3 valves. Sds. winged. 1. *Zanonia*. ♂ ♀. Climbing; lvs. entire; fr. fleshy. Ind. **Tribe 3.** Ova. 3-celled; ov. pend. 1. *Gynostemma*. ♂; corolla 0; fls. paniced. Ova. half-free; pepo fleshy. Asia. **Tribe 4.** Ova. 1-celled; ov. pend. 1. *Gomphogyne*. ♂. Climbing; boll dehiscent. Himálayas. **Tribe 5.** Ova. 1-celled; ov. sol., pend. 1. *Séchium edule*, CHÒCHÒ. ♂. Climbing from a large, fleshy, yam-like, edible rt.; lvs. 5-angled; pepo fleshy, edible, 4' long, green or cream-colored. W. Ind. 2. *Sicyos angulatus*, similar, but weak; fr. 6'' long, spinous, clustered. Can., U. S. **Tribe 6.** Sta. 1-3. Ova. 1-4-celled. Pepo bursting elastically. 1. *Echinocystis lobata*; ♂; ♂ racemes 1° long; tall, climbing; lvs. 5-lobed, pepo 2' long, prickly. N. Eng. to Wis., S. to Ky. **Tribe 7.** Sta. 3; anth. flexuose. Ova. 3-4-celled. 1. *Abobra viridiflora*. ♂ ♀; climbing; lvs. finely dissected; fls. sol.; pepo small, pend., scarlet. S. Am. **Tribe 8.** Sta. 3; anth. flexuose, curved, or straight. Climbers, tendrilled. 1. *Pilogyne (Zehnèria) suavis*, lvs. 5-angled, pepo small; Asia, Af. 2. *Bryonia dioica*, BRYONY. ♂ ♀; lvs. 3-5-lobed; pepos small, scarlet, clustered. Fig. 184. Eur. **B. alba**, similar, ♂. Eur.; hairs, Fig. 106, 9. **B. Boykinii**, similar, climbing 10°-20°; pepo plum-like, crimson. Ga. to Fla. 3. *Melothria pendula*, similar, delicate; pepo small, green. N. Y. to Ga. and La. 4. *Cucurbita Pepo*, PUMPKIN, SQUASH. Asia. Pollen, Fig. 173. **C. vernicosa**, KERSHAW, CROOK-NECK S. N. Am. 5. *Ecbalium agréste*, SQUIRTING CUCUMBER; ☉; trailing, tendrils 0; pepo small, green, bursting and projecting its sds. Fig. 74. S. Eur.

6. Momórdica, BALSAM CUCUMBERS. Sev. fine spec., high-climbing; lvs. lobed or comp.; pepo oblong, orange or red, warted or prickly, bursting and showing the bright, red-ribbed sds. Both worlds. **7. Citrúllus (Cúcumis) vulgáris, WATER-MELON.** ☉. Lvs. sinuate, 3-5-lobed, lobes pinnatifid. Asia. Numerous varieties. **C. Colocýnthis, COLOCYNTH GOURD;** fr. furnishes the drug. Asia. **8. Cúcumis sativus, CÚCUMBER.** ☉. Asia, Egypt. Fig. 168. **C. mēlo, MELON (MUSK-MELON);** the variety CANTALOUPE gets its name from *Cantalúppi*, a seat belonging to the Pope, near Rome. Figs. 220, 224. **C. Angúria, GHERKIN;** pepo small, prickly; used as pickles. **9. Lagénária vulgáris, GOURD, CALABASH;** ☉; with or without neck; often very large; rind horny; used as various utensils. Af., Asia. **10. Lúffa egyptiaca, TOWEL-GOURD, LACE-G.** Rind horny; fibrous within; fibre lace-like, used as sponge, or made into handsome head-dresses, etc. Asia, Af.

Ord. 83. Passifloráceæ.—Fls. ♂ or diclinous by arrest, 4-5-merous, dichlamýd. (called "*monochlamýd.*, with 2-seriate perianth," by some authors). Fl. described fully, Lesson XXI. Corolla sometimes 0, and sta. ∞; corona sometimes 0. Peduncle jointed at the fl., usually 1-flowered. Ova. free, usually stipitate; sometimes sessile. Berry or boll; 1-celled, placentation parietal; sds. ∞. *Herbs, Shrubs,* generally climbing by tendrils; or *Trees.* Lvs. alt., simple, or comp.; stipules rarely 0. 12 gen., 200 spec.; warm regions, Am., W. Ind., E. Ind. 5 Tribes:

Tribe 1. Fls. ♂ ♀, ♀ ♂. Corona 0. **1. Càrica.** ♂ fl. monopetalous, 5-merous; sta. 10. ♀ fls. polypetalous, 5-merous. Berry pepo-like, large, indehisc. Small, unbranched, milky trees with spongy wood and hollow stems. 10 spec., trop. Am. **C. Papàya, PAPAWE,** 20° high; lvs. 7-lobed, 2° in diam.; pepo large, edible; with abundant fibrine. Fig. 237. W. Ind. **Tribe 2.** Fls. diclinous. Corona 0. Corol. monopet., 3-5-fid. **1. Achària tragioides,** only spec.; slender herb; lvs. trifid, fls. 3-merous, involucl 3-leaved, fr. stipitate. Cape of Good Hope. **Tribe 3.** Fls. ♂ or diclinous, small. Corona small or 0. Lvs. entire or lobed. **1. Modécca.** Climbing shrubs; fls. 3-merous; boll stipitate, 3-valved. Sev. spec., trop. Asia, Af. **2. Ophiocaulon cissampeloides,** similar, fls. 5-merous; trop. Af. **Tribe 4.** Fls. ♂. Corona 1-2- or more-seriate. Styles 1, or 3-5, connate at base. **1. Smeathmánnia.** Erect shrubs; fls. white, 5-merous; corona urn-shaped, sta. 20; boll inflated, 5-valved. 2 spec., West trop. Af. **2. Tacsònia.** Climbing shrubs, with showy fls., resembling *Passiflora*; but with 2 coronas, one at throat, the other at base of calyx-tube. Ornamental. Sev. spec.; fr. (berry, pepo) edible; trop. Am. **3. Passiflora, PASSION-FLOWER.** Fl. and fr. described, Lesson XXI. Corona filamentous, ∞-seriate. Herbs or shrubs climbing by tendrils; or trees without tendrils. Sds. with fleshy aril. Berry (pepo) edible in sev. spec. Very many spec., ornamental; fls. of rich and various colors. Chiefly in trop. Am.; few in Asia. **P. quadrangulàris, GRANADÍLLA;** shrubby climber; st. quadrangular, 4-winged; fls. 3' long, crimson, fragrant; lvs. 8' long, oval; berry 6' long, edible. **P. edúlis,** similar; st. round; lvs. 3-lobed, fls. spreading, white; berry 3' long. **P. cærúlea,** similar to last; lvs. 5-7-cleft; fls. blue; berry smaller. **P. incarnàta, SACRED PASSION-FLOWER.** ☉ herbaceous climber; lvs. 3-cleft, serrate, 4½' in diam.;

stip. rudimentary; petiole and bracts with 2 boss-like glands. Fl. pale purple, 3' wide; corona longer than pet. Fr. (May-pop) 2' long, edible. Fig. 155. Va., Ky, S. to Gulf. **Tribe 5.** Corona dentate. Fls. small, sol., but infl. raceme-like. Boll. Stip. 0. 2 gen., 12 spec. **1. Malesherbia**; small shrubs; Peru. **2. Gynopleura**; herbs; Chili.

Ord. 84. Turneraceæ.—Fls. ♀, reg., 5-merous. Ova. free, 1-celled. Stigmas 3-6, fan-shaped. Boll 3-valved, ∞-seeded; sds. strophiolate. Lvs. alt., simple, petioled, exstip., but often with 2 glands at base. *Herbs, Undershrubs, Shrubs, Trees.* Few gen.; trop., both worlds. **1. Erbilchia**, trees; lvs. lanceolate; fls. large, axil., yellow; petals with fine filaments at base. Cent. Am. **2. Turnera.** Herbs or shrubs; lvs. notched or cleft; fls. usually yellow; axil., or adh. to petiole. Many spec.; W. Ind., S. Am., Cape of Good Hope. **T. (Piriquita) fulva**, 2, 1° high; N. C. to Fla. **T. (P.) glabra**, 1°-2° high; S. Fla. **T. (P.) tomentosa**, 1° high; S. Fla.

Ord. 85. Loasaceæ.—Fls. ♀, reg., 4-5-10-merous, polypetalous; sta. 8-10-∞, some of them sterile; grouped in bundles. Ova. adh., placentation parietal; boll 3-5-10-valved, ∞-seeded. Lvs. simple, usually palmilobed; exstip. *Herbs* (except *Kissènia*); often climbing; with rigid or stinging hairs and showy fls. 20 gen. **1. Kissènia** (incorrectly *Fissènia*) *spathulata*, only spec. Shrub, gooseberry-like; petals 10; fls. small, green. Boll 10-ribbed, of 10 nuts. S. and Cent. Af., Arabia. Only type not American. **2. Calophora**; and **3. Blumenbachia**; branching and climbing herbs with showy fls.; Chili, Peru. **4. Loasa**, erect or climbing herbs; fls. large, yellow; same habitat. **5. Bartonia**, showy annuals, branching, 2° high; fls. large, clustered, white or orange. Pacific States.

Ord. 86. Samydaceæ.—Fls. ♀, reg., inconspicuous, 4-5-15-merous. Ova. 1-celled. Berry or boll 1-2-celled, ∞-seeded. Lvs. simple; petioled; stip. small or 0. *Trees* or *Shrubs*. 16 gen., nearly 200 spec.; trop. Ind., Af., Am. 4 Tribes. **Tribe 1.** Ova. adh. or free. Fls. 4-15-merous. **1. Byrsanthes**, LEATHER-FLOWER. Corolla purse-like, leathery. Shrubs with snow-white hairs. Andes. **2. Homalium.** Sta. ∞, bunched in groups. Trees or shrubs. Both worlds. **Tribe 2.** Lvs. opp., ova. free. Petals 0. Calyx 4-partite. Sta. 8-∞. **1. Abatia.** **2. Ralèighia.** Shrubs. S. Am. **Tribe 3.** Lvs. alt. Ova. free. Calyx 4-5-merous; petals 4, 5, or more. Sta. ∞. **1. Bánara.** Small trees, shrubs, 15 spec.; trop. Am. **Tribe 4.** Lvs. alt. Ova. free. Petals 0. Calyx 4-5-merous. Sta. 6-30; staminodes as many. **1. Casearia.** Small trees, shrubs; 100 spec., chiefly in S. Am., W. Ind.; a few in Ind. **2. Samyda.** Staminodes 0. Shrubs or trees, often thorny. **S. suaveolens**, fls. white, with odor of orange-blossoms. Brazil.

Myrtle Alliance.—Fls. usually ♀; reg. or sub-reg. Ova. syncarpous, usually adh.; styles rarely distinct. Placentation various. Lvs. simple, except in *Combretaceæ*. **87. Onagraceæ.** **88. Haloragaceæ.** **89. Lythraceæ.** **90. Melastomaceæ.** **91. Myrtaceæ.** **92. Combretaceæ.** **93. Rhizophoraceæ.**

Ord. 87. Onagraceæ.—Fls. ♀, 2-4-merous; sta. 2-4-8-12. Ova. adh. or half-adh., 1-2-4-celled. Boll; berry; or nut. Aquatic or terrestrial *Herbs* or *Shrubs*. 22 gen., 300 spec.; temp. regions, both worlds.

1. Trapa. Floating herbs. Fls. 4-merous; sta. 4. Ova. half-adh.

Nut large, horned, 1-celled, 1-seeded. **T. nātans**, CALTROP, WATER CHESTNUT; lvs. triangular, petioles long, swollen, fibrous; nut 4-horned; sd. large, edible; cotyledons unequal. Perisperm 0. S. Eur., Asia. **T. bicōrnis**, LING, KI-CHI, similar; nut 2-horned, like a bull's head; sd. edible. China. **2. Gaūra**, terrestrial; nut 4-celled, cells 1-seeded. Fls. white or rose. Sev. spec., N. Am. **G. Lindheimeri**, \mathcal{Q} , 3° high, fls. white; Tex. **G. biennis**, $\textcircled{2}$, 3°-5° high, fls. rose; Can. to Ga. **3. Circaea**. Fls. 2-merous; nut 1-2-seeded, bristly, small. **C. Lutetiāna**, ENCHANTER'S NIGHTSHADE. Terrestrial; \mathcal{Q} , 12'-20' high; fls. small, white, racemed. N. Am., Eur. **4. Eucharidium**, fls. purple or white, 4-merous, reg.; calyx-tube prolonged beyond ovary. $\textcircled{1}$, branching, low; 2 spec., Cal. **5. Clarkia**; similar, but petals lobed. Sev. spec., Pacific States. **6. Godétia**. $\textcircled{1}$, low; fls. purple, pink, day-blooming; otherwise like next. Cal., Columbia R., S. Am. **7. Cenothéra**, EVENING PRIMROSE. Fls. yellow, white, very rarely pink, purple; vespertine, or opening only in bright sunshine. $\textcircled{1}$, $\textcircled{2}$, \mathcal{Q} ; many spec., erect or stemless. N. and S. Am. **C. biennis**, 2°-3° high, lvs. lance-oblong; fls. yellow. Pollen-gr., Fig. 4, 4. U. S. **8. Lopèzia**, calyx-tube not prolonged; petals clawed, irreg. $\textcircled{1}$, slender, branching; fls. small, pink or white. Mex. **9. Jussiaea**. Fls. 4-merous, yellow or white; sta. 8-12. Marsh herbs or shrubs; both worlds. **J. grandiflora**, \mathcal{Q} herb, creeping stems; fls. 2' in diam. Marshes, S. States. Sev. other spec., U. S. **10. Epilobium**. \mathcal{Q} herbs. Fls. 4-merous, pink or red; sta. 8; sds. strophiolate. Many spec., both worlds. **E. angustifolium**, WILLOW-HERB. \mathcal{Q} ; 4°-7° high; lvs. lanceolate; fls. large, pink-purple, racemed; calyx-tube not prolonged. Boll long, slender. Fig. 75. U. S., Eur. **11. Zauschneria californica**. \mathcal{Q} ; 1°-2° high; fls. 4-merous, scarlet, 2' long; sta. 8; calyx-tube prolonged beyond ovary; sds. strophiolate. Cal. **12. Fuchsia**. Fls. as in last, but long-peduncled; calyx very showy; sds. not strophiolate; fr. a berry. Low shrubs or small trees; many spec., fls. very showy. Am.; Mex. to Fuegia. **F. excorticata**, **F. procumbens**, New. Z.; only spec. not Am.

Ord. 88. Haloragææ.—Characters of Onagrææ, but fls. often diclinous. 10 gen., 80 spec., both worlds. **1. Callitriche**, WATER STARWORT. Fls. $\textcircled{1}$, achlamydeous, with or without involucre. Sta. 1. Stig. 2. Ova. free. Fr. 4 cocci. $\textcircled{1}$, \mathcal{Q} ; small, usually aquatic. Lvs. entire, opp. **C. Austini**, 1' high, tufted, terrestr. N. Y., N. J., west to Ill., S. to Tex., Mex., Cal. **C. verna**, amphibious, stems 3'-12' long. Eur., Penn. to Fla. Sev. other spec., both worlds. **2. Günnera**. Fls. $\textcircled{2}$, $\textcircled{1}$, $\textcircled{2}$, $\textcircled{3}$, 2-merous; spicate, racemed, paniced. Ova. adh; drupe 1-celled, 1-seeded. Herbaceous stem; lvs. rad., usually reniform, large. 11 spec., chiefly in S. hemisphere. **G. macrophylla**, Java. **G. scabra**, PANQUÈ; lvs. very handsome; 6° in diam.; Chili. **2. Proserpinaca palustris**, **P. pectinata**, MERMAID. Fls. $\textcircled{2}$, achlamyd., 3-merous; petals 0; drupe 3-angled, 3-seeded. Small, creeping aquatics; lvs. lanceolate or pectinate. Swamps, ditches, N. Eng. to Fla., La. **3. Myriophyllum**, WATER MILFOIL. Fls. 4-merous; sta. 4-8; petals small or 0. Fr. of 4 cocci. Lvs. dissected. Submersed aquatics. Sev. spec., U. S. **4. Haloragis**. Terrestrial; caulescent; fls. sol., or spiked, racemed, paniced; trop. Asia, Australia, New Z. **H. citriodora**, PIRI-JIRI;

lvs. fragrant. New Z. 5. *Hippuris*, MARE'S-TAIL. Aquatic \mathcal{Q} herbs, wholly or partially submerged; stem 1° - 2° high; lvs. linear, whorled; fls. minute, 1-merous, axillary; petals 0; calyx a mere rim. 3 spec. *H. vulgaris*, common; Continental Eur., N. Am. Ov., Fig. 180, E.

Ord. 89. **Lythraceæ**.—Fls. usually reg. Corolla polypetalous, iso-, diplo-, triplo-stemonous; rarely 0. Sta. on calyx-tube. Ova. free (except in Tribe 1), crowned by the persistent or accrescent calyx; 2-, several- (rarely 1-) celled. Boll, drupe, berry; sds. usually ∞ . *Herbs, Shrubs, Trces.* 40 gen., 300 spec., chiefly trop.; both worlds. 3 Tribes:

Tribe 1. Ova. adh. 1. *Punica Granatum*, only spec.; POMEGRANATE, GRENADE. Tree 20° - 25° high; fls. 5-7-merous, scarlet, white, or yellow; berry large; rind tough, golden-red; cells 2-seriate, ∞ -seeded; testa fleshy, red, edible. Rind of berry used to tan morocco leather. Fr., Fig. 208. Sev. dwarf varieties. N. Af., W. Asia. 2. *Olinia cymosa*, only spec., HARDPEER. Fls. 5-merous; cymose; drupe or berry. 3 varieties; all shrubs, 4° - 10° high; wood hard, valuable. Cape; Abyssinia. 3. *Axinandra zeylanica*. Fls. 5-merous. Handsome tree, 60° high. Ceylon. **Tribe 2.** Ova. free. 1. *Lagerstroemia*. Fls. 6-merous; petals clawed, limb crumpled. Boll crowned by calyx. 14 species; large shrubs or trees of Asia; lvs. opp.; fls. white, pink, purple, paniced, showy. *L. reginæ*, JAROL; magnificent timber tree, wood blood-colored, valuable. Ind., Burmah. *L. indica*, CRÈPE (CRAPE) MYRTLE, 10° - 20° high. China. 2. *Lawsonia alba*, only spec. 10° high, fls. 4-merous, white, paniced, fragrant. Asia, N. Af.; sacred in Ind., where it is called MENDEE; lvs. powdered are the HENNA of Persia and Arabia. Called EGYPTIAN PRIVET in Eng.; JAMAICA MIGNONETTE in W. Ind. 3. *Nesaea*. \mathcal{Q} herbs or shrubs; fls. 5-merous, yellow, pink, purple; calyx 5-7-merous. Sev. spec., both worlds. *N. verticillata*, shrubby, stems 2° - 8° long, fls. pink; N. Eng. to Fla. 4. *Lythrum*, LOOSESTRIFE. Similar, but pet. 5-7; fls. purple, pink, or white. *L. Salicaria*, 3° - 4° high; fls. large, pink-purple. Eur. *L. alatum*, fls. smaller, purple; st. alate. W. and S. 5. *Cuphea*. Calyx elongated, gibbous, or spurred; petals usually 6, unequal, sometimes 0. Sev. spec., herbs or undershrubs, trop. and N. Am. *C. platycentra*, CIGAR FLOWER. \mathcal{Q} , $8'$ - $15'$ high; smooth; calyx bright vermilion; teeth violet, edged with white; petals 0. Mex. *C. viscosissima*, \odot , homely, 1° - 2° high, clammy-hairy; fls. small, petals pink. Conn. to Ill., S. **Tribe 3.** Herbs, usually aquatic. Fls. small. 1. *Ammannia*. \odot . Fls. 4-merous, small, axil. Low herbs, in wet places. Sev. spec., both worlds. *A. humilis*, lvs. spatulate. Mass. to Mich. and S.

Ord. 90. **Melastomaceæ**.—Fls. \mathcal{S} , reg., cymose, rarely sol. Calyx-tube campanulate or oblong; limb 5-6-3-partite. Petals 5-6-3; sta. = or double or triple their number; filaments free; connective often appendaged; anthers usually with apical porous dehiscence. Ova. free or variously adh. to calyx-cup; cells 4-5, or 6-20, rarely 1. Berry, drupe, boll. Sds. ∞ ; often reniform or eochleate. Lvs. opp. or whorled; 3-5-7-9-ribbed. *Trees, Shrubs, rarely Herbs*; all innocent; fls. showy. 165 gen., 2000 spec.; warm climates, both worlds; chiefly in Am. and Ind. 3 Sub-Orders:

Sub-Ord. 1. Ova. 1- ∞ -celled. Sds. large, few. 1. **Memecylon.**

50 species, small trees or shrubs; fls. blue. Ind. *M. edule*, berries edible. Sub-Ord. 2. Ova. 2- ∞ -celled. Sds. minute. 1. *Astrônia*. Trees, lvs. 3-ribbed; fls. small, purple, racemed; berry ∞ -seeded. Moluccas. Sub-Ord. 3. 9 Tribes; distinctions in anthers and fr. Tribe 1. 1. *Blàkea*. Trees, shrubs; lvs. leathery, 3-5-ribbed. Fls. large, handsome, white, rose-colored; berry ∞ -seeded, often edible. Trop. Am. *B. quinquerària*, berry yellow, edible. W. Ind. Tribe 2. 1. *Micônia*. Shrubs, small trees; lvs. variable: fls. small, white; anthers curved. Berry globose. Trop. Am. Tribe 3. 1. *Medinilla*. Anthers incurved; connective appendaged. Elegant shrubs; lvs. fleshy, ribs colored; fls. large, rose or white, paniced; peduncles and pedicels red. Fr. a berry. Islands, Ind. Ocean. Tribe 4. 1. *Sone- rila*. Herbaceous or shrubby; fls. 3-merous, purple, in scorpioid racemes. Boll depressed at top. Many spec., E. Ind. Tribe 5. 1. *Brédia*. Shrubs; sta. 8, unequal; fls. rose-colored, cymose. Japan, China. Tribe 6. 1. *Meriània* (after Miss Merian, Brit. scientist). Trees; fls. large, purple, scarlet, crimson, yellow; cymose; sta. 10, equal; boll 3-5-celled. Trop. Am. Tribe 7. 1. *Rhèxia*, DEER- GRASS, MEADOW-BEAUTY. \mathcal{Q} , low, often bristly herbs; lvs. sessile, 3-5-ribbed; fls. large, pink, purple, yellow; cymose or paniced; petals 4; sta. 8; ova. half-adh.; boll 4-celled; sds. cochleate. *R. vir- ginica*, *R. Mariàna*, fls. purple. Penn. to Ill., S. to Gulf. Tribe 8. 1. *Melàstoma*. Small, hairy shrubs; lvs. 3-5-7-ribbed; fls. usually 5-merous; large, purple, pink, or white, fascicled; anthers 10; 5 large, spurred. Many spec. Trop. Asia, Islands of Ind. and Pacific Oceans. Tribe 9. Connective appendaged. 1. *Centradènia*. Un- dershrubs; lvs. inequilateral; fls. 4-merous; sta. 8; fls. small, pink or white, racemed; boll 4-celled. Sev. spec., Mex., Cent. Am. 2. *Lavoisièra*. Shrubs with dichotomous branches, sessile lvs.; showy, bracted terminal fls., which are 5- or 10-merous. Boll. 20 spec., Brazil.

Ord. 91. *Myrtacæ*.—Fls. \mathcal{Q} reg.; rarely with irreg. sta. Corolla polypetalous (monopetalous in Tribe 1), rarely 0; sta. usually ∞ ; ova. adh. or half-adh., 1-2-5- ∞ -celled. *Shrubs*, *Trees*, rarely *Herbs*. 100 gen., 1500 spec. Both worlds, chiefly trop. 6 Tribes:

Tribe 1. Corolla monopetalous, sometimes double. 1. *Asteràn- thus*. Corolla single, multifid; sta. ∞ . Ova. adh. Lvs. alt., entire, petiolate; fls. sol., axil. Shrub, Brazil. 2. *Napoleòna*. Corolla double; sta. with filaments connate into a petaloid cup with many 1- celled anthers. Berry pomegranate-like, 5-celled. Shrubs, resem- bling Pomegranate. W. Af. *N. imperialis*, fls. cream-colored, axillary, in 3's. Tribe 2. Sta. ∞ ; filaments connate into a petaloid, tongue-like cup. Berry or boll, ∞ -seeded. Trees, trop. Am. 1. *Lécythis*, MONKEY-POT TREES. 40 spec.; trunks 80°-90° high be- low the large hd. of branches with glossy foliage. Pyxis large, woody; sds. resembling Brazil nuts; often edible. *L. Oltària*, pot Fig. 156. 2. *Bertholletia excelsa*, BRAZIL-NUT TREE; 100°-150° high, 3°-4° in diam.; no branches, except near top. Boll 6' in diam., 18-24-seeded; indehisc. except by a pore at top; shell $\frac{1}{2}$ ' thick, so hard it must be split with an axe to release the sds. Fig. 201. Guiana, Venezuela, Brazil, forming great forests. 3. *Couroupita*, CANNON- BALL TREE; similar; fls. large, pink or white, adventitious; boll resembles a cannon-ball. Tribe 3. Sta. ∞ , often monadelphous.

Berry 1- or few-celled, 1-few-seeded. Trees, trop. Asia, Am. 1. **Gustavia**. Trees or shrubs; lvs. large, glossy; fls. showy, 5'-6' across, white, pink-tinged, racemed or umbelled; berry fleshy, apple-like. Trop. Am. 2. **Carèya**. Trees; fls. large, red, yellow, in spikes, hds., or corymbs; berry large, orange-like; Ind., one spec. in N. Australia. 3. **Barringtònia**. Large oak-like trees; lvs. large; fls. large, showy, pink, scarlet, white; berry fleshy, 1-seeded, 1'-2' long. Ind., Malaya, Ind. Arch., N. Australia, E. Af. **Tribe 4.** Sta. ∞ , free. Berry 2-more-celled, cells often 1-seeded. Lvs. opp., entire, exstip. 1. **Caryophýllus aromaticus**, CLOVE TREE. Evergreen, 15°-30° high; lvs. large; fls. purple, corymbose; unexpanded fl. buds the Cloves of pharmacy. Amboyna. 2. **Eugènia**. Handsome trees or shrubs; trop., both worlds. Fls. white, axil.; **E. Pimènta**, ALLSPICE, PIMENTO; small berries are the Allspice of commerce. **E. Jambòsa**, ROSE-APPLE; berries as large as a plum, edible. 3. **Psidium**. Trees or shrubs; fls. large, white; berries large. Trop. Am. **P. Guaiàva**, **Guàva**. 15°-20° high; produces the well-known fruit. 4. **Mýrtus**, MYRTLE. Many spec., thyme-like dwarfs, shrubs, small trees; both worlds. **M. commúnis**. Classic MYRTLE. Evergreen shrub; fls. white, fragrant. Wood beautifully mottled, valuable. Fig. 178. W. Asia. **Tribe 5.** Sta. ∞ , free or connate. Boll 2- ∞ -celled. Shrubs or trees, chiefly in Australia. 1. **Eucalýptus**, GUM TREES. Corolla 0. Nearly 150 species, Australasia. **E. gigantèus**, 400° high, 100° in girth. Tasmania. **E. pulverulènta**, lofty tree, New Holland. Fig. 157. 2. **Beaufòrtia**. Shrubs with showy fls.; 5-petalled; New Holland. **Tribe 6.** Sta. often def., some usually sterile. Fr. 1-seeded, indehisc., or 2-valved at top. 15 gen., many spec. Heath-like shrubs, Australia. 1. **Darwinia**; fls. apetalous. 2. **Chamælaiucium**; petals 5, sta. 10, 5 abortive, strap-shaped; fls. white.

Ord. 92. Combretæcæ.—Characters of Haloragæcæ; but *Trees* or *Shrubs*, erect or climbing. 23 gen., 200 spec. Trop., both worlds. 1. **Gyrocárpus**; nut winged; trees, E. Ind., trop. Am. 2. **Illigera**; nut 4-winged; climbing shrubs; lvs. ternate, Java; lvs. quinate, trop. Af. 3. **Combrètum**. Petals 4, sta. 8; drupe leathery, 4-winged. Trees or shrubs, often trailing or climbing by the persistent lf.-stalks, which are changed to hooks. Fls. ♂ & ♀, in spicate panicles. Many fine spec. Both worlds. 4. **Quisquális**. Climbing shrub; petals 5, sta. 10. Fls. white, changing to red; spicate, showy. Asia, Af. 5. **Terminália**. Both worlds. **T. Catappa**, tree, Ind. Emb., Fig. 191, E. **Ord. 93. Rhizophoræcæ.**—Characters of Combretæcæ; but lvs. ent. *Trees, Shrubs*. 14 gen.; trop., both worlds. 3 Tribes:

Tribe 1. Styles 3-5. Perisperm 0. 1. **Anisophýllea**. Shrubs, trees; trop. Asia, W. Af. **Tribe 2.** Style 1. Perisperm fleshy. 1. **Cassi-pourea**. Trees; lvs. opp.; petals 4-5-clawed, fringed. Berry small, few-seeded. 3 spec., W. Ind., Cent. Am., Venezuela, Guiana. **Tribe 3.** Style 1. Perisperm 0. Radicle very large, protruded from the fruit whilst still on the tree. Maritime trees. 1. **Rhizophora**, MANGROVE. Fls. complete, 4-merous; sta. 8-12. Ova. half-adh. Fr. 1-celled, 1-seeded. Branching trees, sending down aerial roots, like the Banyan, into the muddy swamps they inhabit. **R. Manglè**, fls. yellow; fr. edible. La., Fla., S. Sev. spec., Old World.

Rose Alliance.—Fls. usually ♂; reg. or irreg. Carpels 1 or more;

usually free in bud, sometimes variously united afterwards with the calyx-tube or enclosed in the swollen top of the peduncle; styles usually distinct. 94. *Bruniaceæ*. 95. *Hamamelidaceæ*. 96. *Droseraceæ*. 97. *Crassulaceæ*. 98. *Saxifragaceæ*. 99. *Rosaceæ*. 100. *Leguminosæ*. 101. *Connaraceæ*.

Ord. 94. *Bruniaceæ*.—Fls. 4-5-merous, isostemonous; small, reg., in spikes or hds. Ova. adh., rarely free (*Raspailia*), 1-2-3-celled; styles 2-3, more or less coherent. Fr. dry, crowned by calyx (sometimes by corol. and andrœcium). Heath-like *Shrubs* or *Undershrubs*. Cape of Good Hope. 15 gen., 60 spec. 1. *Grubbia*. 2. *Ophira*. 3. *Brunia*. 4. *Raspailia*.

Ord. 95. *Hamamelidaceæ*.—Fls. ♂, ♂, ♂ ♀, in hds. or spikes. Corol. 0 or polypetalous, 4-5-7-merous; sta. twice as many, half of them staminodes; in the apetalous fls. the sta. are ∞. Ova. half-adh., 2-celled; styles 2. Boll half or quite free; sds. few or sol. *Shrubs* or *Trees*. Lvs. alt., simple, petioled. 2 Sections:

A. *Cells 2-∞-ovuled*. 1. *Liquidambar*. Fls. ♂. Petals 0. ♂ achlamyd.; ♀ monochlamyd.; infl. in catkins or unisexual hds. Carpels connate, forming a multiple cone-like fr. Trees with balsamic resin, both worlds. L. *Altingia*, RÁSSA-MÁLA, RÔSA-MÁLLOS, gigantic trees, forming vast forests in Java, Asia, New Guinea; yields *Liquid Styrax*. L. *styraciflua*, SWEET-GUM TREE, similar, but not so large; handsome, 60° high, 5° in diam.; lvs. palmate, serrate; balsam and wood very fragrant. Fig. 118. Conn. and Ill., S. and W. 2. *Bucklandia*. Calyx bell-shaped; fls. in hds. of 8 fls. Poplar-like tree, Ind. 3. *Rhodolèia Championi*. Evergreen shrub; petals bright pink; fls. 5 or 6 in a hd.; petals radiately arranged, giving the semblance of a single large *Camellia*. Hong-Kong; a second spec. in Java.

B. *Cells 1-ovuled*. 1. *Hamamelis*, WITCH (WYCH) HAZEL. Fls. 4-merous; petals yellow. Boll 2-beaked, 2-celled, 2-seeded. Deciduous shrubs, N. Am., China. H. *virginiana*, 10°-18° high; petals long, linear; blooming in winter. Moist, rocky woods, Can., U. S. 2. *Fothergilla*. Petals 0. Sta. ∞, showy. Deciduous shrubs. N. Am. F. *alnifolia*, 2°-4° high; lvs. oval, crenate; calyx white, sta. long, white or pink; fls. fragrant; in spikes or catkins. Swamps, Va. to Fla.

Ord. 96. *Droseraceæ*.—Fls. ♂, 5-merous; sta. 5 or some multiple. Ova. free. Boll 1-2-3-celled. *Herbs*, *Undershrubs*, or *Shrubs*, sprinkled with glandular hairs. Lvs. simple, alt., circinate in veneration. 7 gen., 100 spec., both worlds. 1. *Byblis*. Herbs; stem short, lvs. linear, fls. sol., blue. Australia. 2. *Roridula*. Viscid shrubs, undershrubs; fls. white, racemed. S. Af. 3. *Dionæa muscipula*, only spec., VENUS' FLY-TRAP. Stemless, small herb; lvs. rosulate; blade spinulose, sensitive, catching insects, folding them in, and digesting them. Scape 6'-12' high, with an umbel of white fls. Bogs near Wilmington, N. Car. 4. *Drosera*, SUNDEW. Similar to last; but lvs. not folding over the insects; infl. scorpioid. Sev. spec., both worlds. D. *rotundifolia*, peaty bogs, U. S. Fig. 112. D. *filiformis*, lvs. filiform; scape 6'-12' high; fls. pink. Fig. 179, D. Wet sands, Mass. to Fla. 5. *Aldrovanda vesiculosa*, floating, in still water; lvs. whorled, blade inflated; fls. white, sol. S. France, N. Italy, Bengal.

Ord. 97. *Crassulaceæ*.—Fls. ♂, or dichinous by arrest; reg., ♂ to 20-merous; sta. as many or twice as many; infl. often in unilateral

cymes. Carpels usually as many as petals. Follicles free; sds. numerous, minute. *Herbs* or *Undershrubs*, with more or less fleshy stems and branches. Lvs. fleshy, simple, entire, rarely pinnatifid or pinnate; exstip. 24 gen., 470 spec. Dry regions; cosmopolitan. 1. **Kalánchoë**. Erect herbs or shrubs. Fls. 4-5-merous, large, in paniculate cymes, yellow, purple, scarlet. Lvs. entire, crenate, or pinnatifid. 30 spec. Trop. Af., Asia, Brazil. 2. **Bryophýllum calycinum**. Fls. 4-merous, green-purple, drooping, in elegant racemes; lvs. pinnate, bearing buds with rts., on the leaf-margins. 2 herbs; rocks. Moluccas, Madagascar, Mauritius. 3. **Sempervivum**. Fls. 12-merous, purple, white, yellow. Shrubs or herbs; chiefly in Canaries. **S. tectórum**, HOUSELEEK; lvs. fleshy, rosulate, fls. purple, cymose. Plant, fls., Fig. 148. 4. **Ròchea**. Fleshy shrubs; lvs. opp., connate; fls. 5-merous, in umbelled cymes, white, pink, scarlet. Sev. spec., Cape of Good Hope. 5. **Sédum**, STONECROP. Fls. 4-5-merous, cymose, yellow, white, pink, purple. Fleshy, herbaceous, or shrubby, almost epiphytal on rocks and walls. **S. pulchéllum**, BEAUTIFUL STONECROP, KENTUCKY ROCK-MOSS. Spreading and rooting; stems 4'-12' long, delicate; lvs. linear, terete, crowded, fleshy; fls. rosy-pink, in unilateral, 5-branched, star-like cymes; 5-merous, the central fl. 4-merous. Fl. plan, Fig. 82. Exquisite; forming great mossy, star-embroidered carpets on bare rocks and cliffs. Va., Ky., to Ga. and Tex.; abounding in Ky. **S. ternátum**, spreading; stems 6' high; lvs. in 3's, obovate; cyme 3-branched; fls. as in last, but white. Penn., W. and S. **S. Telèphium**, ORPINE, LIVELONG. 2, 2° high; lvs. oval, fleshy, wavy-toothed; fls. 5-merous, white or purple, cymose. Eur. 6. **Cotylèdon orbiculàta**. Evergreen undershrub; lvs. orbicular, fls. 1' long, red, clustered, showy. Cape of Good Hope. 7. **Echevèria coccinea**. Shrubby base; lvs. in rosettes; fls. 5-merous, yellow within, red without. Mex. 8. **Cràssula**. Herbs or shrubs. Fls. 5-merous, pink or white, in cymes or heads. 120 spec, chiefly in S. Af.

Ord. 98. Saxifragáceæ.—Characters of Crassulacæ and Rosacæ, but fls. reg., sds. with perisperm. A great Order, varied, cosmopolitan. About 60 gen., 670 species. 6 Tribes, with 2 anomalous genera.

Anomalous genera. 1. **Cephalòtus folliculàris**. Ova spec. Fls. 6-merous, white; sta. 12, petals 0; infl. spicate. Ova. free. Follicles 6. Perennial herbs; lvs. dimorphous, radical; true lvs. spatulate, others pitcher-like (resembling *Nepenthes*), whorled around them. Swamps, S. W. Australia. 2. **Baùera**. Fls. 6-10-merous, handsome, nodding, pink or purple. Ova. free. Follicles 2. Small shrubs, with 3-foliate lvs. Australia.

Tribe 1. Ova. adh., 1-celled. Fr. a berry.—Shrubs. Lvs. alt., simple. Fls. usually racemed. 1. **Ribes**. Fls. 5-merous; lvs. lobed. 60 spec., 40 American, from Straits of Magellan (Magalhaens) to Arctic Circle; 20 in temp. regions, Eur., Asia. **R. speciosum**, FLOWERING GOOSEBERRY; straggling climber, prickles few; fls. red, fuchsia-like. Cal. **R. Grossulària**, GARDEN GOOSEBERRY. Shrub, thorny-prickly; fls. small; berry large, edible. Fig. 207. Eur., Af. Sev. wild spec., U. S. **R. rubrum**, RED CURRANT. Stems straggling; raceme many-flowered; fls. small, berries bright red, edible, but very acid. Eur., Can. **R. nigrum**, BLACK C. Berries black, spicy. Eur. **R. sanguineum**. Fls. bright red; Oregon, Cal. **R. aureum**, MISSOURI C. Fls. yellow, spice-scented. Miss. to Oregon.

Tribe 2. Trees or shrubs. Lvs. opp., simple, or comp., stip. 1. *Cunônia capénsis*, ROOD ELZÈ. Fls. 5-merous, small, white, in dense racemes. Lvs. pinnate. Ova. free. Follicles 2. Small tree, with red twigs. Cape of Good Hope. **Tribe 3.** Trees or shrubs. Lvs. alt., simple, exstip. 1. *Escallônia*. Fls. 5-merous, handsome, white, pink, or red. Ova. adh. Boll opening at base. Numerous species, evergreen trees or shrubs. S. Am., chiefly in Chili. 2. *Itæa virginica*, only spec. 6° high. Fls. 5-merous, white, racemed. Ova. adh. Boll 2-celled. 3. *Bréxia*. Fls. 5-merous, leathery, greenish, umbelled. Ova. nearly free. Lvs. leathery. Drupe 5-ribbed, as large as an orange. Small trees. Madagascar. **Tribe 4.** Shrubs, trees. Lvs. opp., simple, exstip. 1. *Philadélphus*. Fls. 4-5-merous, white, clustered, resembling orange-blossoms. Ova. adh. Boll 3-5-celled, splitting into as many carpels. Shrubs. Many species. S. Atlantic States, Pacific States, Japan. *P. coronarius*, MOCK ORANGE, 8° high; fls. fragrant. Japan. *P. grandiflorus*, 6° high; fls. large, scentless. Va., S. *P. Gordonianus*, similar, but taller; Oregon. Sev. other pretty spec. in U. S. 2. *Decumária bárbara*. Climbing shrub. Fls. 7-10-merous, white, fragrant, cymose; sta. ∞. Ova. adh. Boll many-ribbed. Shores of streams, S. 3. *Deutzia*. Shrubs. Fls. 5-merous, white, showy, paniced. Sev. species. Lvs. rough with stellate hairs. Japan, China. 4. *Hydránga*. Shrubs. Fls. 5-merous, cymose; central fls. complete, outer fls. neutral, of large showy-colored sepals. Ova. adh. Boll 2-celled, 2-beaked. *H. horténsis*, GARDEN H. Cymes globose, all the fls. neutral, colors various. Japan. *H. quercifolia*, OAK-LEAVED H. Cymes paniced. 5°-8° high. Ga., S. *H. arboréscens*, cymes flat; lvs. ovate; 5°-7° high. Mid. and W. States. *H. radiata*, 5°-8° high; Tenn., Car., Ga. **Tribe 5.** Scapigerous herbs. Fls. 4-merous. 1. *Fráncoa*. Lvs. rad., lyrate; scape racemed. Ova. free. Boll 4-valved, ∞-seeded. Chili. **Tribe 6.** Herbs, usually scapigerous. Fls. usually 5-merous. Ova. 1-3-celled. 1. *Parnássia*. Lvs. rad., round, smooth. Petals with clusters of glandular staminodes. Fl. sol., large, white. Ova. free. Boll 1-celled. *P. palústris*, GRASS OF PARNÁSSUS; elegant, scape 1° high. Mts., Eur., Can. *P. caroliniana*, lvs. larger, scape 1°-2° high. N. and S. 2. *Heùchera*. Rad. lvs. round, more or less lobed, large, geranium-like; scape paniced. Ova. half-adh. Boll 1-celled, 2-beaked. Sev. spec., all handsome. N. Am., Siberia. *H. americana*, ALUM ROOT. Rt. astringent. Scape with loose panicle, 2°-3° high. U. S. Sev. other Am. spec. 3. *Boykinia aconitifolia*, cyme fastigiata, fls. secund, white. Ova. adh. Boll 2-celled, 2-beaked. Stem with palmilobed lvs. Mts., Va., N. C., Oregon. 4. *Saxifraga*, SAXIFRAGE. Rt. perenn., lvs. rad. Scape cymose or paniced; fls. white, pink, red, yellow. Ova. half-adh. Boll 2-celled, 2-beaked. 150 species. all handsome rock-plants. Both worlds. *S. umbrósa*, LONDON PRIDE, EUR. *S. virginiensis*, EARLY S. Lvs. pubescent; fls. white, purple-tinged. U. S. *S. sarmentósa*, miscalled BEEFSTEAK GERANIUM. Lvs. rounded, fleshy; sending off axillary runners. Scape paniced; fls. irreg., pink, spotted. China, Japan. 5. *Astilbe*. Lvs. 3-ternate; fls. paniced, white; sometimes ♂ ♀. Ova. half-adh. 6 spec., tall, branching herbs, resembling *Spiræa*. N. Am., Japan, Java, Himálayas. *A. decándra*, 3°-5° high. Mts., Va., S. *A. japónica*, smaller, more delicate; fls. pure

white. Japan. 6. *Sullivantia ohidnis*. Rad. lvs. round; cauline minute; stem slender; fls. paniced, white. Highland Co., Ohio. 7. *Tiarélla cordifolia*. 8. *Mitélla diphglla*, *M. nuda*, MITREWORT; small plants, with leafy runners, and racemose white fls. Can. to Ky., Ga. 9. *Chrysoplénium*, GOLDEN SAXIFRAGE. Low, delicate, fleshy; fls. bright yellow-green. Boll 1-celled. Edges of streams. Sev. spec., both worlds. *C. americanum*, N., U. S.

Ord. 99. **Rosáceæ**. ROSES.—Fls. usually reg.; ♂, or rarely unisexual. Petals 5-4 (rarely 8, rarely 0), perig., sub-epig. Sta. usually ∞. Carpels 1-2-3-4-5-10-∞, free or variously connate; ovules usually 2, sometimes 1; anat.; styles ventral or sub-terminal. Perisperm 0, except in Tribe 5 (Spiræacæ). Lvs. simple or compound, usually alt. and stip. *Herbs, Shrubs, Trees*. Cosmopolitan; chiefly in temperate regions. The most beautiful Order; the fourth in usefulness. (See Grasses, Palms, Pod-Bearers.) About 90 gen.; more than 1000 spec. 10 Tribes. Types only given here:

Tribe 1. Trees or shrubs. Lvs. simple, rarely pinnate. Petals 5. Calyx-lobes usually persistent. Fls. often unisexual. Sta. 5-10-20. Carpels 5. Ov. 1 or more. Fr. of 5 cocci or follicles, or a boll not included in calyx-tube. Sds. usually winged. 1. *Vauquelinia corymbosa*, elegant tree, 30° high; fls. small, white, corymbose. Mex. 2. *Lindléya mespiloides*, small evergreen tree; fls. large, white, solitary, term., fragrant. Mts., Mex. 3. *Kagenéckia*; 3 known spec.; evergreen trees; fls. unisexual, hawthorn-like. Lvs. bitter, medicinal. Chili, Peru. 4. *Quillája*, QUILLAI, CULLAY, SOAP-BARK TREE; 4 spec., tall evergreen trees; fls. unisexual or ♂, large, white, terminal, single or few in a cluster. Bark abounds in saponine; the *Soap-bark* of commerce. Chili, Peru, S. Brazil.

Tribe 2. Trees or shrubs. Lvs. simple, entire. Petals 5. Calyx-lobes usually decid. Stamens 3-7-10-15-∞, often unilateral. Carpel 1; ovules 2. Boll (or drupe) not included in calyx-tube. 1. *Hirtélla*. Sta. long, protruding; fls. small, white, or purplish, racemed; drupe 1' long, 1-seeded. 30 spec., trop. S. Am. *H. silicea*, tree of Trinidad; bark silicious; used in making pottery. 2. *Parinarium*, trees, 30-40 spec., warm regions, both worlds. Drupe 2-seeded, edible. *P. excelsum*, GRAY PLUM, W. Af. *P. macrophyllum*, GINGERBREAD PLUM, W. Af. 3. *Moquilea*, trop. American trees; infl. racemose. *M. utilis*, POTTERY TREE, bark silicious, used in pottery. Amazon River. 4. *Couépia*, fls. white or cream-colored, paniced or racemed, handsome. About 12 spec., S. Am. trees. *C. chrysocalyx*, 30° high, handsome; Amazon. *C. guianensis*, 60° high, wood red, valuable. Guiana. 5. *Licânia*, slender trees, often 100° high below the branches; wood hard as iron; bark used in pottery. 35 spec., Guiana, Brazil. 6. *Chrysobalanus*, fls. small, white, paniced. Shrubs, small trees; 4 spec., trop. Af. and Am. *C. Icacó*, COCOA PLUM. Small tree, drupe edible. W. Ind., S. Fla. *C. oblongifolius*, stem prostrate, branches 12'-15' high; drupe as large as a plum. Pine barrens, Ga, Ala., Fla.

Tribe 3. Shrubs or trees, yielding gum; branches often spinescent. Lvs. simple. Fls. usually ♂; infl. various. Petals 5. Calyx decid.; sta. ∞. Carpel 1, rarely several; ovules 2; fr. a drupe, sd. usually solitary by arrest. 1. *Prinsépie utilis*, small prickly shrub; fls. resemble those of the blackthorn; berries small, purple. Himálayas.

2. Prunus. Trees or shrubs, with spiny branches; temp. regions, both worlds. Fls. white, sol. or clustered. Drupe pruinous. Stone flat-tish (furrowed at the edge) and pointed. Many spec. *P. spinosa*, SLOE, BLACKTHORN. Shrub; drupe dark purple, sour. Eur. *P. insititia*, BULLACE PLUM, similar to last, fr. black, round. Eur. *P. domestica*, GARDEN PLUM, DAMSON. 15°-20° high. Many fine varieties; GREEN GAGE, REINE CLAUDE, etc.; dried varieties are known as PRUNES. Native of Caucasus and Asia Minor. American: *P. Chicasa*, CHICKASAW P. 6°-12° high; drupe globular, red. Penn., S. and W. *P. americana*, small tree; drupe globular or oval, red, crimson, or orange. Along streams, common. *P. umbellata*, small bushy tree; drupe red. Copses, Ga. and Fla. *P. Armeniaca*, APRICOT, 20°-30° high; drupe round, orange or brown. Armenia. Many fine varieties. **3. Amygdalus.** Similar to *Prunus*, but drupe velvety, large; stone rugose and porous; fls. often pink or red. *A. communis*, ALMOND. 20° high; fls. large, pink; epicarp dry when ripe, and separating like a husk from the brittle stone; stone with 1 large, edible sd. (sometimes 2 sds.). Barbary, Morocco. Many varieties: BITTER ALMOND has white fls. and bitter sds. *A. nana*, FLOWERING A.; dwarf, with double fls., white, pink, red; and fr. of last. Asia. *A.* (*Prunus*) *Persica*, PEACH. Similar to Almond, but epicarp fleshy and larger. Fig. 206. Asia. Many varieties: FREE-STONE, CLINGSTONE, etc. Var. *laevis*, NECTARINE, has a smooth skin. **4. Cerasus, CHERRY.** Similar to *Amygdalus*, but fls. (usually) white, umbelled, or racemed; fr. smaller, nearly globular, shining; stone round, smooth; wood hard, fragrant, valuable. Many spec., temp. regions, both worlds; many and variable varieties. 2 Sections:

1. *Fls. umbelled*: 1. *C. vulgaris* (*Prunus Cerasus*), GARDEN CHERRY. Cultivated from Asia Minor, where it grows to the height of 100°, diam. 5°. In Eur. and Am., tree 25°-30° high; drupe red, amber-colored, or dark. Var. KENTISH, MAY-DUKE, MORELLO. *C. Avium* (probably of same origin), 40°-50° high; drupe ovoid, various shades of red. Var. OX-HEART, BOARREAU. *C. pennsylvanica*, WILD RED C. 25°-30° high, drupes small, red. Common, N., U. S. *C. pumila*, DWARF C. Spreading, 2° high, fr. dark red. Sands, N., U. S. 2. *Fls. racemed*: *C. serotina*, WILD BLACK C. 50°-80° high; fr. black, small, pleasantly bitter; wood valuable. Common, U. S. *C. virginiana*, CHOKE C. 5°-20° high; fr. red, showy, astringent. Woods, hedges, U. S. *C. Pādus*, BIRD C. 10°-25° high; fr. black, stone corrugated. Eur. *C. Mahaleb*, St. LUCIA'S C. 20°-30° high; fr. black, bitter. Fls. and wood remarkably fragrant; wood very valuable. Mid. and S. Eur., abounding near St. Lucia's Abbey, Vosges, France. *C.* (*Prunus*) *sinensis*, CHINESE C. Shrub, fls. double, red and white. China; pistils, Fig. 179. *Evergreen*: *C. caroliniana*, LAUREL CHERRY. 30°-50° high, fr. black. S. C. to Fla. and La. *C. lusitânica*, similar; 20°-40° high. Portugal, Azores. *C. Laurocerasus*, similar, but shrub; Asia Minor. 2. *Nuttallia*. Small tree; fls. ♂ ♀, racemed, white; ova. 5, distinct, 1-seeded; fewer in fr. (leading to *Spiræa*). N. W., Am.

Tribe 4. Herbs. Lvs. sinuate-pinnatifid. Calyx-tube accrescent. Pet. 5; sta. 10; boll orbicular, of 10 1-seeded follicles sunk in the hardened calyx-tube. 1. *Neuràda procumbens*, small, prostrate; fls. small, axil.; ☉. Sands, N. Af., S. W. Asia.

Tribe 5. Shrubs or herbs. Fls. ♂; infl. various. Petals 5 or 0. Sta. ∞. Carpels usually 5, whorled, usually free; ov. 2-12; sds. of 1 and 2, with perisperm (connecting the Order with Saxifragaceæ).
1. Neviusia alabamensis; monotypic. Fls. apetalous, but showy; calyx-lobes large, leaf-like. Lvs. simple. Handsome shrub, 3°-5° high. Cliffs near Tuscaloosa, Ala. **2. Neillia**, 2 spec.; handsome shrubs, with simple lvs. and white (petalous) fls., racemed. Himälayas. **3. Gillenia**, INDIAN PHYSIC; perenn. herb, 2° high, lvs. trifoliate, fls. white or rosy, paniced. *G. trifoliata*, N. Y., S. and W. *G. stipulacea*, stipules leaf-like, W., U. S. **4. Spiræa**. Shrubs or perenn. herbs. Extensive and beautiful genus, both worlds. *S. lobata*, herb, 2°-8° high, lvs. pinnate, fls. pink, in a cymose panicle. Prairies, W., U. S. *S. Ulnaria*, MEADOWSWEET; herb; 1°-3° high; lvs. pinnate, fls. yellowish, fragrant, cymose. Eur. *S. Filipendula*, DROPWORT; herb, 1°-2° high; lvs. pinnate, fls. white or rosy-tipped, cymose. Eur. *S. Aruncus*, GOATSBEARD; herb, 3°-5° high; lvs. 3-pinnate, fls. yellowish, small, in spicate panicles. N. Y., S. and W. Shrubs with simple lvs. *S. Douglâssii*, 2°-3° high, fls. deep pink, paniced. Pacific States. *S. tomentosa*, HARDHACK, similar, fls. white or pink. E., U. S. *S. hypericifolia*, ITALIAN MAY, 3°-6° high, branches long, fls. white, in sessile umbels. Many fine foreign spec. **5. Kèria japonica** (miscalled *Córchorus*). Evergreen shrub, with many stems 5°-8° high; fls. yellow, double. Japan.

Tribe 6. Shrubs, herbs. Lvs. usually compound. Petals 5-4-8-9. Calyx usually calyculate; sta. ∞; ova. 2-5-10-∞, 1-ovuled. **1. Waldsteinia**, low herbs, fls. yellow. *W. geoides*, Hungary. *W. fragaroides*, N., U. S.; S. along Alleghenies. **2. Potentilla**, CINQUEFOIL; ♀ herbs or low shrubs; about 100 spec., both worlds; lvs. often 5-foliolate; fls. white, yellow, red, crimson, showy. *P. anserina*, SILVER WEED, GOOSE-GRASS; ♀ herb; sts. creeping; fls. yellow, sol. N. Eng. to Can. *P. nepalensis*, fls. large, red. Himälayas. **3. Dryas**. Elegant little evergreens (lvs. simple), fls. 8-9-merous, large, white or yellow; akaines with feathered tails. *D. integrifolia*, White Mts., N. H. *D. octopétala*, mts., Gt. Brit. **4. Dryadánthe Bungeana**, only spec., silky dwarf 2'-4' high, in dense tufts; fls. 4-merous. Altai Mts. **5. Géum**, herbs; many spec., both worlds; fls. yellow, purple, crimson, showy. **6. Fragaria**, STRAWBERRY; herbs; several spec.; fls. white (yellow in last), fr. red, consisting of the fleshy torus with akaines embedded. See Lesson XXVIII. *F. vesca*, ALPINE S., Wood S., Eur. Fl., Fig. 175, A. *F. clatior*, HAUTOIS S., Eur. *F. virginiana*, U. S., original of VIRGINIA SCARLET S. *F. chilensis*, Chili to Oregon, original of PINE S. *F. indica*, INDIAN S.; like the others, but fls. yellow, fr. insipid. E. India; wild in S. States.

Tribe 7. Shrubs, rarely perenn. Herbs. Lvs. usually compound. Petals 5. Calyx ebracteate. Ova. ∞, 2-ovuled, 1 ovule abortive; fr. consisting of fleshy drupelets on a conical dry or fleshy torus. See Lesson XXVIII. Only gen., **Rûbus**. 5 spec. (Bentham); or 45, according as varieties are considered species. 2 Sections:

Sec. 1. Raspberries. Drupelets cohering in a mass and separable from the dry torus. *R. Idaeus*, RED R. Rt. perenn., stems (called *canes*) biennial. Fls. white, fr. red, luscious. Eur., W. Asia; abounding on Mt. Ida, whence the specific name. *R. strigosus*, WILD RED R. Similar, perhaps a var. Can., N., U. S. *R. occi-*

dentatis, BLACK R. Similar, but taller; fr. black. Can., U. S. R. *odoratus*, stems shrubby, lvs. simple, fls. purple, fr. red. Brit. Am., U. S. R. *Chamæmoris*, CLOUDBERRY. Herb; lvs. simple; st. 6'-8' high, 1-flowered; fls. white, ♂ ♀; fr. large, orange-red. Mts., N. Eur., White Mts., N. H., and N.

Sec. 2. Brambles, Blackberries. Drupelets adnate to the fleshy torus. R. *fruticosus*, COMMON BRAMBLE, BLACKBERRY. Shrubby, prickly; fls. white, fr. black, edible. Eur. R. *villosus*, AMERICAN B. Similar, st taller, branching 4°-6° high. Can., U. S. Many other spec. (or var.), both worlds; several ornamental. R. *caësius*, DEWBERRY; low, trailing; fr. with glaucous, dew-like bloom. Eur. Fig. 131. R. *canadensis*, NORTHERN D.; extensively trailing; fr. of last. Can. to Va. R. *trivialis*, SOUTHERN D.; procumbent, evergreen. Sands, Va., S. Many other Am. spec. (or var.).

Tribe 8. Herbaceous, rarely woody. Lvs. usually compound. Fls. small, ♂ or diclinous. Petals 0, rarely 4. Calyx-limb 4-5-3-fid. Sta. few or ∞. Carpels 1-4, ripening into akaines, and included in calyx-tube. 1. *Sanguisorba*; herbaceous. Petals 0; fls. ♂, 4-merous. S. *officinalis*, BURNET, 1°-3° high, fls. in ovate hds., dark purple. Eur. S. *canadensis*, 3°-6° high, fls. white, spicate. Can., N., U. S. 2. *Poterium Sanguisorba*, LESSER BURNET, COOL TANKARD; herbaceous; tufted, stems 1° high; lvs. cucumber-flavored, used in a cooling drink. Petals 0; fls. ♂, purplish, in hds.; stig. penicillate. Eur. 3. *Alchemilla*; low herbs; lvs. lobed or compound. Petals 0; fls. ♀, gold-green, clustered. A. *vulgaris*, LADY'S MANTLE; ♀, borders of streams. A. *arvensis*, PARSLEY PIERT; ♀, meadows. A. *alpina*, ♂, mts.; Eur. 4. *Brayera anthelmintica*, only known spec.; Abyssinian tree; lvs. pinnate. Petals 5, minute; fls. ♂ ♀, paniced; a specific for tape-worm; carpels 2. 5. *Agrimonia*, AGRIMONY. ♀ herbs. Lvs. interrupted-pinnate. Pet. 5; fls. ♀, yellow, in slender racemes. Akaines 2; calyx-tube armed with hooked bristles. A. *Eupatoria*, 1°-3° high; hedges, Eur., Am. Fig. 129. A. *parviflora*, 3°-4° high, Penn. to S. C., Tenn. to Iowa. A. *incisa*, fls. larger; N. C. to Fla.

Tribe 9. St. woody, usually thorny; erect or sarmentose. Lvs. imparipinnate, stipulate; rarely simple; sometimes 0 and replaced by stipules. Petals 5. Fls. ♀, large, showy; white, pink, red, yellow, corymbose, terminal. Sta. ∞. Ova. ∞, ripening into 1-seeded akaines lining the fleshy accrescent (and nearly closed) calyx-tube (hip). Only genus, *Rosa*. The queen of flowers, sacred among all nations. One of the *Four Cordial Flowers*. (See Alkanet, Borage, Violet.) 30 spec., innumerable varieties. R. *Banksia*, LADY BANKS R. Unarmed, tall-climbing; fls. small, buff or white, violet-scented. China. Common in S. gardens. R. *indica*; erect or climbing; prickles remote; splendid varieties, of every hue: NOISETTE, SANGUINEA, CLOTH-OF-GOLD, GIANT-OF-BATTLES, and all the TEA-ROSES. Ind. R. *gallica*, PROVENCE R, FRENCH R. Sts. slender, prickly. More than 300 varieties: VELVET, CARMINE, TRICOLOR, YORK-AND-LANCASTER, etc. Fragrance persistent in dried fls., which are used in *Conserve of Roses*. S. Eur., Asia. R. *centifolia*, CABBAGE R. Similar, but fls. full, double, rose-purple or white; original of Moss R. Asia. R. *damascena*, DAMASK R., similar to last; hip pulpy. Asia. R. *alba*, WHITE R., erect, 6°-8° high, fls. pure white.

Eur. *R. canina*, DOG R. (Rt. once used in hydrophobia.) Erect, 4°-8° high; fls. pink or white; resembles Sweet-Brier; hips large, red, pulpy, edible, made into preserves. Fig. 211. Eur. *R. rubiginosa*, SWEET-BRIER; tall, scandent, prickly; fls. pink; petals 5; usually solitary; hips large, showy. Fl., Fig. 175, B. Eur. *R. lævigata* (*sinica*), CHEROKEE R.; evergreen, scandent; fls. large, white; petals 5. China. Made into hedges in S. States. *R. multiflora*, scandent; fls. corymbose, double, white, pink. Fine varieties. Japan. Common S. *R. setigera*, PRAIRIE R.; scandent; fls. corymbose, pink. 20 fine varieties. Mich., W. and S. *R. blanda*; 1°-3° high; fls. 1-3, pink; N. and Mid. States. *R. lucida*, 1°-3° high, fls. 1-3, petals large, pink. Common, U. S. *R. carolina*, 4°-8° high, bushy; fls. pink, corymbose. Swamps, Can., U. S. *R. spinosissima*, SCOTCH R.; 1°-2° high, prickly; fls. single or double, white, pink, yellow. Eur. *R. sulphurea*; tall; prickles few; fls. full-double, yellow. Asia. *R. (Lòwea) berberidifolia*, small, rare shrub; lvs. 0, replaced by stipules; fls. small, yellow. N. Persia, Cent. Asia, deserts.

Tribe 10. Shrubs, trees. Lvs. simple or compound. Fls. ♂, in a corymb, cyme, raceme, or umbel. Petals 5. Sta. ∞. Calyx-tube accrescent, adh. (except in *Stranvaësia*). Ova. (and styles) 5-4-3-2-1, 1-celled, 1-2-pluri-ovuled. Fr. a pome or haw, except in 1. *Stranvaësia* (*Crataëgus glaucescens*); evergreen tree; lvs. simple, fls. white, corymbose; fr. haw-like, but calyx-tube free from the 5 (2-seeded) carpels. Nepal. 2. *Cydônia* (a city in Crete), QUINCE. Trees, shrubs. Ova. 5, many-seeded. Pome large, golden-yellow, fragrant. *C. vulgaris*, COMMON Q.; small tree, fls. white or pink. Fig. 210. Levant. *C. japonica*, JAPAN Q.; branchy shrub, fls. scarlet, pink, or white. Japan. 3. *Pyrus*. Trees, shrubs. Ova. 5-3-2, 2-seeded. Pome large or small, or baccate, Lvs. simple. *P. communis*, PEAR. 20°-35° high; fls. white, corymbed; pome large. Innumerable varieties. Eur. *P. Malus*, APPLE. 25°-60° high; fls. large, pink, umbelled; pome large. Wild in Eur. Innumerable cultivated varieties. *P. prunifolia*, SIBERIAN CRAB; graceful tree; pome small, yellow. Siberia. *P. coronaria*, GARLAND CRAB; 10°-20° high; fls. large, pink, corymbose; pome small, yellow. Mid., S., and W. States. *P. angustifolia*, similar, 20°-30° high; Penn. to Ga. and Fla. *P. spectabilis*, FLOWERING CRAB; 20°-30° high; fls. large, red, umbelled. China. *P. (Arônia) arbutifolia*, ARÔNIA, CHOKEBERRY; 4°-8° high; fls. white, corymbose; pome very small, baccate, dark red. Can., U. S. Several other N. Am. spec.; fr. purple or black. Lvs. imparipinnate, lfts. 9-17; fls. white, cymose; pome baccate, scarlet-red; *P. aucuparia*, ROWAN, MOUNTAIN ASH. 20°-40° high; pomes ½' in diam. Eur. *P. americana*, AM. R., M. 15°-20° high; pomes ¼' in diam. N. Eng., Mid States. *P. Sorbus*, SERVICE TREE. 40°-60° high, wood red, valuable; pomes pear-shaped, 1' long, brown. Medit. States. 4. *Amelanchier* (Savoy name for Medlar). Lvs. simple; fls. white, racemed; styles 5; ova. 5; pome baccate, 10-celled. *A. canadensis*, AM SERVICE T. 35° high; varieties much smaller; pome very small, purple. U. S., Brit. Am. *A. vulgaris*, 20°-25° high; pome very small, dark blue. Mts., Continental Eur. 5. *Mespilus germanica* (only spec.), MEDLAR. Lvs. simple, large; fls. solitary, large, white; pome edible when decaying. Tree 35°-40° high, branches tortuous. Eur., W. Asia. 6. *Eriobotrya (Mespilus) japonica*,

LÔQUAT, JAPAN MEDLAR. Lvs. simple, evergreen, 1° long; fls. large, white, in term. panicles; pome 1-5-seeded, pear-shaped, yellow, 1' long, edible; fr. and fls. woolly. Tree 30°-40° high, handsome. China, Japan. 7. **Photinia**. Evergreen shrubs or trees; lvs. large; fls. as in *Eriobdtrya*; pome baccate, succulent; carpels thin or vanishing. **P. serrulata**, Japan. **P. arbutifolia**, Cal. 8. **Cotoneaster**. Small trees, or trailing shrubs; lvs. simple; fls. white, cymose or solitary; haw scarlet, or black, with 2-5 pyrenes. **C. vulgaris**, 3°-5° high; lvs. small, haws red. Sunny alps, Eur., Siberia. **C. buxifolia**, **C. rotundifolia**, evergreen trailers; haws scarlet; mts., Hindostan. Many other fine Asiatic species. 9. **Crataegus** (Greek name), THORN. Trees, shrubs; branches usually thorny; lvs. simple, lobed or serrate; fls. white, pink, red; corymbose, cymose, or solitary; haw scarlet, crimson, yellow, black; pyrenes 5-2-1. **C. Oxyacantha**, HAWTHORN, MAY. 15°-20° high; lvs. 3-5-lobed; fls. corymbose, white, pink, scarlet, appearing in May; haws red, yellow, black, or white, according to variety. Eur., N. Af., W. Asia. **C. apiifolia**, 8°-12° high; lvs. deeply 5-7-fid; fls. white or rose, corymbose; haws coral-red. Va. to Fla. and La. **C. cordata**, WASHINGTON H. 15°-20° high; lvs. cordate, often 3-5-cleft; fls. white, haws red. Va., Ky., S. **C. astivalis**, APPLE H. 20°-30° high; lvs. spatulate; fls. white, 3-5 in a corymb; haws large, red, edible. S. C. to Fla. and La. **C. Crus-galli**, COCKSPUR H. 10°-20° high, branched; lvs. oblanceolate; shining, deep green; fls. white, large, many in corymb, fragrant; haws small, dull red. Thickets, Can., U. S. **C. Pyracantha**, BURNING BUSH, BUISSON-ARDENT. 4°-6° high; lvs. ovate-lanceolate, evergreen; fls. white, many in corymb, small; haws scarlet. S. Eur. Many other fine Am. and foreign species. All the genera of this tribe are easily propagated by cuttings. **C. Oxyacantha**, var. *praecox*, the GLASTONBURY THORN (which flowers at Christmas), is descended, says the legend, from the hawthorn staff which Joseph of Arimathea brought from Palestine to England after Our Lord's crucifixion, and which he planted where now stand the ruins of the grand old Abbey of Glastonbury, Eng. (on a slip of land which was once the Isle of Avalon).

Ord. 100. Leguminosæ. POD-BEARERS.—Fls. irreg. or reg., ♂, sometimes diclinous. Corolla perig. or hypog., reg. and valv., or irreg. and imb.; rarely 0. Sta. double the no. of petals, or ∞. Ova. usually 1-carpelled; fr. a pod (cod, legume) or loment, dehisc. or indehisc.; many- or few-seeded, dry or fleshy; or 1-seeded, drupe-like. Perisperm usually 0. *Trees, Shrubs, Herbs*, cosmop., abundant in tropics. Extensive and beautiful Order, third in usefulness (see Grasses, Palms, Roses). 420 gen., 6500 spec. 3 Sub-Orders; only prominent types given:

Sub-Ord. 1. Papilionacæ. PEAS.—Trees, shrubs, herbs. Lvs. stip., simple or compound; sometimes 0 and replaced by stipules, or wings edging the stem. Fls. ♂, rarely ♂ ♀; infl. ax., in a raceme, spike, hd., or umbel, rarely solitary; papilionaceous, petals 5, sometimes 4-3-2-1. Sta. 10 or less by abortion; mon- or diadelphous, or free. Ova. solitary, usually pluri-ovuled; ov. campyl. Pod or loment. Rad bent. 11 Tribes:

Tribe 1. Unarmed trees. Lvs. imparipinnate or simple. Fls. ♂, racemed; petals unequal, 5-3-1, or 0. Ova. 1-celled, stipitate. Pod 1-celled, few- or 1-seeded, 2-valved. Perisperm 0. 1. **Aldina**. Large

trees; lvs. coriaceous, fls. large, white. Pod 1-seeded, drupaceous, large. 5 spec., N. Brazil, Guiana. 2. *Swartzia*. Large trees, timber valuable. Lvs. imparipinnate or 1-foliolate; petals 1-2-3; pods small, several-seeded. 60 spec., all (but one) trop. Am. *S. tomentosa*, PALO SANTO. 60° high; trunk buttressed; heart-wood red; exudes a blood-red resin. French Guiana. *S. madagascariensis*, only spec. not Am.

Tribe 2. Trees or shrubs, erect or climbing; rarely small or sub-herbaceous. Lvs. pinnately 5-∞-foliolate, or 1-3-foliolate. Sta. 10, free. 1. *Virgilia capensis*, handsome tree, 20° high; fls. pink, racemed. Cape of Good Hope. 2. *Cladrastis tinctoria* (*Virgilia lutea*), YELLOW-WOOD; elegant tree, 25°-40° high; fls. cream-white, paniced; heart-wood yellow. E. Ky., S. 3. *Sophora*. Trees, shrubs, herbs. *S. speciosa*, showy evergreen tree; 30° high; fls. racemose, blue, very fragrant; pod large, tough, constricted; sds. red. W. Texas. *S. japonica*, fls. white, paniced; tree 30°-50° high. Japan. 4. *Castanosperrnum australe*, only spec., AUSTRALIAN CHESTNUT. Tree 50° high; fls. yellow, racemed; pod with usually 4 very large, chestnut-like, edible sds. Moreton Bay, Austral. 5. *Myroxylon toluiferum*, tree, Colombia, S. Am., yields *Balsam Tolu*. 6. *Camoënsia* (after the Portuguese poet Camoëns?) *maxima*, magnificent climber; fls. yellow, 8'-10' long, racemed. Tropical W. Af.

Tribe 3. Erect or climbing trees or shrubs. Lvs. pinnately 1-3-5-∞-foliolate. Sta. mon- or diadelphous. Pod indehisc. 1. *Lonchocarpus*, trees 40° high or high-climbing shrubs; fls. purple or white, racemed; pods long. Many spec., trop. Am., Af. 2. *Piscidia Erythrina*, JAMAICA DOOWOOD; similar, but pod 4-winged; small tree, S. Fla., W. Ind. 3. *Dalbergia*, large timber trees, or climbing shrubs; pod 1- or several-seeded. Numerous spec. trees furnish ROSEWOOD; trop. Am., Af., Asia; best wood that of *D. nigra*, Brazil. 4. *Machaerium*, similar in timber, habit, etc.; Cent. and S. Am., many spec. *M. Schomburgkii*, TIGER-WOOD; tree; wood elegantly mottled. Brit. Guiana. 5. *Dipteryx* (*Dipterix*). Calyx 2-lipped; pod 1-seeded, drupaceous, like an almond, but larger. 8 spec., large trees, wood valuable; Brazil, Guiana. *D. odorata*, 60°-80° high; sd. fragrant, the TONKA BEAN of commerce. Fig. 198. Cayenne.

Tribe 4. Herbs, usually twining; or shrubs or trees. Lvs. usually pinnately 3- (rarely 1-7-) foliolate. Pod 2-valved. 1. *Rhynchosisia*; fls. yellow, racemed, or clustered; pod flat, short, often falcate; 1-2-seeded. Many spec., S. Asia, Austral., W. Ind., Am. *R. tomentosa*, twining, Maryland, S. *R. galactoides*, bushy, 4° high, Ala., S. *R. precatória*, tall-climbing; sds. small, half-black, half-scarlet, made into rosaries. Mex., Panama. 2. *Dolichos*; few spec., 70 varieties, twiners, often showy; both worlds; pod long, flat; green pod and ripe beans edible. *D. sesquipedalis*, pod 12'-18' long, beans red. Trop. Am. *D. lignosus*, evergreen; fls. purple; E. Ind. *D. multiflorus*, fls. purple; Ga, W. 3. *Láblab* (*Lablavia*, *Dolichos Láblab*), fls. purple or white; showy twiners; fls. racemed; pods flat, long; beans edible, of various colors. Ind. 4. *Phaseolus*, KIDNEY B. Keel spirally twisted. Twiners. Many spec., beans edible. *P. Caracalla*, CARACÓL, SNAIL-FLOWER B., showy, ornamental; Brazil. *P. multiflorus*, SCARLET RUNNER, fls. scarlet or white; S. Am. *P. vulgaris*, HARICOT, POLE B., fls. usually white. Young cells, Fig. 213. Var.: *P. lunatus*, LIMA B., BUTTER B., twining; *P. nana*, BUSH,

DWARF B. Sev. wild Am. spec. 5. *Vigna*, 30 spec., twining or prostrate, chiefly trop. Am. Fls. yellow or purple. Pods cylindric. *V. sinensis*. Pods 3° long, edible. Ind. *V. glabra*, fls. yellow. Salt marshes, S. C. to Fla., W. to Tex. 6. *Galactia*, 45 spec., chiefly Am.; prostrate or climbing herbs, or erect shrubs; fls. red, white, violet, often showy. *G. glabella*, prostrate, fls. large, red-purple, N. J., S. and W. *G. mollis*, similar, but downy, racemes fuller; Maryland, S. and W. *G. floridana*, similar to last, but racemes and fls. largest. W. Fla. *G. Elliottii*, only spec. with pinnate lvs.; lfts. 7-9. Twining; fls. white, red-tinged, racemed. Coast, Fla. to S. C. 7. *Canavalia*, showy, usually shrubby climbers; 12 spec., both worlds. *C. gladiata*, OVERLOOK; fls. dark purple, pods 12' long; scimitar-shaped; beans red or white. Held sacred and planted by negroes of Jamaica to guard their gardens. Both worlds. *C. obtusifolia*, prostrate, fls. rose. St. Vincent's Island, S. Fla. 8. *Physostigma*, stigma covered with a great oblique hood; fls. otherwise like *Phaseolus*. *P. venenosum*, ORDEAL BEAN, ESERÈ; great twining climber; fls. purple, racemed; pods 6' long. Beans blackish brown, somewhat hemispherical, 1' long, with long, dark, sunken hilum; extremely poisonous; used as an ordcal. Old Calabar. 9. *Butea*, trees, or large climbing shrubs; 4 spec. *B. frondosa*, DHAK TREE, 40° high; fls. racemed, orange-red, with black calyxes, profuse-flowering before the lvs. appear,—a gorgeous sight; wood, juices, and fls. valuable. Jungles, Bengal. 10. *Erythrina*, CORAL TREE; trees or shrubs, both worlds; fls. blood-red or coral-colored, racemed; pods long, moniliform; sds. usually red, often with a black spot. Wood often as light as cork, valuable. *E. umbrosa*, COCOA-MOTHER; 50°-60° high; planted in cocoa-plantations to protect the palms from winds and to give them moisture. Trop. Am. *E. Caffra*, KAFFIRBOOM, tree, 60° high; S. Af. *E. indica*, 30° high, E. Ind. *E. herbacea*, sts. many, 2°-5° high, herbaceous, from a woody base; racemes 1°-2° long; sds. bright red. N. C. to Fla., W. to Tex. 11. *Kennedya*, prostrate or twining, wiry; fls. red, pink, or black, in showy racemes. Few spec., Australia, Tasmania. 12. *Hardenbergia*, twining; near last, but fls. smaller. S. and W. Austral. Lfts. usually 3; but *H. monophylla* has 1-foliolate lvs. and blue or violet fls. 13. *Glycine*, decumbent or twining; fls. yellow or purple. Sev. spec., both worlds. *G. Saja*, only erect spec.; dwarf ☉, resembling Bush-Bean; sds. made into *Soy*. Japan. 14. *Clitoria*, BUTTERFLY PEA, elegant gen.; more than 20 spec.; tropics, both worlds. Often evergreen erect or climbing shrubs. Lvs. imparipinnate, fls. large, purple, blue, white, or red, often 2'-3' long; solitary or racemed. *C. Mariana*; erect or slightly twining, 2°-3° high; decid.; fls. blue, racemed. S., U. S.; Mex.; Khasia Mts. in Ind. 15. *Centrosema*, SPURRED P.; fls. as in last, but standard spurred. 26 spec., both worlds, chiefly in Brazil. *C. virginianum*, slender, low-twining; fls. violet-purple; rac. 1-4-flowered. S., U. S.; Brazil; W. Af. 16. *Mucuna*, COWHAGE, COWITCH; fls. white, purple, yellow, sol. or racemed; pod leathery, clothed with stinging hairs. Handsome evergreen twiners or climbers; tropics, both worlds.

Tribe 5. Herbs. Lvs. paripinnate, rachis ending in a tendril or point; pod of Tribe 4. 1. *Abrus*. 5 spec. Best known is *A. precatorius*, PRAYER-BEAD PEA, RÈTTI, RÀTI; twiner, fls. pale purple; sds. small, globose, scarlet; used as weights, each weighing 1 grain;

Rétti (or *Ràti*), the original of the word *Curat*. Used in making rosaries or prayer-beads; hence the specific name. Ind.; naturalized in all the tropics. 2. *Pisum*, PEA; tendrils branched; stipules large, leafy; fls. large, white or purple; sds. globose. 2 spec. *P. sativum*, GARDEN P. Bushy or climbing, 6°-8°. Pod, Fig. 5, 6, and Fig. 197, A; Emb., Fig. 7, A. Many varieties. S. Eur. 3. *Láthyris*, near last; prostrate or climbing; many spec., both worlds. *L. palústris*, fls. purple; *L. ochroleúcus*, fls. yellow; 2°-3° high; N. and W., U. S. *L. vendus*, 2°-4° high; st. 4-angled; lfts. 10-17; fls. purple, large. W. and S., U. S. *L. sylvéstris*, WOOD-P.; st. wing-margined; lfts. 2; fls. red-purple. Eur. Var. *latifólius*, EVERLASTING P. of gardens; fls. larger, colors showier. *L. odorátus*, SWEET P. Similar to last, but hairy, ☉; fls. fragrant, of various colors. Sicily. Fl.-organs, Fig. 167, A. *L. Apháca*, ☉; lfts. reduced to a tendril between 2 stipules; fls. yellow; *L. Nissólia*, ☉; lfts. 0, stip. 0; lf.-stalk flattened, grass-like; fl. solitary, red; Eur. 4. *Léns* (*Érvum*). Lvs. pinnate, usually tendrilled. Few spec. Best known *Léns esculénta* (*Érvum Léns*), LENTIL; 1½° high; lfts. 8-10, fls. pale blue, in 2s and 3s, pod nearly as broad as long, 1-2-seeded, sds. large, flat, lenticular. One of the first food-plants used by man; Esau's "mess of pottage." Asia. 5. *Vicia*, VETCH; weak, usually climbing; near *Érvum*. Many spec., both worlds. *V. americana*, N. and W. *V. acutifólia*, S., U. S.; 1°-4° high; fls. purple. *V. sativa*, VETCH, TARE; fls. violet, solitary or in 2s; forage plant. Eur. 6. *Fába vulgáris*, only spec. (*Vicia Fába* of some bot.), COMMON BEAN; erect, 1°-2° high; lfts. 2-6, tendril reduced to a point; fls. large, white, with a black spot, clustered, very fragrant. Persia, but cultivated everywhere; the proud Roman Fabii got their name from their success in bean-culture. Fig. 195. 7. *Cicer*. 7-15 spec., herbs, undershrubs, tendrilled or imparipinnate; pods swollen, 2-3-seeded, sds. irreg. in form. S. and E. Eur.; W. Asia; Abyssinia. *C. arietinum*, CHICK-P.; ☉; 9'-20' high; with glandular hairs. Containing oxalic acid. Lvs. imparipinnate; fls. white or rose; pod 1-2-seeded. Sds. large, shaped like a ram's hd. S. Eur., Ind. Widely cultivated for the sds. as well as the acid.

Tribe 6. Habits of Tribe 4, but pod indehisc., 1-2-several-seeded. 1. *Lespedéza*, BUSH-CLOVER. Herbs, shrubs, undershrubs. Many showy spec., both worlds; chiefly in Am. Lvs. 3-foliolate, rarely 1-foliolate or entire. Pod 1-seeded. *L. capitata*, *L. hirta*, 2°-4° high, st. simple, fls. white, capitate or spicate; *L. violácea*, bushy, fls. of 2 kinds, apetalous fls. most fertile, sessile; petalous fls. in open panicles; these are N. Am. spec. *L. striata* (stip. striate); 3'-10' high, branchy, spreading, fls. small, purplish; China, Japan; introduced in some unknown way into S. Atlantic States, U. S., where it is a wide-spread, valuable forage-plant. 2. *Onóbrychis*, SAINFOIN. Many fine spec., Old World; suited for rock-work and borders; fls. showy. Pod 1-seeded. *S. sativa*, 1°-2° high; lvs. imparipinnate; lfts. numerous, fls. pink. Forage-plant, Eur. 3. *Hedýsarum*; similar to 2, but loment as in 4. Many fine spec., Eur., N. Af., N. Asia. *H. coronárium*, showy, Eur. Loment, Fig. 197, B, C. 4. *Chapmánnia floridána*, 2°-3° high, slender; lvs. 3-7-foliolate; fls. yellow, racemed; loment 1-3-jointed. E Fla. 5. *Desmódium*, BEGGAR'S TICKS. So called from the separable joints (2-6) of the loment, which are round, flat, prickly, resembling ticks (*Ixodidæ*). Herbs, shrubs, or small

trees; lvs. usually pinnately 3-foliolate, sometimes simple; fls. pink, white, purple, blue. More than 120 spec., chiefly tropical, both worlds. Many N. Am. spec., chiefly \mathcal{Q} herbs. *D. canadense*; 3°-6° high; fls. pink; N. and W., U. S. *D. canescens*, 3°-5° high; fls. purple; S. States. *D. gyrans*, TELEGRAPH PLANT, $\textcircled{2}$; fls. violet, racemed; lvs. with apparently independent motion, described, Lesson XXXIII., 417. Ind. 6. *Æschynomene*, SENSITIVE PEA. Lvs. imparipinnate, in some spec. sensitive; fls. usually yellow, racemed, showy. Loment of last; joints 2-10. Herbs or small shrubs; 30-40 spec., chiefly tropical; both worlds, most numerous in Brazil. *Æ. aspera*, CORK TREE PEA, SÖLAH; shrub; wood light, used as cork. Ind. *Æ. montevidensis*, HUMMING-BIRD BUSH; fls. frequented by humming-birds. *Æ. hispida*, $\textcircled{1}$, 2°-4° high. Penn., S. to Gulf. *Æ. viscidula*, $\textcircled{1}$, prostrate; sts. 1°-2° long; fls. small. S. C. to Fla. 7. *Coronilla*. Loment several-jointed, round. Lvs. imparipinnate. Fls. umbelled. 20-30 spec., herbs or shrubs, ornamental. Eur., N. Af., Asia. 8. *Arachis hypogæa*, only spec., GOOBA, PEA-NUT. (*Gooba*—misspelt Góbbè and Goober—is the original negro name, and common throughout the S. States.) $\textcircled{1}$. Sts. long, trailing; lvs. 4-foliolate. Fls. small, yellow, in spikes or hds. Ova. on a long stalk, and thrust into the ground by the plant itself, where it ripens into a 2-3-seeded thick pod. See Lesson XXVII., 418. Sds. valuable as food and for their fine olive-like oil; plants valuable as forage. W. Ind., W. Af.; cult. in all warm regions. 9. *Voandzèia subterrânea*, BAMBÚRA GOOBA. (Voândzon, Madagascar name.) Similar to last, but lvs. 3-foliolate. E. Af.; Bamburra to Natal; naturalized in S. Am.; called MANDÛBI in Brazil, GOOBA in Surinam.

Tribe 7. Herbs, not climbing; trees; or erect or climbing shrubs. Lvs. pinnately 5- ∞ - (rarely 3-1-) foliolate; lfts. usually entire. Pod 2-valved; or small, 1-2-seeded and vesicular. Fine Tribe. 1. *Glycyrrhiza*, LIQUORICE. \mathcal{Q} herbs; pods often curved, prickly; fls. blue or white; rts. furnish the *Liquorice* of commerce. Sev. spec., Eur., N. Af., Levant, Asia. *G. glabra*, Spain, *G. echinata*, Italy, furnish the best liquorice. *G. lepidota*, AM. L. 2°-3° high; lvs. 15-19-foliolate; pod bur-like, prickly. Ark. to Cal., N. 2. *Astragalus*. \mathcal{Q} . Lvs. imparipinnate; branches often spiny. Pod curved. Fls. in axil. clusters. More than 500 spec. Many handsome. Eur., N. Af., Asia, N. Am., Andes. *A. lotoïdes*, fls. red, showy; China. *A. caryocarpus*, GROUND PLUM. Low, smooth; fls. purple; pod small, plum-like, 2-seeded. N. W., U. S. *A. mexicanus*, 2'-8' high; fls. yellow; pod of last; prairies, S. Ill., W. and S. *A. canadensis*, 1°-4° high; fls. greenish white; pod leathery. Can. to Ga. Sev. other N. Am. spec. 3. *Caragana*. Lvs. paripinnate, but rachis tipped with a spine; fls. yellow. Pod linear, several-seeded. Shrubs or trees; about 15 spec.; Asia. *C. arborescens*, 15° high, fls. sol.; Siberia. *C. spinosa*, 6° high, spiny; Siberia. *C. Chamlaqu*, 4° high, spreading; China. 4. *Colutea*, BLADDER SENNA. Pods inflated, bladder-like. Lvs. imparipinnate, purgative. Fls. yellow or scarlet. Shrubs, ornamental. 3 species, S. Eur., Ind. *C. arborescens*, 10° high; fls. yellow. France, Italy. *C. cruenta*, 4° high, fls. scarlet; Levant. 5. *Sutherlandia*, similar to last; fls. scarlet; 3 spec.; Cape of G. H. 6. *Swainsonia*, elegant; similar to last; fls. white, purple, red, pink; 23 spec.; Australia, N. Holl., N. S. Wales. 7. *Clánthus*, GLORY-FLOWER. Vex-

illum oval, pointed, reflexed; much larger than the alæ. Fls. large, showy, racemed. Pod bladdery, or coriaceous. *C. carneus*, 3° high, fls. flesh-color; Philippines. *C. Dampieri*, 3° high, fls. scarlet; N. Holl. *C. puniceus*, PARROT'S BEAK; 6° high, fls. crimson; N. Z. 8. **Sesbania**. ☉, ♀; about 12 spec.; trop.; both worlds. Fls. yellow; pod long, knobby. *S. macrocarpa*, 8°-12° high; fls. racemed, dotted with red and purple. Fla. to Tex. 9. *Agati grandiflora*. Handsome tree, 20°-30° high; fls. 3'-4' long, white or red, 2-4 in a cluster; pod 18' long. E. Ind., Australia; introduced in Fla. 10. *Robinia Pseudacacia*, AMERICAN LOCUST. Fls. white, fragrant, racemed. Elegant tree, 40°-80° high; Penn., S. and S. W. Wood dark, valuable. *R. viscosa*, CLAMMY L.; fls. pink. Tree 40° high. Mts., N. C., Ga. *R. hispida*, ROSE-ACACIA; fls. deep rose. Shrub 5°-8° high. S., U. S. 11. **Wistaria** (*Wistaria* of De Candolle; after Caspar Wistar, or *Wister*, as tradition says his name was correctly spelt. "C'est à tort que Loudon et quelques auteurs après lui ont écrit Wistaria." L'illustration horticole, vol. v.). High-climbing, hardy shrubs, with fine foliage and showy fls., racemed. Pod knobby. Few spec. *W. frutescens*, fls. lilac. S. States. *W. sinensis*, similar, but bolder and climbing much higher. China. *W. alba*, similar, fls. white. Japan. 12. **Apios tuberosa**, GROUND PEAR. ♀, twining; fls. brown-purple, fragrant, racemed; subt. runners bearing small, pear-shaped, edible tubers. Common, U. S. 13. **Millætia**. High-climbers, like *Wistaria*; or trees, like *Robinia*, with valuable, dark wood. Fls. racemed or paniced, handsome. Trop. and S. Af., Asia, Australia. 14. **Tephrosia**. Lvs. gray-silky; fls. showy, white or purple, racemed; pod linear, flat. Trees, shrubs, herbs, chiefly trop.; both worlds. *T. virginiana*, 1°-2° high; fls. white, purpled-tinged. Can. to Fla. and Miss.; *T. spicata*, 1°-2° high; fls. white and purple. Del., S. and W.; *T. hispida*, *T. chrysophylla*, low, fls. purple. S.; all ♀ herbs. 15. **Indigofera**, INDIGO. Fls. pink, purple, or white, racemed. Pod straight or curved. More than 200 spec., ☉, ♀ herbs or shrubs. Chiefly in Af. and Asia; several of which yield Indigo. *I. tinctoria*, shrub, 3°-4° high, fls. pink; Asia; nat. in Af. and Am.; and *I. Anil*, similar, 5°-6° high, fls. purple; W. Ind.; nat. in Old World; yield the *Indigo* of commerce. Both nat. in Fla. *I. caroliniana*, ♀ herb, 3°-5° high, fls. brown. N. C. to Fla. *I. leptosépala*, ♀, decumbent; sts. 2°-3° long; fls. pale scarlet. S. Fla., W. 16. **Dalea**. Fls. spicate, white, yellow, pink, purple. Pod 1-2-seeded. ♀, ☉, herbs, shrubs. More than 90 spec., New Mex. to Chili. *D. alopecuroides*, ☉ herb, 1°-2° high; fls. violet and white. Ill. to Tex., E. to Ala. Only spec. E. of Miss. River. 17. **Petalostemon**, PRAIRIE CLOVER. Petals 5; 4 adnate to the tube of the 5 monadelphous stamens; the fifth petal (standard) free. Fls. small, in dense hds. or spikes. Pod 1-seeded, indehisc. 14 spec., chiefly ♀ herbs. N. Am. *P. corymbosum*, 2° high, fls. white. N. C. to Fla., W. *P. violaceum*, fls. violet; Mich. to Minn., S. 18. **Amorpha**. Fls. with but 1 petal, the vexillum, which is wrapped round the sta. (10, monadelph.) and the style. Fls. violet, purple, blue, in clustered virgate racemes. Pod 1-2-seeded. Elegant shrubs, N. Am. *A. fruticosa*, BASTARD INDIGO. 6°-15° high, fls. purple. Wis. to Fla., W. to Rocky Mts. Sev. other spec., U. S. 19. **Psoralea**. Petals complete; fls. blue, white, purple, racemed. Pod 1-seeded. Scurfy shrubs or herbs. 100 spec., both

worlds; many common in U. S. *P. esculénta*, POMME BLANCHE. \mathcal{Q} herb; rt. tuberous, turnip-shaped, edible. Lvs. palmate, 5-foliolate. St. 10'-15' high. N. Wisconsin, W. *P. Ondobrychis*, \mathcal{Q} herb, 3°-5° high. Lvs. pinnate, 3-foliolate. Ohio to Ill., S.

Tribe 8. Herbs or shrubs. Lvs. usually pinnately 3-foliolate or pinnate; lfts. entire. Fls. usually umbellate or in hds. Sta. 10, mon- or diadelphous; alt. fil. often dilated. 1. *Hosáckia*. Lvs. 3-5-7-21-foliolate. Fls. yellow or yellowish-white. Shrubs, \mathcal{Q} or \odot herbs. About 80 spec., showy; Oregon, Cal., Mex., N. C., Ark. *H. Scopárius*, broom-like shrub, 3°-8° high; lfts. 3, linear. Cal. *H. Purshiana*, \mathcal{Q} herb, 18' high; fls. sol., pink. N. C., Ark. 2. *Lótus*. Fine ornamental genus, \mathcal{Q} herbs, near 50 spec. Eur., Canaries, Af., Asia, Australia. *L. corniculátus*, decumbent; fls. yellow, umbelled. Forage-plant, Eur. Mentioned by Homer: *Odyssey*, Book IV., v. 602; *Iliad*, Book II., v. 775. Plant, fls., fr., Fig. 163. *L. purpúreus*, fls. dark red, Sicily, S. Eur. *L. jacobaeus*, fls. nearly black, Cape Verde. *L. atropurpúreus*, fls. similar, Teneriffe. *L. coimbricénsis*, fls. red, Portugal. *L. australis*, fls. pink, New Holl. *L. indicus*, fls. yellow, E. Ind. 3. *Anthýllis*. Showy, small shrubs or herbs; fls. yellow, white, purple, crimson, in hds.; hds. twin. About 20 spec., Eur., Af., Teneriffe, Levant. *A. Vulnerária*, LADY'S FINGERS, KIDNEY VETCH. \mathcal{Q} herb, 6' high; fls. usually yellow; red, white, purple, crimson near the sea. Gt. Brit.; other parts of Eur. *A. Webbiána*, fls. pink; \mathcal{Q} herb, 9' high; Teneriffe. *A. Bàrba Jovis*, JUPITER'S BEARD; evergreen, silvery shrub, 3° high; fls. pale yellow. S. Eur.

Tribe 9. Herbs, rarely shrubs. Lvs. 3-foliolate, usually dentate. Sta. 10, mon- or diadelphous. 1. *Trifólium*, TREFOIL, CLOVER. Fls. in hds. \mathcal{Q} , \odot , \odot , herbs, many with showy fls. More than 100 spec., chiefly in Old World. 15 in U. S., chiefly in Rocky Mt. States. *T. pratense*, RED CLOVER, fls. red; *T. médium*, ZIGZAG C., fls. purple; *T. incarnátum*, FRENCH C., fls. crimson; *T. repens*, SHAMROCK, creeping, fls. white, lvs. small; all \odot forage-plants; Eur. *T. repens*, indigenous in Can. Fig. 132. *T. reflexum*, BUFFALO C.; fls. large, rose-red. *T. stoloníferum*, LARGE WHITE C., fls. white, Atlantic States of U. S. *T. procumbens*, YELLOW C., fls. yellow. Eur.; nat. in U. S. 2. *Melilótus*, MELILOT, SWEET CLOVER. \odot , \odot , \mathcal{Q} or shrubs; fragrant when dry. Fls. small, yellow, or white, in loose racemes. *M. officinális*, \odot , \odot , erect, branching, 2°-4° high, fls. yellow. Eur., N. Asia. *M. álba*, similar, fls. white. Eur., Asia. *M. arbórea*, evergreen shrub, 15° high; fls. white. Turkey. 3. *Medicágo*, MEDICK. \odot , \mathcal{Q} herbs, or shrubs. Nearly 50 spec.; fls. yellow, rarely violet. Pods more or less spirally twisted. *M. satíva*, LUCERNE. \mathcal{Q} herb, 2° high; fls. violet. Forage-plant. Eur. *M. arbórea*, evergreen shrub, 8°-10° high; fls. yellow. Italy. 4. *Trigonélla*. \odot , \mathcal{Q} herbs. Fls. yellow, blue, white, red; sol. or few in a cluster. About 50 spec., Old World. *T. Foenum-graecum*, FENUGREEK, erect \odot , 2° high; fls. white. S. France. Sds. used to scent provender. 5. *Onónis*, RESTHARROW. Small shrubs, \mathcal{Q} , \odot herbs; rts. long, often creeping. Fls. yellow, pink, purple, blue, white, red. About 60 spec., S. Eur., Af., Teneriffe. Showy little plants. *O. rotundifólia*, evergreen shrub, 18' high; fls. red; lvs. orbic. Ov., Fig. 180, C. Pyrenees. *O. longifólia*, evergreen shrub, 2° high; fls. yellow. Teneriffe.

Tribe 10. Shrubs or herbs. Lvs. simple or digitately comp.; lfts. entire. Sta. 10, usually monadelphous. Fls. sol., fascicled, or racemed.

1. Cytisus, BROOM. Many fine species, shrubs, trees, Old World. **C. (Sarthamnus) Scoparius, COMMON BROOM.** 6° high; fls. yellow. Eur.; especially in Eng. and Scot.; run wild in Va. Fig. 166. **C. albus, WHITE B.** 8° high; fls. white. Portugal. **2. Ulex, GORSE, FURZE.** Very elegant evergreen shrubs, armed with prickles, which are transformed lvs., and with showy yellow (rarely white) fls. Few spec.; Eur. **U. europæa, COMMON FURZE.** 3°-18° high, according to climate. Mid. and S. Eur., Gt. Brit. **3. Genista, WHIN.** Small, branching shrubs. More than 70 spec., smooth, or spiny; fls. yellow. Chiefly in Medit. States, W. Asia, and Canaries; 3 in Gt. Britain. **G. tinctoria, DYER'S BROOM.** Stems low, green, from creeping rts. Gt. Brit.; nat. in Mass. **4. Laburnum vulgare (Cytisus Laburnum), LABURNUM, GOLDEN-CHAIN.** Handsome tree; 20° high; fls. yellow, in pendulous racemes. Eur. **L. alpinum, ALPINE L.** Similar, 25°-30° high. Alps, Apennines Nat in Scotland. **5. Lupinus, LUPINE.** ♂, ♀ herbs or shrubs; fls. richly colored, spicate or racemose. 80 spec., both worlds. More than half in America, chiefly in Pacific States; Old World spec. chiefly annual. **L. albus, fls. white, ♂, 3°-4° high, lvs. 5-7-foliolate.** Levant. Cultivated from time of ancient Egyptians. **L. polyphyllus, ♀, 3°-4° high; lvs. 13-15-foliolate, fls. blue, purple, variegated, racemed.** Oregon, Cal. **L. villosus, ♀, downy, spreading; lvs. simple, oblong; fls. blue, purple, pink, racemed.** Coast, N. C., S. **6. Crotalaria.** Herbs, shrubs; fls. usually yellow, in full racemes. Pod inflated. About 120 spec., both worlds, chiefly trop. **C. juncea, SUNN-HEMP; shrub 8°-12° high; lvs. simple, lanceolate, with silvery hairs; fls. yellow, racemed, showy.** Bark made into hemp. India. **C. sagittalis, ♂; N. H., S. and W.; and C. ovatis, ♀. N. C. to Fla. and La.,** are low herbs with simple lvs. and few-flowered racemes of yellow fls. **7. Goddia, 2 spec. (G. latifolia, G. pubescens).** Handsome shrubs, with 3-foliolate lvs. and yellow, laburnum-like fls.; **8. Bossiaea, 34 spec.,** herbs or shrubs; highly ornamental; lvs. simple, or 0; fls. sol., yellow; **9. Hovea, 11 spec.,** handsome evergreen shrubs; fls. blue or purple, lvs. simple; all Australian. **10. Priestleya, 15 spec.,** evergreen shrubs. Lvs. simple, fls. yellow, usually in hds. or racemes. S. Af.

Tribe 11. Shrubs, rarely herbs. Lvs. simple or digitately comp. Sta. 10, free. Chiefly Australian evergreen shrubs, very handsome:

1. Daviësia, fls. yellow, purple; lvs. reduced to spines, or linear, or 0. More than 55 spec., about 2° high. **2. Mirbëlia, fls. colored as in last; lvs. simple, often lobed at top, often prickly.** 16 spec., 2° high. **3. Chorözema (sometimes written Chorizema), lvs. simple, sometimes spiny; fls. red, scarlet, yellow.** More than 15 spec. 1°-2° high. **4. Brachysëma, usually climbing; lvs. simple, or 0, and branches leaf-like; fls. blood-red, scarlet, green, yellow.** 14 spec.; all these Australian. **5. Podalyria, silky evergreen shrubs; lvs. entire; fls. purple, blue, red, white.** 17 spec.; 2°-6° high. Cape of Good Hope. **6. Baptisia, FALSE INDIGO.** ♀ herbs; lvs. 3-foliolate or simple; fls. yellow, blue, white. Showy plants; about 15 spec., U. S., Atlantic to Rocky Mts. **B. tinctoria, used as indigo; racemes few-flowered, fls. yellow.** 3° high. Can., U. S. **B. australis, 2°-5° high; fls. large, blue, showy; racemes 1°-2° long.** Ky. to Ga. and La. **B. leucantha,**

2°-4° high, fls. large, white; racemes 1°-2° long. Ohio to Wis., S. and W. 7. **Thermopsis**. 2 herbs, resembling *Baptisia*; fls. yellow or purple. Few spec., N. Asia, N. Am. *T. barbata*, 18' high; fls. purple; Himálaya; *T. lanceolata*, 18' high, fls. yellow; Siberia; *T. fabacea*, 1°-2° high; fls. yellow, Oregon to S. Cal. and N. Mex.; *T. Caroliniana*, 3°-5° high, fls. yellow; mts. of E. Tenn., N. C.

Sub-Ord. 2. Cæsalpinieæ. BRAZIL-WOODS.—Stem woody; straight or climbing, sometimes flattened. Lvs. generally comp.; stip. Fls. ♂, rarely ♀ ♂; sep. 5; pet. 5, rarely 3-2-1, more rarely 0. Sta. 10 or fewer; fl. rarely coherent. Pod often indehisc. 7 Tribes:

Tribe 1. Lvs. 1-2-pinnate. Fls. small, spicate. Pet. 5. Ov. ∞. 1. **Erythrophlaëum**. Armed trees, juice red, poisonous. 2 spec. E. *guineëse*, GRÈGÈRE TREE, 100° high. Juice used as an ordeal. W. Af. E. *Labouchèrii*, IRONBARK, Australia.

Tribe 2. Lvs. paripinnate or 2-8-foliolate. Fls. small. Pet. 5 or 0. Ov. 1-2. 1. **Copaifera**. Trees, shrubs, gum-yielding. Petals 0; fls. white, spicate. Pod 1-seeded. Trop. Am., W. Af. Few species. *C. officinalis*, 20° high; *C. guianensis*, 25° high; yield *Balsam Copaiva*. W. Ind., S. Am. *C. Ghibourtiàna*, yields a *Red Copal* (resin). W. Af. 2. **Detarium senegalense**, tree 30° high. Petals 0; fls. white, panicled, fragrant. Pod 1-seeded, large, drupe-like, edible. Wood dark, valuable. W. Af.

Tribe 3. Lvs. usually pinnate. Ov. 3-∞. 1. **Hymenæa**. Pet. 5, unequal; sta. 10. Lvs. 2-foliolate. H. *Courbaril*, W. IND. LOCUST, enormous evergreen trees, more than 2000 years old, trunk 60°-80° in girth. Wood brown, valuable; yields a fine *Copal* (resin). W. Ind., S. Am. 2. **Tamarindus indica**, only spec. Petals 3; fls. yellow, showy, racemed, fragrant. Pods with fleshy pulp, the *Tamarinds* of commerce. Lvs. paripinnate, 22-28-foliolate. Elegant tree, E. Ind. 3. **Humboldtia**. Pet. 3-5; fls. scarlet, racemed. Handsome scrambling shrubs, with tumid branches; lvs. imparipinnate. 4 spec., Malabar, Ceylon. 4. **Jonèsia**. Pet. 0. Calyx colored; fls. large, scarlet or orange, showy, clustered, fragrant. Pod scimitar-shaped. Lvs. evergreen, glossy, 12'-18' long, 6-12-foliolate. Handsome trees or scandent shrubs. Malay peninsula and islands. J. *Asòca*, ASÒKA TREE; 20°-40° high. J. *scandens*, climbing. 5. **Amhèrstia nobilis**, only spec., evergreen tree, 40° high; lvs. paripinnate, large, purple when young; fls. large, bright vermilion, spotted with yellow, in gigantic, pendulous, close racemes. Near Martaban, Malay peninsula. 6. **Bròwnea**, evergreen shrubs or trees; lvs. paripinnate, 12'-18' long, 8-24-foliolate; fls. red, crimson, in dense hds.; showy. Several spec., W. Ind., S. Am.

Tribe 4. Lvs. simple, cordate, 2-lobed; or 2-foliolate. 1. **Cercis**, JUDAS-TREE; said, with the Elder (*Sambucus*), to be the tree on which Judas hanged himself. Lvs. cordate, like 2 fts. united. Petals 5; fls. rich rose-color or pale red, in profuse clusters, axil. or adventitious, appearing before the lvs. in spring. Pod long, flat, persistent. *C. canadensis*, 20°-30° high, lvs. cordate. River-banks, N. Y. to Miss. River, S. to Fla. and La. *C. Siliquastrum*, 20° high; S. Eur., Levant. *C. sinensis*, China; *C. japonica*, Japan. Wood in all valuable. 2. **Bauhinia** (after the brothers John and Caspar Bauhin). Lvs. 2-lobed; lobes separate or partly united. Petals 5; fls. white, red, yellow, pur-

ple, sol. or racemed. Showy evergreen trees or shrubs, often climbing. Many species. Tropics, chiefly in Ind. and Brazil. **B. tomentosa**, ST. THOMAS' TREE. 20' high; fls. pale yellow, spotted with crimson, which the legend says was the blood of St. Thomas. Ceylon. **B. Vahlîi**, MALDO CLIMBER; gigantic climbing tree; stems 300' long, flat, ribbon-like, encircling and festooning the tallest trees and often strangling them. Lvs. 12'-18' in diameter, lobes joined half their length. Fls. snow-white, racemed. Many other fine spec.; shrubs with white fls., W. Ind., trop. N. and S. Am. **B. guianensis**, climbing, fls. white, Guiana. **B. spathacea**, shrub, 6' high, fls. white, Mex. **B. variegata**; MOUNTAIN EBONY, 6°-15° high, fls. rosy-white, wood dark, valuable. E. Ind.

Tribe 5. Lvs. pari- or imparipinnate. Petals 5 or 0. Anth. bursting by slits or pores. 1. **Ceratonia Siliqua**, only spec., CAROB, ALGARÔBA, LOCUST, ST. JOHN'S BREAD. Evergreen tree, 15°-30° high; fls. red, racemed. Pod 6'-12' long, flat, indehisc., with fleshy, sweet, edible pulp, in which the sds. are separately embedded; said to be the Locusts on which St. John fed in the wilderness. East Mediterranean States. 2. **Cassia**, SENNA; more than 200 spec., chiefly evergreen shrubs or trees, with handsome foliage and showy, usually yellow, fls., racemed or paniced. For the most part tropical; both worlds. Lvs. of several Asiatic and African species, **C. obovata**, ☉, Egypt; **C. lanceolata**, evergreen, 1° high, Levant; are the Senna of pharmacy. **C. marilandica**, AMERICAN SENNA. Rt. perenn., sts. 3°-5° high. **C. occidentalis**, ☉, 1°-5° high; **C. obtusifolia**, ☉, 1°-4° high; **C. chamaecrista**, ☉, spreading, sts. 12'-18' long, fls. large, are common in U. S. **C. Fistula**, PUDDING PIPE TREE; handsome evergreen tree, with laburnum-like fls. and black, woody, indehisc. pods 1°-2° long. Ind. Cultivated in tropics, both worlds.

Tribe 6. Lvs. 2-pinnate, sometimes sensitive. Petals usually 5, subequal. 1. **Parkinsonia**, handsome, evergreen, spiny shrubs; fls. yellow, racemed. **P. aculeata**, 15° high, trop. Am. Two other spec.; one, Cape of Good Hope; the other in Mex. 2. **Poinciana**, evergreen trees; fls. yellow, with long, richly-colored stamens; racemed. **P. elata**, Ind., Af. **P. regia**, Madagascar. 3. **Cæsalpinia**. Evergreen trees, shrubs, sometimes climbing; fls. yellow, rarely white. 38 spec., trop., both worlds. **C. (Poinciana) pulcherrima**, BARBADOES FLOWER-FENCE. Spiny shrub, 10° high; fls. large, orange, with long, protruding, red stamens. E. Ind. **C. (Poinciana) Gilliesii**, similar, stamens longer. S. Am. **C. echinata**, small prickly tree, yields the Brazil-wood and Brasiletto dye of commerce. Brazil. **C. Sappan**, small tree, the Sappan-wood of commerce. 4. **Gleditschia**. Handsome deciduous trees, with branching thorns when young. Fls. ♀ ♂ ♂, green, inconspicuous, spicate, often fragrant. Pod flat, with sweet pulp, in which the sds. are embedded. Few spec., N. Am., Asia, Af. **G. triacanthos**, HONEY-LOCUST, 50°-80° high, with spreading branches; armed when young with formidable branched spines. Pods 12'-18' long, dark red; pulp honey-sweet. Penn., S. and S. W. **G. monosperma**, WATER-LOCUST, 30°-60° high; pod short, 1-seeded, pulpless. Swamps, Ill., S. and W. **G. sinensis**, **G. macracantha**, trees 40°-70° high, with branchy spines; China. 5. **Gymnocladus canadensis**, COFFEE TREE, CHICOT (*Shee-ko*) TREE. Only spec. 50°-70° high; fls. small, ♂ ♀ or ♂ ♂ ♀, racemed; pod flattened, 6'-10' long; sds.

large, flat, used as coffee by early settlers. Lvs. handsome, 2-pinnate, 2°-3° long. Western N. Y. to Ill., S. and S. W. 6. *Hæmatóxylon campechiánnum*, LOGWOOD TREE. Only spec. 30°-40° high; fls. yellow, racemed; pod flat, 2-seeded; lvs. paripinnate. Heartwood furnishes the *Logwood* dye of commerce. W. Ind., Cent. Am.

Tribe 7. Lvs. usually imparipinnate. Petals usually 5, subequal. Ov. 3-∞. 1. *Sclerolóbium*. Fls. ♀, small, yellow, fragrant, in large racemose panicles. Pod compressed, woody, indehisc., few-seeded. 10 spec., trees, Brazil, Guiana. S. *chrysophyllum*, lvs. with golden-silky hairs on under surface; tree 60°-100° high; wood white, used in making charcoal. N. Brazil.

Sub-Ord. 3. Mimósææ. MIMOSAS.—Stem woody, rarely herbaceous; sometimes aquatic and floating. Lvs. simple (phyllodes) or 2-3-pinnate, sometimes sensitive. Petals small. Fls. ♀, or ♀ ♂ ♀, reg., 4-5-merous, mono- or polypetalous, in spikes or hds., rarely in panicles or racemes. Sta. usually double or multiple the petals, rarely equal; filaments free or monadelphous, usually much longer than petals. 5 Tribes:

Tribe 1. Sta. indef. (rarely 10-15); fls. connate at base or beyond the middle. 1. *Ínga*. Lvs. pinnate, lfts. 4-12, petiole often alate. Fls. monopet., white or yellowish, in spikes or hds.; sta. ∞, monadelph., much longer than corolla. Pod woody, indehisc., with thickened edges; straight or slightly curved. Sds. enveloped in sweet, edible pulp. 150 spec., large evergreen shrubs or trees. Trop. Am., chiefly Guiana and Brazil. 1. *Fevillei*, PACAY. Pods 2° long. Peru. 1. *spectabilis*, large, showy tree; pods 2°-3° long, 3' wide. Panama. 1. *vera*, small tree; fls. white; pods falcate, 6' long. W. Ind. 2. *Pithecolóbium*. Fls. of *Ínga*; but lvs. 2-pinnate, pinnæ few; pod dehisc., falcate, curved into a ring, or spirally twisted, with thin, edible pulp; evergreen trees, shrubs; 100 spec., trop. Am., trop. Asia, Australia. P. *dúlce*, large tree; pods irregularly swollen, curled at top. Mex. P. *únquis-cãti*, tree; legume spirally twisted. S. Fla., W. Ind. P. *guadalupense*, pod falcate. S. Fla., S. Am. 3. *Calliandra*. Lvs. 2-pinnate, pinnæ often numerous. Corolla small; stas. with long, showy, usually red filaments; in hds. or racemes. Pods debisc.; valves rolling back and exploding the ripe sds. 80 spec. Elegant evergreen shrubs or small trees, rarely herbs. C. *diademata*, shrub, fls. pink, lvs. 600-800-foliolate. Brazil. C. *Twëddii*, shrub, fls. scarlet, crimson. Mex. 4. *Albizzia*. Near *Calliandra*. Small trees. A. (Acácia) *Julibrissin* (Persian *Julibrichim*, Silk-rose), SILK-FLOWER TREE. 20°-30° high; fls. in large, pompon-like hds., stamens very long, silk-like, pale rose. Sd. sprouting, Fig. 7, B. Persia. Common in Southern gardens, U. S. Included in Acácia by some botanists.

Tribe 2. Sta. ∞, fls. free, or connate at base. 1. *Acácia*. Petals free or connate; fls. in globular hds. or long spikes. Lvs. 2-3-pinnate, often 800-1800-foliolate, elegant; in some spec. (chiefly Australian) reduced to phyllodes. Pods various. Evergreen shrubs or trees, often gum-bearing; wood valuable, light or heavy in weight, light or dark in color, often resembling (and called) *Ebony*. About 420 spec., both worlds. A. *arábica*, 20°-30° high; fls. white. Yields *Gum Arabic*. Arabia, E. Ind. A. *melanóxylon*, AUSTRALIAN EBONY, 20° high; fls. yellow; lvs. reduced to phyllodes. Wood black, light

in weight. Van D. Land. *A. scleróxylon*, EBONY ACACIA, 20° high; fls. white, wood heavy. W. Ind. *A. procèra*, 60° high, fls. yellow. E. Ind. *A. (Vachéllia) Farnesiána*, CASSIE, SWEET OPOBANAX, 10°-15° high, thorny; fls. yellow, in small hds., fragrant. St. Domingo. *A. (Mimòsa) nilótica*, 20° high; yields *Gum Arabic*. Af. Fig. 130.

Tribe 3. Sta. free. Calyx often pappose, or 0. 1. *Mimòsa*. Lvs. 2-pinnate, 8- or many-foliolate, often sensitive. Sta. double the number of petals. Fls. white or pink, in hds. or spikes, handsome. Pod with persistent rim, from which the valves or the joints fall away. 230 spec., herbs, shrubs, climbers, often prickly. Nearly all tropical; both worlds, chiefly in Am. *M. pudica*, SENSITIVE PLANT; ☉, branching, 1°-2° high; fls. pink, in hds.; lvs. very sensitive. S. Am.; nat. in Fla. *M. strigillòsa*, ♀, prostrate, bristly; fls. pink, hds. oblong. Gulf States. *M. myriadènia*, evergreen climbing shrub, climbing the tallest trees. Trop. Am. 2. *Schránkia*. Lvs. 2-pinnate; fls. pink, in hds. or spikes; pod linear, 4-sided. ♀, straggling herbs, with recurved prickles and sensitive, many-foliolate. lvs. 10 spec., Gulf States to Brazil. *S. uncinàta*, POSSUM PLANT, very prickly; *S. angustàta*, sparingly so; both with hds. of pink fls.; from Va. to Mo., S. and S. W. 3. *Desmánthus*. ♂ ♀ ♀. Sta. 5-10. Petals 5, or corol. monopet., 5-cleft. Fls. white, in hds. or spikes. Lvs. 2-pinnate, sensitive. Pod flat, slender, smooth, 1'-2' long. Small evergreen shrubs, or ♀ herbs, warm regions, Am., Ind. *D. depréssus*, ♀, prostrate, sts. 1°-2° long, peduncles 2-4-flowered. S. Fla. *D. virgatus*, ♀, erect, virgate, 1°-2° high; hds. few-flowered. *D. brachylobus*, ♀, erect, striate, 1°-3° high; fls. in hds. Ill. to Miss., La., and Tex.

Tribe 4. Sta. free, usually twice as many as petals; anth. usually with a stalked gland. 1. *Neptùnia*. Fls. ♂, in hds.; near *Desmánthus*, but pod broad, few-seeded. Few spec., undershrubs or stiff, slender ♀ herbs; hot regions, both worlds. *N. oleràcea*, short stems, often floating by means of hollow swellings, and thus branching and covering watery tracts. Trop. Am., Asia, Af. *N. lùtea*, ♀, stems ascending; hds. oval, many-flowered, nodding; sterile fls. spatulate, yellow; fertile fls. white. Gulf coast, Key West to Tex. 2. *Prosòpis*. Sta. 10, antib. glandular. Fls. ♀, whitish green, or yellowish, small, in small hds. or spikes. Pod indehisc., straight or twisted; pulp succulent, mealy or pithy. Lvs. 2-pinnate, pinnæ 2-4-10, lfts. ∞. Evergreen trees, shrubs, prickly or spiny. 18 spec., warm regions, Am., Af., Asia. *P. glandulòsa*, MEZQUIT, MUSKEET TREE; 20°-30° high, gum-bearing; pod falcate, moniliform. Timber valuable. Tex., W. and S. W. *P. pubéscens*, SCREW-BEAN; 6°-10° high; pods closely spiral, 1'-2' long. New Mex., Arizona, S. Nevada. *P. dulcis*, AMERICAN ALGARÒBA; 40° high; pods sweet, succulent, fed to cattle. Cent and S. Am. *P. spicigera*, 30° high; pod sweet, spicy. E. Ind. 3. *Adenanthèra*. Fls. resembling last, yellow, spicate. Lvs. 2-pinnate or decompound. Evergreen trees, shrubs. E. Ind., Malaysia, Madagascar. *A. pavonina*, immense tree; timber red, valuable. Sds. bright scarlet, used as ornaments; also as weights, each weighing just 4 grains. E. Ind. 4. *Entàda*. Petals 5, sta. 10. Fls. in spikes or racemes, white or yellow. Pod loment-like, woody, very long. Lvs. 2-pinnate. Evergreen high-climbing shrubs; 10 spec., trop., both worlds. *E. scàndens*, SEA-BEAN. Immense, high-climbing, near sea-

coasts, both tropics. Pods falcate, 6°-8° long; sds. 2'-3' across, ½ thick, of a fine, lustrous brown; made into snuff-boxes, purses, scent-bottles, etc. Sds. carried by Gulf Stream and ocean currents to Scotland, Orkneys, Norway. Constantly drifted to Texas coast (especially at Galveston).

Tribe 5. Sta. 5-10. **1. Párkia.** Fls. ♂, small, in dense, long-stalked hds. Sta. 10, monadelph. Pod with edible sds. and pulp. Lvs. 2-pinnate, pinnæ and lfts. very numerous. Large unarmed trees, foliage elegant; few spec., W. Af., Ind., Java, Brazil, Surinam. **P. africana**, DOÛRA, 40° high; lvs. with 20-30 pairs of pinnæ, each pinna with 30-50 pairs of lfts.—60 × 100 = 6000 lfts. in a single lf. Sds. ground and made into cakes; pulp made into sweetmeats and drinks. W. Af., trop. Asia. Brought to Am. by negroes. **2. Pentacletéra.** Fls. ♀ or ♂ ♀, spicate; sta. 10; 5 sterile. Lvs. 2-pinnate, multi-foliolate, as in Párkia. Trees, 2 spec. **P. macrophylla**, ÉBOE BEAN, 60°-70° high; lvs. and lfts. larger than in the other spec.; pods 2° long, sds. edible. Trop. Af. **P. filamentosa**, fls. similar, but lf. with more numerous pinnæ, and about 4000 linear lfts. Elegant tree, Brit. Guiana. Fine specimens of lf. and fls. in herbarium of Columbia College, N. Y. City.

Ord. 101. Connaræcæ.—Fls. usually ♀, nearly reg., small, racemed or paniced; 5-merous; sta. 5 or 10; carpels 5, rarely 1-3; globose, free, hirsute, 1-celled; fr. a follicle, 1- rarely 2-seeded. Lvs. alt., exstip., 1-3-foliolate or imparipinnate; lfts. coriaceous, entire. Erect or climbing *Trees* or *Shrubs*, with watery juice. Affinities complex. 12 gen.; 140 spec., tropics, both worlds, but chiefly Asiatic and Malayan. Wood in many very valuable; sds. edible. **1. Connarus.** Fls. white, red. 53 spec., small trees, shrubs, often scandent; trop. Am., Asia, Af., Pacific Isles. **C. (Omphalobium) Lambertii**, ZEBRA-WOOD. Tree with valuable striped wood. Guiana. **C. grandis**, Malaya. **2. Rourea**, 42 spec., chiefly in Am., Asia; one, **R. santaloides**, in Af. **R. glabra**, Cuba. **3. Cnestis**, shrubs usually climbing; follicles with stinging hairs. Few spec. Guinea, Mauritius.

Subdivision 2. Discifloræ.—Torus usually conspicuous as a disk; annular, or a cushion, or lining the base of the calyx-tube, or confluent with the base of the ovary, or broken up into glands. Stamens on or at the inner or outer base of the disk.

Cashew Alliance.—Fls. ♀, ♂, ♂ ♀ ♀, ♂ ♀, often irreg. Disk adnate to base of calyx or lining its tube. Sta. usually def. Ova. entire, lobed, or apocarpous. Ov. 1-2, rarely more in each cell, usually ascending with ventral raphe, or reversed, or pendulous from a basal funicle, rarely ∞ horizontal. Perisperm usually 0. Emb. often curved or crumpled. Lvs. usually compound. **102. Anacardiæcæ.** **103. Sabiæcæ.** **104. Sapindæcæ.**

Ord. 102. Anacardiæcæ.—Fls. small, reg., in fascicles, spikes, panicles; calyx and pet. sometimes accrescent. Pet. 3-5, sometimes 0. Sta. 5-6-10, rarely more. Ova. 1-2-5-celled, rarely 5-6 distinct carpels all sterile but 1. Drupe, rarely nut; free, or girt by a disk, or on a pear-shaped torus. *Trees* or *Shrubs*, erect or climbing, gummy, milky-resinous. Lvs. alt., exstip., rarely opp.; simple, or compound. About 50 gen., 450 spec., chiefly intertropical. Both worlds. 2 Tribes:

Tribe 1. Ova. 2-5-celled. Ov. pend. **1. Spôndias**, HOG-PLUM.

Evergreen trees, 30°-40° high, tropics, both worlds. Fr. drupe-like, edible. About 8 spec. **Tribe 2.** Ova. 1-celled. Ov. suspended. **1. Schinus Mülli** (*Mölle*), PEPPER TREE. Fls. ♂ ♀, apert. Sta. 10. Fls. small, white, paniced. Berries small, rose-color, polished; taste of black pepper. Lvs. imparipinnate. Evergreen tree, 15°-20° high. Peru. **2. Melanorrhæa**. Fls. ♀, paniced. Pet. 5, sta. ∞. Lvs. simple. 2 spec. evergreen trees more than 100° high, yielding *Black Varnish*. Ind. **3. Anacardium**, CASHEW-NUT. Lvs. large, simple; fls. ♀, red, paniced. Fr. nut-like, at apex of a pear-like edible torus. Evergreen trees, 20°-40° high. **A. occidentale**, Fig. 76. W. Ind., trop. S. Am. **A. indicum**, E. Ind. **4. Mangifera indica**, MANGO T. Fls. ♀, pink or yellow, paniced. Fr. large, edible. Lvs. simple. Evergreen tree, 50° high. Ind. Several other spec., and varieties, Asia, Af. **5. Pistacia**. Fls. ♂ ♀, apert., paniced or racemed. Drupe dry, 1-seeded. Lvs. pari- or imparipinnate. Trees yielding fine varnish; evergreen or decid., 20°-30° high. Few spec., tropics. **P. Lentiscus**, evergreen; yields *Mastic*. S. Eur., N. Af., W. Asia. **P. Terebinthus**, evergreen; yields *Terebinth*. Habitat of last. **P. vera**, decid.; fr. is the edible *Pistachio nut*. W. Asia. **6. Rhus**, SUMACH. Fls. ♂ ♀, ♂ ♂ ♀, ♀, paniced, spiked. Pet. 5, sta. 5. Drupe minute, 1-seeded. Lvs. rarely simple. Shrubs and small trees, 120 spec., temperate regions, both worlds, chiefly in N. Am., S. Af.; rare in tropics. **R. succedanea**, lfts. 11-15; evergreen tree, 10°-20° high; yields wax; Japan. **R. vernicifera**, lvs. similar, but decid.; tree 15°-25° high; yields *Lacquer varnish*. Japan. **R. copallina**, lvs. decid., lfts. 9-21. Drupe red, hairy. 5°-25° high; yields a copal-like varnish; **R. typhina**, similar, lvs. larger; 10°-30° high; **R. glabra**, smaller and glabrous; **R. venenata**, lfts. 7-13; drupe whitish, smooth; 8°-18° high; poisonous; **R. Toxicodendron**, POISON OAK. Lfts. 3; drupe dun-colored. Climbing by rootlets; poisonous; **R. aromatica**. Lfts. 3; fls. ♂ ♀, in catkin-like spikes preceding lvs.; drupe red, hairy. Shrub 1°-3° high; all from Can. to Gulf. **R. Cotinus**, SMOKE TREE, WIG T. Lvs. simple; fls. ♀; panicles with showy, abortive pedicels. Drupe smooth. Fig. 137. Shrub 6°-15° high. Mediterranean States **R. cotinoides**, similar, but panicle nearly sessile, narrow. Tree 30°-50° high; mts., N. C., Ala. (Buckley); probably in Ark. (Nuttall); and almost identical with **R. Cotinus**.

Ord. 103. Sabiaceæ.—Fls. reg. or irreg., small, usually paniced. Pet. 4-5. Sta. opp. petals; only 2 usually perfect. Fr. 1 or 2 dry, 1-seeded drupes. 4 gen., 32 spec., trop., both worlds. **1. Săbia**. Pet. 4-5. Sta. 4-5, all perfect; all the floral parts opp. Lvs. simple. *Shrubs*, straggling or climbing; 10 spec. Asia. **2. Meliosma**. Lvs. simple or pinnate. 20 spec., trees, shrubs; mts., trop. Asia, Am. **3. Ophiocaryon paradoxum**, SNAKE-NUT. Monotypic. Fls. ♀ or ♂ ♀ ♀. Pet. 5, sta. 10; 8 sterile. Drupe large; emb. with a coiled, snake-like radicle. Lvs. pinnate. Large tree, Brit. Guiana. **4. Phoxanthus macrophyllus**, monotypic. Fls. ♀, in large red panicles. Pet. 5. Drupe small. Lvs. large; simple on lower branches (which alone bear fls.) and 9-foliolate on upper branches. Slender tree; or high-climbing shrub. N. Brazil, Guiana.

Ord. 104. Sapindaceæ.—Fls. reg. or irreg., often large; paniced. Petals 5-4-12-0. Sta. 5-7-8-10, rarely 2-4-12-∞. Fr. 2-3-4-celled (or 1-celled by suppression), rarely 5-6-celled. Boll dehisc., often

apical; or samàra, drupe, berry. *Trees, Shrubs, rarely* \mathcal{Q} *Herbs.* Often saponaceous. Chiefly tropical, both worlds; most numerous in Am. More than 70 gen. 700 spec. 5 Sub-Orders:

Sub-Ord. 1.—Fls. \mathcal{S} , reg. Boll 2-3-lobed, dehisc. apical. Lvs. opp. **1. Staphylèa, BLADDER-NUT.** Pet. 5, sta. 5. Fls. white, racemed or panicled. Boll 3-lobed, inflated. Lvs. pinnate. Shrubs, low trees. 4 spec., Eur., Asia, Am. **S. trifidìa,** decid., 10° high. Can. to Gulf. **2. Turpinia occidentàlis,** near last, but evergreen. Tree 25° high; fr. edible. W. Ind.

Sub-Ord. 2.—Fls. irreg. Boll 4-5-celled. **1. Meliánthus.** \mathcal{S} . Evergreen shrubs. Pet. 5, sta. 4. Fls. large, honey-bearing, purple, yellow, brown, racemed. Few spec., Cape G. H. **2. Greylia Sutherlandii.** Pet. 5, sta. 10. Fls. crimson, racemed. Elegant tree, Natal.

Sub-Ord. 3.—Fls. reg. Petals sometimes 0. Fr. various. Lvs. rarely opp. **1. Dodonaèa.** Fls. apert., \mathcal{S} or \mathcal{M} \mathcal{S} \mathcal{F} , racemed or panicled. Sta. 5-8. Boll angled, winged. 50 spec., evergreen shrubs; both worlds, chiefly in Australia. **D. viscosa,** SWITCH SORREL. Boll 3-angled, 3-seeded; sds. edible. Lvs. simple, acidulous. Shrub, 6°-10° high. S. Fla., W. Ind., Polynesia.

Sub-Ord. 4.—Fls. reg. Samàra. Lvs. opp. **1. Negúndo aceroides,** BOX-ELDER. Fls. \mathcal{M} \mathcal{F} , apert.; \mathcal{M} fascicled, \mathcal{F} racemed. Sta. 3-12. Samàra twin, 2-seeded. Lvs. pinnate, 3-5-foliolate. Tree 30°-50° high. Can to Gulf. **2. Àcer, MAPLE.** Fls. \mathcal{M} \mathcal{S} , \mathcal{M} \mathcal{S} \mathcal{F} , small; pet. 5-4-12 or 0. Sta. 3-12. Infl. in corymbs or racemes. Samàra twin, 2-seeded. Lvs. palmi-lobed, often large. Trees, temperate regions, both worlds. **A. rubrum,** RED M. Fls. crimson, preceding lvs. 40°-60° high; old, distorted trunks furnish *Curled Maple*. Swamps; Mid. States to Gulf. **A. dasycàrpum,** SILVER M. Lvs. silvery-white beneath. 60°-70° high. Northern U. S. to Gulf. **A. saccharinum,** SUGAR M. 60°-80° high. Sap made into sugar. Old wood furnishes *Bird's-Eye Maple*. Can. to Gulf. **A. Pseudo-Plátanum.** 40°-60° high. Eur. Fig. 205. **A. campèstre,** FIELD M. 15°-40° high; planted for hedges. Eur. Sprout, Fig. 7, D; rt., Fig. 222; wood, Figs. 226, 227. Many other spec., Am. and foreign.

Sub-Ord. 5.—Fls. often apert. Lvs. rarely opp. Ov. and fr. various. **1. Melicócça.** Fls. white, small, fascicled or panicled. Drupe edible. Lvs. paripinnate. **M. bijuga,** GENIPAP. Fr. edible. Evergreen tree, 40°-50° high. Trop. Am. **2. Nephelium.** Pet. 4-6-0. Sta. 8-12. Infl. panicled. Fr. buckeye-like, warty or prickly; sd. surrounded by a fleshy edible pulp. Lvs. paripinnate. 20 spec., small evergreen trees. S. Asia, Ind. Arch, Feejee Islands. **N. Litchi,** LEE-CHEE. 20° high. China. **3. Æsculus.** Fls. \mathcal{S} or \mathcal{M} \mathcal{S} \mathcal{F} , irreg.; pet. 5-4. Sta. 7-6-8. Infl. panicled. Fr. drupe-like, prickly, 1-3-seeded; sds. large, shining. Lvs. digitate. Trees, shrubs, both worlds. **Æ. Hippocàstanum,** HORSECHESTNUT. Pet 5 Fls. large, white, mottled. 60°-80° high. Fig. 192. Ind. **Æ. glàbra,** BUCKEYE. Pet. 4. Fls. small, yellow. Small tree; Va. to Ill., S. to Tenn. **4. Pàvia,** similar to **Æs.**, but fr. smooth. **P. flàva.** Fls. pale yellow. 50°-70°. Va. to Ill., S. to N. C., Ga., Miss. **P. rubra.** Fls. large, red, showy. 10°-25° high. Va. to Ky., S. to Fla. **5. Cardiospèrmum,** HEARTSEED. Fls. \mathcal{S} . Pet. 4, irreg. Sta. 8. Fls. small, white or green (rarely scarlet), racemed. Boll 3-celled, 3-angled, inflated, few-seeded; sd. with heart-shaped hilum. Lvs. 2-ternate or

very compound. Scandent or climbing evergreen shrubs; or herbs climbing by tendrils. About 15 spec., chiefly in S. Am. *C. grandiflorum*, SUPPLE-JACK; fls. white. Evergreen climber, Jamaica. *C. Halicacabum*, BALLOON-SEED; fls. white. ☉ herb, climbing by tendrils. Missouri to Fla.; found in all tropics.

Staff-Tree Alliance.—Fls. ♀, ♂ ♀, ♂ ♀ ♀, reg. Disk as in Cashew Alliance. Pet. 4-5, rarely 0. Sta. 4-5, rarely 10. Ova. entire; cells 1-2-ovuled. Emb. straight. Lvs. simple, except in Vitææ. 105. Vitææ. 106. Rhamnææ. 107. Stackhousiææ. 108. Celastrææ.

Ord. 105. Vitææ. VINES.—Fls. ♀, ♂, ♂ ♀ ♀. Pet. 4-5. Sta. 4-5. Pet. caducous, usually coherent at top; small, green, yellow, red; in racemes, panicles, thyrsi, cymes, rarely in flattened, expanded hds. Ova. free, cells 2-3-6; 1-2-ovuled. Berry 2-3-6-celled. Lvs. simple or comp.; lower opp.; upper alt. *Trees or Shrubs*, usually climbing; often with woody, leaf-opposed tendrils, which are transformed peduncles and which sometimes bear fls. 5 gen.; or 3, if *Cissus* and *Ampelopsis* be included in *Vitis*. About 250 spec.; trop. and temperate regions, both worlds. None in Eur. 1. *Leëa*. Pet. separating at top, connate at base. Lvs. opp., 1-2-3-pinnate, rarely simple. No tendrils. Small, rough, erect, evergreen trees or shrubs; rarely 2 herbs. 20 spec., trop. Asia, Af., Mauritius. 2. *Pterisanthes*. Fls. ♂. Petals separating. Sexes together on a peduncled hd., which is expanded and flattened; ♀ fls. sessile, covering the disk-like expansion; ♂ fls. on its margin. Lvs. simple or 3-7-foliolate. Slender shrubs, far-climbing by tendrils. Few spec., Ind. Arch. *P. cissoïdes*, cottony; lvs. 3-foliolate; tendrils bearing the infl. *P. polita*, polished; lvs. simple; tendrils bearing the red disk-like expansion. 3. *Ampelopsis*. Fls. ♀, without disk. Petals separate, greenish, cymose. Berry small, black. Lvs. decid., large, digitate, quinate. Hardy, high-climbing shrubs; tendrils with disk-like expansions at their tips, which aid in climbing. *A. quinquefolia*, VIRGINIAN CREEPER. Only genuine spec.; several varieties. U. S. 4. *Cissus*. Fls. ♀, green; disk large. Petals separating or coherent at top; 4 in foreign spec., 5 in Am. Berry small. Lvs. simple or compound; tendrils few or 0. Shrubs, usually evergreen and climbing. Numerous spec., foliage often showy, colored. *C. discolor*, evergreen climber; lvs. simple, large, cordate, crimson beneath, mottled above. Java. *C. bipinnata*, fls. cymose, berries black; lvs. 2-pinnate or decompound, decid. Shrub, bushy, nearly erect; tendrils 0. Va., Ky., S. to Gulf. *C. indivisa*, fls. cymose; berries red, turning black; lvs. simple, cordate, acuminate, decid. High-climber, with tendrils. Va. to Mo., S. to Fla. and Tex. 5. *Vitis*, VINE. Fls. ♀ in foreign spec., ♂ ♀ ♀, ♂ ♀ in Am. Petals 5, caducous, coherent at top; fls. small, green, in thyrsus, raceme, or panicle. Berries edible; called *Grapes* in English, *Raisins* in Fr. Lvs. decid., simple, entire or lobed. Shrubs, usually bold high-climbers. Many spec., both worlds. *V. vinifera*, WINE-BEARING VINE. Grapes large. Fl., Fig. 4; branch, fr., Fig. 101. Native to Persia and W. Asia; cultivated from immemorial times. Innumerable varieties, furnishing all the fine vines and grapes of the world; finest in Mediterranean States, especially Italy, France, Spain. *V. Labrusca*, FOX-GRAPE. Thyrsi few-flowered; grapes large, purple or amber. Lvs. larger. Bold, large climber, ascending tallest trees.

Original of *Isabella, Catawba, Concord*. Common throughout U. S. **V. æstivalis**, SUMMER-G. Raceme long, slender; grapes small, black, pleasant; lvs. 4'-7' wide. High-climber. Common, U. S. Original of *Clinton* and var. **V. cordifolia** (*riparia, odoratissima*), FROST-G. Fls. very fragrant; thyrsus large, loose; grapes small, black, acid, sweetened by frost. Common, U. S. **V. vulpina** (*rotundifolia*), MUSCADINE-G. Panicle small; berries large, $\frac{3}{4}$ ' in diam., brownish-purple, pleasant; skin thick, tough. Lvs. small, round. High-climber, bark smooth. Maryland, W. to Ark., S. to Gulf States. Original of *Scuppernong*.

Ord. 106. Rhamnaceæ.—Fls. 4-5-merous, ♂, ♂ ♀, ♂ ♀ ♀, usually small, green, white, sometimes red, yellow, blue; sol. or fascicled. Disk fleshy, lining calyx-tube. Ova. free or adh. Fr. a drupe, boll, 3-4-angled, or of 2-3 cocci. Lvs. simple, usually alt.; sometimes 0. *Trees, Shrubs*; branches often spiny; sometimes climbing. 40 gen., both worlds. 5 Tribes:

Tribe 1. Fr. 3-angled or 3-winged. **1. Gouania**, climbing. 30 spec., trop. Am., Asia. **G. domingensis**, CHAWSTICK. S. Fla., W. Ind. **Tribe 2.** Fr. 2-3 cocci, or a drupe. Trees or shrubs, often spiny; lvs. opp., small or 0. **1. Collètia**. Shrubs, very spiny. Mex., Peru, Chili. **Tribe 3.** Fr. 3-4-coccous, dry, or drupe with 3-4 pyrenes. **1. Colubrina**, SNAKE-WOOD. Small evergreen trees or shrubs, often climbing. S. Am., Asia, Af. **C. americana**, shrub, erect, S. Fla. **2. Ceanothus**. Shrubs or small trees, usually evergreen; rts. red. Both worlds. **C. cæruleus**, evergreen tree, fls. brilliant blue, in large panicles. Mex. **C. americana**, NEW JERSEY TEA, decid. shrub. N. J. to Fla. **3. Rhamnus**, BUCKTHORN. Shrubs or small trees, often evergreen, often spiny. Many spec.; N. hemisphere, chiefly in Eur., N. Asia; few in mts. of Ind. and Abyssinia. **R. carolinianus** (*Frangula caroliniana*), **R. lanceolata**, both spineless, decid. N. J. to Ill., S. to Gulf. **Tribe 4.** Drupe dry or fleshy, girt by calyx-tube. **1. Zizyphus**, JUJUBE. Shrubs or small trees, often spiny; widely spread, tropics, chiefly in Old World. Drupe (jujube) edible. **Z. Jujuba**, INDIAN J. Evergreen, 12° high. E. Ind. **Z. Lotus**, LOTUS J. Evergreen, 6° high; believed to be the Lotus of the Lotophagi (Odyssey, Book IX.). Mediterranean States of Af., especially Tripoli. **Z. vulgaris**, COMMON J. Decid., 6° high. S. Eur. **Z. spina Christi**, CHRIST'S THORN. Evergreen, 6° high; branches used for Our Saviour's crown of thorns. Syria, N. Af. **2. Paliurus**. Decid. Habit of last, but fr. dry, with broad-brimmed disk. 2 spec., Eur., Asia. **P. aculeatus**, PORTE-CHAPEAU; also (and perhaps with better right) called CHRIST'S THORN. Spiny shrub or tree, 10°-35° high. S. Eur., W. Asia. Fig. 77. **3. Berchemia**. Drupe fleshy. Slender, tough, high-climbing. 10 spec. Both worlds. **B. volubilis**, SUPPLE JACK. Va. to Ky., S. to Gulf. **Tribe 5.** Samara. Unarmed climbers. **1. Ventilago**, evergreen. 10 spec. E. Ind.

Ord. 107. Stackhousiææ.—Fls. ♂, reg. Pet. 5, white or yellow; infl. various. Disk thin, lining base of calyx-tube. Fr. 2-5 indehisc. cocci, winged, angled, or smooth, separating from a central persistent column. Small *Herbs*, rhizome giving off slender branches; lvs. entire. Only gen. **Stackhousia**. 20 spec.; Australia; one in New Z., one in Philippine Islands.

Ord. 108. Celastrææ.—Fls. ♂ or ♂ ♀ ♀, small, cymose. Pet.

4-5. Sta. 4-5. Ova. 2-3-5-celled, more or less buried in a fleshy disk lining the calyx-tube. Fr. a boll, drupe, or samàra. Lvs. simple, alt., rarely opp. *Trees* or *Shrubs*, often climbing. 39 known gen., 400 spec.; warmer parts of both worlds. 2 Tribes:

Tribe 1. Sta. 3, rarely 2-4-8. Lvs. usually opp. 1. **Hippocratea**, evergreen climbing shrubs; 60 spec., both worlds; fr. samaroid. **Tribe 2.** Sta. 4-5, rarely 10. 1. **Myginda**. ♀. Evergreen shrubs. Fr. a drupe. 8 spec., trop. Am. *M. ilicifolia*, *M. Rhacoma*. S. Fla., W. Ind. 2. **Schæfferia**, ♂ ♀. Evergreen shrubs or trees. Drupe dry. *S. frutescens*, small tree, S. Fla., W. Ind. 3. **Cassine**. Ev. bushes or climbers, drupes edible. 8 spec., S. Af. 4. **Kokoona zeylanica**, KOKOON. Large evergreen tree, 60° high. Fr. 3-angled, sds. winged, oily. Ceylon. 5. **Celastrus**, STAFF-TREE. Small trees, shrubs, usually evergreen, sometimes climbing. Boll berry-like, 3-angled, red or orange; sds. with fleshy red aril. Many spec. Trop., both worlds. **C. scandens**, CLIMBING BITTERSWEET. ♂ ♀; decid. U. S. 6. **Euonymus**. ♂. Boll 3-4-5-lobed, red; sds. with fleshy red or orange aril. Shrubs or small trees, often evergreen, both worlds. **E. europæus**, SPINDLE TREE. Decid., 10°-30° high; wood made into spindles, etc. Eur. **E. atropurpurea**, WHAHO; fls. dark purple, 4-merous. Decid., 8°-12° high. U. S. **E. americanus**, STRAWBERRY BUSH. Fls. 5-merous. Boll warty. Decid. 3°-6° high. U. S. and Can.

Olax Alliance.—Fls. ♀, ♂ ♀, ♂ ♀ ♀. Ova. 1-∞-celled, cells 1-3-ovuled. Emb. small. *Shrubs*, *Trees*; lvs. alt., simple, exstip. 109. **Empetraceæ**. 110. **Ilicineæ** (**Aquifoliaceæ**). 111. **Olacineæ**. (Close to Sandalwood Alliance.)

Ord. 109. Empetraceæ.—Fls. ♂ ♀, ♂ ♀ ♀, small, reg., sol., or clustered. Perianth of 4-6 hypogynous scales, inner sometimes petaloid, marcescent. Sta. 2-3. Ova. 2-3-6-9-celled, cells 1-ovuled. Stig. radiate. Drupe fleshy, of connate or separate pyrenes; small, berry-like. Low heath-like evergreen *Shrubs*, Eur., N. Am., Straits of Magellan. 4 gen., 5 spec. 1. **Ceratiola ericoides**. Stig. horned. 2°-5° high; fls. whorled, reddish, drupes yellow. S. C. to Fla. 2. **Corëma alba**, low; drupes white. Portugal. 3. **Oakësia** (**Corëma**) *Conradii*, 6'-9' high; drupe dry. N. J. to Newfoundland. 4. **Empetrum nigrum**, CROWBERRY, CRAKEBERRY; low; drupes black, edible. Fig. 99. N. Eur., N. W. Asia; adv. in Can. **E. rubrum**, drupes red, edible. Magellan.

Ord. 110. Ilicineæ.—Fls. ♀, ♂ ♀ ♀-♂ ♀; sol., fascicled, cymose; 4-5-6-7-8-merous; small, white. Drupe small, berry-like. 4 gen. Both worlds. 1. **Nemopánthes canadensis**; only spec.; decid., 4°-6° high. Drupe red. Va. to Maine, Wis, Can. 2. **Byrônia**, holly-like shrubs; few spec. Australia, Sandwich Islands. 3. **Prinos glaber**, 2°-4° high, Mass. to Fla., W. to Miss.; and *P. coriáceus*, 4°-8° high; Fla., Ga., W., are evergreen, with black drupes, called *Gall-berries* or *Ink-berries*. *P. lanceolatus*, Ga., S. C.; *P. lævigatus*, Maine to Va.; *P. verticillatus* (drupes whorled), Can. to Fla., are decid., 6°-9° high, berries red, called *Winterberries*. 4. **Ilex ambigua** (*monticola*), N. Y. to Fla.; *I. decidua* (*prinoïdes*), are 6°-10° high, decid.; berries red or purple.—Evergreen, berries red: **I. Cassine**, YAUPON, 8°-12° high. Gulf States. **I. Dahdon**, 10°-20° high, Va. to Gulf. **I. opaca**, AM. HOLLY, 20°-40° high; lf.-margins wavy, with spiny teeth. Maine to

Gulf States. 1. *Aquifolium*, EUROPEAN HOLLY, 30°-60° high; lf.-margins very spiny. Wood white, valuable. Eur. 1. *paraguayensis*, tree; lvs. used as tea. Paraguay. Many other spec., both worlds.

Ord. 111. **Olacineæ**.—Fls. ♂ or unisexual; racemed, spiked, panicled. Pet. 4-5-6. Sta. 4-10-12. Pet. sometimes connate; calyx often accrescent. Ova. free or partly adh. 1-4-celled. Drupe 1-celled, 1-seeded. *Trees, Shrubs*, often climbing. 36 gen., 170 spec., trop., both worlds. 4 Tribes, distinctions in sta. and ovules. Types given:

Tribe 1. Several gen. 1. **Phytocrène** *gigantæa*, evergreen climber, 40° high; stem porous, filled with delicious water. Martaban, Birmah.

Tribe 2. Numerous gen. 1. **Acacina**, ♂; shrubs with ascending or twining branches; panicled fls., scarlet fr. 3 or 4 spec., trop. W. Af.

Tribe 3. Only 4 gen. 1. **Cansjèra**, ♂; corol. monopet. Shrubs, few spec. Asia, trop. Anstralia. **Tribe 4.** Numerous gen. 1. **Oïax**,

♂; evergreen shrubs, often climbing, sometimes thorny, or small trees. 24 spec., Asia, Anstralia. O. *stricta*, ov., Fig. 181, A. 2. **Ximènia**.

Fls. ♂, 4-merous, petals distinct. 3 or 4 spec., evergreen; thorny; large shrubs, small trees. Drupes large, edible. Tropics, both worlds. X. *americana*, W. Ind., Key West, Fla.

Geranium Alliance.—Fls. often irreg.; sometimes unisexual. Petals usually 5, rarely 3-4. Sta. few or ∞, free or connate; sometimes a part of them reduced to staminodes. Disk usually annular; sometimes reduced to glands, or 0. Petals sometimes clawed; sometimes 0. Styles free or connate. Ova. of several carpels, syncarpous or partly apocarpous. Ov. 1-2, rarely ∞. *Trees, Shrubs, Herbs*, bitter, pungent, or resinous; often fragrant.

112. **Chailletiacæ**.

113. **Meliacæ**.

114. **Burseracæ** (**Amyridacæ**).

115. **Ochnacæ**.

116. **Simarubacæ**.

117. **Rutacæ**.

118. **Geraniacæ**.

119. **Batidæ**.

120. **Zygophyllacæ**.

121. **Coriariacæ**.

122. **Malpighiacæ**.

123. **Humiriacæ**.

124. **Linacæ**.

Ord. 112. **Chailletiacæ**.—Fls. ♂ or unisexual, small, in capitate cymes. Pet. 5. Drupe pubescent, dry. Lvs. simple, alt. Evergreen *Shrubs* or small *Trees*; tropics, both worlds. 3 gen., 38 spec. 1. **Tapura**. Several spec., trop. Am. T. *africana*, trop. Af. 2. **Stephanopodium**, fl. hd. on the swollen top of the peduncle. Tree, Peru. 3. **Chailletia**. Fls. white. *Trees* or shrubs, often high-climbing. 30 spec., both worlds; chiefly in Brazil. C. *toxicaria*, RATSbane; sds. poisonous. Sierra Leone.

Ord. 113. **Meliacæ**.—Fls. ♂, or ♂ ♀ ♀-♂ ♀; panicled, showy. Pet. 4-5, rarely 3-7. Sta. usually twice or multiple the number of pet. Disk various. Sta. united into a tube; free only in Tribe 1. Stig. disciform or pyramidal. Ova. free, usually 3-5-celled. Fr. a drupe, berry, or boll, often poisonous. Large or small *Trees*, rarely small *Shrubs*; often evergreen. Wood hard, colored, fragrant. Lvs. alt., exstip., pinnate; rarely simple in some gen. of Tribe 4. More than 40 gen., 270 spec.; trop., both worlds. 4 Tribes:

Tribe 1. Boll (sta. free); sds. winged. Few gen. 1. **Chloroxylon** *Svietènia*, evergreen. 60°-100° high; wood yellow; one of the *Satin-*

woods of commerce. E. Ind. 2. *Cedrêla*, evergreen trees; fls. yellow, pink; wood red, cedar-scented. Several spec., trop. Am., Asia, Australia. **Tribe 2.** Boll. Sds. usually winged. Few gen. 1. *Swietënia Mahâgoni*. Fls. red. Boll woody, 3'-4' in diam. Evergreen tree, 70° high; wood is *Mahogany*. Rocky places, Cent. Am., Mex., S. Fla. **Tribe 3.** Boll or berry. Numerous gen. 1. *Trichilia*. Fls. white, paniced. Boll. Sds. arillate, emetic. 20 spec., evergreen trees, shrubs, often climbing. Trop. Am., W. Ind., Af. **Tribe 4.** Boll, drupe, berry. Sds. not winged. Several gen. 1. *Mëlia*. Fls. paniced, fragrant. Lvs. 2-pinnate, large. Drupe with 5 coherent pyrenes; made into rosaries. *M. Azëdarach*, BEAD TREE, CHINA T., PRIDE OF INDIA. Fls. lilac; drupe gold-colored. Decid., 40° high. Asia. *Evergreen*: *M. Azadirächta*, NEEM TREE, MARGÔSA; fls. white. 40° high. E. Ind. *M. sempervirens*, INDIAN LILAC; fls. brown. 25° high. W. Ind. *M. austrâlis*, fls. lilac. 20° high. New Holl.

Ord. 114. Burseracæ. INCENSE TREES.—Fls. reg., ♂ or ♀ ♂ ♀, paniced or racemed. Pet. 3-4-5. Sta. 6-8-10. Drupe with 2-5 pyrenes. Lofty *Trees* or *Shrubs*; evergreen, balsamiferous. Lvs. exstip., alt., rarely opp.; 3- (rarely 1-) foliolate, or imparipinnate. Tropics, both worlds. 2 Tribes:

Tribe 1. Ova. 1-celled. Few gen. 1. *Ámyris*. Lfts. 3-7; fls. white. Numerous spec., both worlds. *A. balsamifera*, TORCHWOOD; 50° high; resin black. W. Ind. *A. floridâna*, small tree, S. Fla.

Tribe 2. Ova. 2-5-celled. Several gen. 1. *Búrsera*. ♂ ♀ ♀. Trees, shrubs, near 40 spec., both worlds; yielding *Bdellium*. *B. gum-mifera*, 50°-80° high. W. Ind., S. Fla. 2. *Balsamodëndron*. Low, stunted trees; foliage scant, branches often spiny. Several spec., Af., Asia. *B. Makûl*, Ind.; and *B. africanum*, Af., yield *Bdellium*. *B. gileadense* yields *Balm-of-Gilead*. Red Sea coasts of Asia, Af. *B. Myrrhâ* yields *Myrrh*. Fig. 104. Arabia Felix. 3. *Boswellia*. Elegant trees. *B. serrata* (*thurifera*), 40° high, yields *Frankincense* (*Olibanum*). Fig. 125. Several African species.

Ord. 115. Ochnacæ.—Disk elongating after flowering; sometimes 0. Style ventral, gynobasic. Fr. a holl. drupe, or of 3-10 whorled drupelets. Pet. 5-3-4-10. Sta. 5-4-8-10-∞; staminodes 1-3-seriate. Infl. usually paniced. Lvs. simple, rarely pinnate; alt., stip. *Shrubs, Trees*, evergreen. 12 gen., 140 spec., trop., both worlds. 3 Tribes:

Tribe 1. Boll, ∞-celled. 6 gen., Am. 1. *Luxembûrgia*, trees, shrubs; fls. yellow, racemed. Sev. spec., Brazil. **Tribe 2.** Berry, 5-pyrened. *Eûthemis*, small shrubs; fls. white, racemed. Few spec., Malayan Archipelago. **Tribe 3.** Whorled drupelets. 5 gen., both worlds. 1. *Gómphia*, trees, shrubs; fls. yellow; drupes edible; 80 spec.; both worlds; chiefly in Brazil. 2. *Ochna*, trees, shrubs; fls. yellow, racemed. Asia, Af.

Ord. 116. Simarubacæ.—Fls. ♂ ♀, ♂ ♀ ♀, small, paniced or racemed. Pet. 3-5, rarely 0. Sta. 3-5-10, rarely more. Disk rarely 0. Drupe, boll, samâra. Lvs. pinnate, 1-2-3-foliate, rarely simple. *Shrubs, Trees*; bark and wood bitter, medicinal. 30 gen., chiefly trop.; both worlds. 2 Tribes: **Tribe 1.** Ova. 3-5-1-celled. Several gen. 1. *Picrámnia*, small trees, shrubs, evergreen; fls. ♂ ♀; lvs. pinnate. Drupe. Several spec. Trop. Am., W. Ind. *P. pentândra*. Fls. green. W. Ind., S. Fla. **Tribe 2.** Carpels free. Numerous gen. 1. *Ailântus*,

AILÁNTO, AILÁNTHUS. Fls. ♂ ♀ ♀. Fr. a samàra. Decid. trees; lvs. imparipinnate. Few spec., Asia. **A. glandulòsa**, 50° high, lvs. 2°-3° long, fls. green. Common. **2. Simarùba.** Fls. ♂, ♂ ♀. Fr. 1-5 drupes. Lvs. imparipinnate. Evergreen trees. Few spec. **W. Ind., trop. Am. S. glàuca**, fls. green. Large tree, S. Fla., Cuba. **3. Quàssia.** Fls. ♀, large, red; pet. 5. Fr. 5 drupes. Lvs. imparipinnate. **Q. amàra**, lofty evergreen tree; wood bitter, medicinal, made into *Quassia-cups*. Surinam. **4. Suriàna marítima**, monotypic. Fls. ♀, small, yellow, in terminal racemes; pet. 5. Fr. 5-carpelled. Lvs. simple, linear-spatulate, fleshy. Maritime coasts, nearly all tropics; S. Fla.

Ord. 117. Rutàcæ.—83 gen., 650 spec., both worlds. 7 Tribes, in 2 Sections:

Sec. 1. Ova. entire or slightly lobed. Style terminal. Berry or drupe.

Tribe 1. Fls. ♀, reg., white, fragrant, clustered. Sta. double or multiple the petals, free or mon- or polyadelph. Berry yellow, rarely red, usually edible. Lvs. 1-3-foliolate or pinnate. 13 gen., ev. trees or shrubs, trop. Asia, E. Ind., few in trop. Af., Australia. **A. Lvs. 1-foliolate. Petals usually 5, rarely 4. 1. Citrus.** Trees, usually spiny. **C. Aurántium**, ORANGE. *Mandarin, Tangerine*, are small-fruited varieties. **C. mèdica**, CITRON; fr. large, rind very thick. **C. Limònum**, LEMON, Fig. 127. **C. Limétta**, LIME. **C. Bigaràdia**, BITTER ORANGE. **C. decumàna**, SHADDOCK, PAMPLEMOUSSE; fr. very large, weighing 10-20 lbs. **2. Atalántia monophýlla**, WILD LIME; berry 1' in diam.; wood yellow, valuable. **3. Ægle Marmelos**, BENGAL QUINCE. (*Marmelos*, its Ind. name; original of our Eng. word *Marmalade*.) Berry as large as an orange, delicious. **B. Lvs. pinnate or 3-foliolate. Petals 5-4-3. 4. Ferònia elephántum**, ELEPHANT APPLE; monotypic; large tree; fr. large, delicious. **5. Clausèna**, trees, shrubs; berries small. Several spec., Asia, Africa; one, **C. brevistylis**, Australia. **6. Cookia.** Trees, shrubs; several spec., Asia. **C. punctàta**, WAMPEE; berries small, edible. China, E. Ind. **7. Luvúnga**, petals 4-5. Several spec.; spiny climbers, lvs. 3-foliolate. **Ind. 8. Triphásia trifoliàta**, monotypic. Pet. 3, lvs. 3-foliolate; berries small, edible. Spiny shrub, S. China.

Tribe 2. Fls. reg., often ♂ ♀ ♀-♂ ♀. Shrubs, trees, usually trop. Several gen. **1. Skimmia.** Fls. 4-merous, small, white, fragrant; paniced; drupes small, red. Lvs. simple. Evergreen shrubs, N. Ind., Japan. **2. Ptélea**, SHRUBBY TREFOIL, HOP TREE. Fls. ♂ ♀ ♀, white, fragrant; cymose; pet. 4-5. Samàra broad. Shrubs, small trees; lvs. simple or 3-5-foliolate. Few spec., N. Am., Asia. **P. trifoliàta**, lvs. decid.; 3-foliolate. 6°-10° high. U. S.

Sec. 2. Ova. deeply 2-5-lobed. Styles basal or ventral, free or connate by the stigmas. Fr. a boll; or 3-5 cocci, endocarp separating.

Tribe 3. Disk free or 0. Fls. as in Tribe 2, but smaller. Fr. 2-5 carpels. Lvs. compound. Trees, shrubs, usually trop. Several gen. **1. Xanthóxylum.** Large or small (often prickly) trees, shrubs; often evergreen; erect or climbing; lvs. 1-3-∞-foliolate. Fr. with taste of black pepper. Many spec., both worlds. **X. piperítum**, JAPAN PEPPER T. Japan. **X. americanum**, PRICKLY ASH. Decid., 10°-15° high; lfts. 9-11. Common, U. S. **Tribe 4.** Fls. ♀, reg. Australian shrubs, evergreen. Several gen. **1. Borònia**, lvs. pinnate;

petals 4; fls. white or pink. Numerous spec. **Tribe 5.** Fls. usually reg. Heath-like evergreen shrubs. Several gen., S. Af. 1. *Barrósma*, BUCHÉ. Petals 5; fls. usually white, heavy-scented. Lvs. medicinal. 15 spec. **Tribe 6.** Fls. usually reg., ♂ ♀; pet. 4. Lvs. often pinnatisect. ♀ herbs or evergreen undershrubs, often heavy-scented. Only 6 gen., N. temperate regions, Old World. 1. *Rûta*. Fls. reg., petals 4, yellow. 40 spec. *R. graveolens*, RUE. 2°-3° high; lvs. pinnatisect, medicinal. Fig. 188. S. Eur. **Tribe 7.** Fls. usually irreg.; pet. 5. Lvs. usually broad, compound, lfts. 3-5. Several gen., trop. Am. 1. *Galipêa*. Evergreen trees, shrubs; fls. pink, white. 20 spec. *G. Cusparia*, bark medicinal.

Ord. 118. Geraniaceæ. Fls. ♂, large, often irreg., sol. or clustered. Pet. 4-5-3. Sta. 5-6-8-10-∞, often with staminodes. Fr. various. *Herbs, Shrubs, Trees.* About 20 gen., 750 spec., both worlds.

Tribe 1. Fls. irreg., 5-merous; posticous sepal spurred. Stig. sessile. Sta. covering the ova., and coherent at top. Boll. opening elastically; or drupe. Lvs. simple. *Herbs.* 1. *Hydrocera* (*Tytônia*) *nâtans*; drupe. Aquatic herb; lvs. linear. Marshes, Asia. 2. *Impatiens*; boll. Succulent ⊙ ♀ herbs; lvs. cordate or reniform. Many spec., both worlds. 1. *Balsamina*, BALSAM. Fls. of various colors. Low, ⊙. Section of lf., Fig. 234. Ind. 1. *Nôli-me-tângerè*, TOUCH-ME-NOT, ⊙; fls. yellow. 2° high. Fig. 104. Eur. 1. *fúlva*, fls. orange, spotted; ⊙, 2°-4° high, branching; Can. to Fla. 1. *pállida*, fls. pale yellow; ⊙, 3°-6° high, branching; Can. to Gulf States. **Tribe 2.** Fls. reg. Pet. 5. Sta. 10. Fls. dimorphous; apert. in the odd form. Boll. 5-celled, or berry 5-furrowed. *Herbs, shrubs, trees.* Lvs. comp. Both worlds. 1. *Averrhôa*. Berry large, gherkin-like. Evergreen trees, lvs. pinnate, fls. racemed; trop. Asia. *A. Carâmbola*, *A. Bilimbi*, berries edible. 2. *Oxalis*. Boll. Lvs. petioled, palmate, lfts. 4-3-2-1, rarely 0; or paripinnate. *Herbs, shrubs, rarely climbing;* bulb, rhiz., fusiform rt., tuher, edible. Nearly 300 spec.; trop. Am., S. Af., N. Am., Eur. *O. scândens*, Mt. Quindiu, S. Am. *O. Acetosella*, WOOD-SORREL. ♀, rhiz., fls. white, red-veined; lfts. 3. N. C. to Can.; Eur. *O. stricta*, ⊙, ♀; stem leafy, 3'-15' high; fls. yellow. Common, U. S. *O. violacea*, ♀, scaly bulb; fls. violet. U. S. **Tribe 3.** Fls. reg., sol., colors various. Boll. Lvs. simple, small, usually opp. Evergreen shrubs, Peru, Chili. 1. *Rhynchótheca*, spiny; 2. *Wéndtia*, unarmed. **Tribe 4.** Boll. Fls. reg. Pet. 5. Sta. 10. Infl. panicled. Lvs. simple, opp. or whorled. ♀ herbs, low shrubs. Chili. Few gen. 1. *Viviânia*, evergreen shrubs; several spec.; fls. red, white. **Tribe 5.** Fls. reg., sol. Pet. 3-5. Sta. 6-10. Fr. 5-3 akenes. Lvs. pinnate. ⊙ marsh plants, temp. regions, N. Am. 1. *Floerkea proserpinacoides*, small; pet. 3; inconspicuous. Can. to Ky. 2. *Limnánthes*. Pet. 5; large, yellow, white, fragrant. Only 3 spec.; pungent. Cal. **Tribe 6.** Fls. irreg., showy; 1 sepal spurred. Fr. 3-5 carpels. 2 gen. 1. *Tropaëolum*, NASTURTION, NASTURTUM. Pet. 5-2. Sta. 8. ⊙ succulent herbs or evergreen plants, usually climbing; pungent, like true Nasturtium. Many spec., S. Am. *T. majus*, INDIAN CRESS; climbing, or low; lvs. peltate. *T. peregrinum*, CANARY-BIRD. High-climbing, almost epiphytal; 2 of the pale yellow petals fringed. Lvs. deeply lobed and cut. 2. *Pelargonium*

(miscalled *Geranium*). Pet. 2-4-5. Sta. 4-5-6-7, often with attendant staminodes. Fls. irreg., calyx spurred, sta. declinate. Fr. a regma. Lvs. simple or comp. More than 300 spec.; varied in lf., stem, fl. habit; often evergreen shrubs; often fragrant; stems often fleshy. Cape of Good Hope; few in Australia; 1 in Canaries; 1 in Asia. *P. Endlicherianum*, evergreen shrub, fls. pink. Taurus Mts. *P. cordatum*, lvs. cordate, fls. pink, Fig. 150; *P. tricolor*, lvs. lance-oblong, pinnatifid; fls. pansy-like; Fig. 150; both evergreen shrubs, Cape. **Tribe 7.** Fls. reg. or nearly so. Fr. a regma. Herbs, evergreen shrubs, lvs. various. Few in Am. 1. **Erodium**, STORK'S-BILL. Pet. 5. Sta. 5, staminodes 5. Carpel-beaks bearded, spirally coiled. \odot , \mathcal{Q} herbs. Many showy spec., chiefly in Medit. States; none in Am. **E. cicutarium**, PIN-GRASS. \odot , low, fls. pink; lvs. pinnate. Eur.; nat. in Tex., Cal.; greedily eaten by cattle. 2. **Geranium**, CRANE'S-BILL. Fls. reg. Pet. 5. Sta. 10, connate at base. Carpel-beaks not bearded. Lvs. palmate-lobed, lobes cut. Herbs, evergreen shrubs. Many showy spec., chiefly in Medit. States. **G. Robertianum**, HERB ROBERT, \odot , diffuse, fls. pink. Fig. 150. Eur.; Can. to Ky. **G. carolinianum**, \odot , \mathcal{Q} , 6'-18' high; fls. pink; **G. maculatum**, \mathcal{Q} , 2° high; fls. purple, lvs. blotched. Can. to Gulf. **G. sanguineum**, \mathcal{Q} , 1° high; fls. blood-red. Fr., Fig. 174. Gt. Brit. 3. **Monsönia**, 4. **Sarcocaulon**, fleshy low shrubs, fls. showy. S. Af.

Ord. 119. Batideæ.*—Founded on a monotypic plant, *Batis maritima*, salt-marshes, W. Ind., Gulf coast of Fla. Fls. \mathcal{Q} , 4-merous; \mathcal{Q} fl. achlamyd.; infl. spicate, fleshy. Drupe, 4-seeded. Gray, prostrate stems 2°-3° long; lvs. opp., fleshy, club-shaped. Affinities obscure; near *Tribulus* in Zygophyllaceæ.

Ord. 120. Zygophyllaceæ.—Pet. 5-4. Sta. 10-8, rarely fewer. Fls. reg. or irreg., red, white, yellow, blue. Peduncles 1-3. Fr. 2-10 cocci, gynobasic; connate or separable; sometimes a boll. Lvs. opp., pinnate; stipules sometimes spinescent. *Herbs, Shrubs, Trees*, chiefly trop., both worlds. 17 gen. 1. **Guaiacum**. Fls. blue. Ova stipitate. Cocci 2-5. Lfts. 4-6-8. Evergreen trees, yielding the gum *Guaiac* and the heavy wood *Lignum-vitæ*. Trop. Am. Several spec. **G. officinale**, 30° high. Fig. 128. **G. sanctum**, HOLY G. 20° high. S. Fla., W. Ind. 2. **Zygophyllum**. Fls. yellow, red, white. Boll. Lfts. 2, often fleshy. \mathcal{Q} herbs, or evergreen trees, shrubs. Several spec., Cape of G. H., Cape Verde Islands, Levant. 3. **Fabago**, BEAN-CAPER, \mathcal{Q} herb, 4° high; boll legume-like, used as capers. Syria. 3. **Tribulus**, CALTROPS. Lfts. 6 to 16. Fls. yellow, white. Cocci 2-5. spiny. \odot ; \mathcal{Q} prostrate herbs; numerous spec., both worlds. **T. cistoides**, fls. large, yellow; stems 1°-2° long. S. Fla., W. Ind.

Ord. 121. Coriariaceæ.*—Fls. \mathcal{Q} , \mathcal{Q} \mathcal{Q} \mathcal{Q} , racemed. Pet. 5, fleshy; sta. 10. Fr. 5-8 cocci, embraced by the accrescent petals. Shrubs, unarmed, evergreen; lvs. simple, opp. or whorled. Only gen. **Coriaria**. Several spec., Medit. States, trop. Asia, New Z., S. Asia. Affinities obscure; near Malpighiaceæ.

Ord. 122. Malpighiaceæ.—Fls. \mathcal{Q} , \mathcal{Q} \mathcal{Q} \mathcal{Q} , racemed or panicled. Pet. 5, fringed. Sta. 10; fl. usually connate at base. Fls. dimorphous; apert. in the odd form. Fr. 3, or fewer, samaras or cocci, or carpels connate into a drupe. Lvs. stip., usually opp.; petiole jointed to the stem. Evergreen *Trees, Shrubs*, usually climbing; showy. 45

gen., 600 spec.; trop. Am.; rare in Asia; rarer in Af. and Australia.
 4 Tribes: **Tribe 1.** Style 1. Coccus or samâra. Several gen. 1. **Gaudichaudia.** Fls. dimorphous. Samâra. Climbers. Mex. **Tribe 2.** Styles 3. Samâra. Numerous gen. 1. **Hiraëa.** Fls. yellow, white. Climbers, both worlds. **Tribe 3.** Samâra; or smooth or feathered coccus. Sev. gen. 1. **Banistèria.** Samâra. Fls. yellow. Trees, shrubs. Climbing or erect. Both worlds. **Tribe 4.** Cocci free or connate into a fleshy or woody drupe. Usually erect. Numerous gen. 1. **Malpighia.** Fls. yellow or white. Drupe, edible. Many spec. **M. saccharina,** SUGAR-PLUM; tree 80° high. Sierra Leone. **M. glâbra,** BÂRBADOES CHERRY; shrub 10° high. W. Ind. 2. **Byrsônima.** Fls. yellow. Drupes small. 80 spec., trees, shrubs, trop. Am. **B. lucida,** shrub. S. Fla., W. Ind.

Ord. 123. Humiriæcæ.—Fls. ♀, reg., white, cymose. Pet. 5. Sta. 10–20–∞, more or less connate at base; connective produced, fleshy. Ova. free, 5–6–7-celled. Fr. a drupe. Lvs. simple, alt., exstip. *Trees, Shrubs,* usually balsamiferous. 4 gen., 20 spec. 1. **Aubrya,** trop. W. Af. 2. **Saccoglottis,** 3. **Vantanea,** 4. **Humirium,** Guiana, Brazil. *Humirium* yields the fragrant *Umiri* balsam. **H. balsamiferum.** 40° high; sta., Fig. 168, E.

Ord. 124. Linæcæ.—Fls. ♀, reg., in raceme, panicle, spike, hd., fascicle. Pet. 5–4, rarely 6. Sta. 5–4, with as many staminodes; or twice or thrice the number of pet. Boll, drupe. Lvs. simple, alt. or opp. *Herbs, Shrubs, Trees,* both worlds. About 12 gen. 4 Tribes. **Tribe 1.** Boll. Sta. twice or more than twice the number of pet. Several gen. 1. **Ixonâthes.** Pet. 5–6. Trees, shrubs, trop. E. Asia. **Tribe 2.** Drupe. Sta. twice the number of pet. 1. **Erythroxylon.** Pet. 5. Trees, shrubs, 70 spec. W. Ind., S. Am. **E. Còca,** shrub 8° high; fls. white. Lvs. furnish *Cocaine.* Pacific coast, S. Am. **Tribe 3.** Drupe. Sta. twice or thrice the number of pet. 1. **Hugonia.** Pet. 5. Shrubs. Ind. **H. Mystax,** rts. violet-scented. **Tribe 4.** Boll; rarely indehisc. and 1-seeded. Sta. often with staminodes. Perfect sta. as many as pet. 4 gen. 1. **Linum.** Herbs, small shrubs. Pet. 5. Fls. panicked, corymbed, fugacious; of various colors. Many spec., temp. regions. **L. usitatissimum,** ☉, erect; fls. blue, lvs. linear. Stems furnish *Flax*; sds. are *Linseed.* Egypt, Asia.

Subdivision 3. Thalamifloræ.—Torus usually a Thalamus (that is, with all its floral parts free and distinct, as it were, in a common bridal-chamber), rarely changed into a disk, gynophore, or gonophore. Sta. often indef., sometimes monadelph. Pet. 1–2–∞-seriate.

Mallow Alliance.—Fls. rarely irreg. Sepals 5–3, rarely 2–4, free or connate. Pet. 5–2–4 or 0. Sta. usually ∞ and monadelph. or polyadelph. Ova. 3–∞-celled, rarely 1 carpel. Ov. in inner angles of cells. Lvs. alt., usually stip. *Trees, Shrubs, Herbs,* usually mucilaginous. 125. **Tiliæcæ.** 126. **Sterculiæcæ.** 127. **Malvæcæ.**

Ord. 125. Tiliæcæ.—Fls. reg., ♀, rarely imperfect; pet. 4–5–0. Fls. sol., or in small cymes, corymbs, panicles. Lvs. simple. *Trees, Shrubs, Herbs* 40 gen., 330 spec., temp. and trop. regions, both worlds. 7 Tribes, distinctions various. **Tribe 1.** 4 gen., 57 spec., both worlds. 1. **Elæocarpus.** Drupe, often edible. Pet. 5, dentate or fimbriate; fls. racemed. Lofty evergreen trees or shrubs. 50 spec., Ind., Java, Australia, New Z. **Tribe 2.** 4 gen., 40 spec., both worlds. 1. **Sloanea.** Boll woody, bristly, often large; dehisc. Fls. small,

white or green; racemed, paniced. Ev. or decid. trees, 100° high. 30 spec., trop. Am. **Tribe 3.** 4 gen., 7-8 spec., both worlds. 1. *Próckia*. Berry small, dry. Pet. 0; fls. sometimes unisexual; small, racemed, fragrant. 2 or 3 spec., ev. shrubs, trop., both worlds. **P. *Crúcis*** (*Kellettia odoráta*), W. Ind., Panama. **Tribe 4.** 2 gen., 7 spec., Af., Am. 1. *Apcíba*. Boll woody, bristly; fls. yellow, racemed. 5 spec., ev. trees, shrubs. Mex., W. Ind., trop. S. Am. **Tribe 5.** 12 gen., 80 spec., both worlds. 1. *Tilia*, **LIME, LINDEN**. Boll small, nut-like, 1-2-seeded. Pet. 5. Fls. small, yellow, fragrant, cymose; peduncle with a long bract. Decid. trees, 100° high; lvs. cordate, inequilateral. 8 species. N. hemisphere. **T. *europaëa***, Eur.; bark (called *Bast*, *Bass*) fibrous; made into mats, etc. Fig. 117. **T. *americána***, **LIN, LINDEN, LIME**. Lvs. smooth. 60°-80° high. Can. to Ga. **T. *álba*** (*heterophylla*), lvs. large, canescent beneath. 50°-90° high. Mts., Penn. to Ky., S. to Gulf. 2. **Córchorus**. Boll siliquöse or oblong. Pet. 5. Fls. small, yellow, sol. or clustered. 35 spec., evergreen shrubs, herbs; tropics, both worlds. **C. *capsuláris***, **C. *olitórius***, ☉, 10°-12° high, yielding *Jute* fibre. Asia. **C. *siliquósus***, 2°-3° high. W. Ind., Mobile, New Orleans. **Tribe 6.** 7 gen., 132 spec., both worlds. 1. **Triumfetta**. Shrubs, herbs, 40 spec. Trop. Am. 2. **Grewia**. Small ev. trees, shrubs, wood valuable. 80 spec. Asia, Malaysia, Af. **Tribe 7.** 7 gen., 10 spec., ev. trees: 1. **Cardodiptera**, Cuba; 2. **Berrya**, trop. Asia; 3. **Christiana**, trop. Af.; 4. **Pityránthe**, Ceylon; 5. **Diplodiscus**, Philippines, are monotypic ev. trees. 6. **Péntace**, 2 spec., one Malacca, one Java. 7. **Brownlowia**, 3 spec., fine trees; lvs. like *Tilia*, but 1° long. E. Ind.

Ord. 126. Sterculiáceæ.—Fls. reg., ♂ or unisexual, often large, showy. Infl. various. Pet. 5-4-3-0. Sta. 5-4-3 or multiple; often with staminodes; monadelph. into a column, rarely free. Ova. 1-3-5-10-12-carped; carpels sometimes winged, or twisted together. Fr. dry or fleshy; boll, or follicles, or cocci. Lvs. simple or digitate. *Trees, Shrubs*, or climbing *Herbs*; wood soft. 43 gen., 520 spec., trop. and sub-trop. regions, both worlds; chiefly S. Af., Australia. 7 Tribes:

Tribe 1. ♂. Pet. 0 or scale-like. Calyx petaloid. Carpels free; or boll. 9 gen., 64 spec., Australia; 2 anomalous gen., Am. 1. **Lasiopétalum**. Sta. monadelph. or free; fls. woolly. 25 spec., low ev. shrubs. Australia. *American gen., monotypic; apetalous; placed by Bentham and Hooker in Malvæcæ*: 2. **Fremontia californica**. Fls. large, yellow, sol. Calyx 5-lobed, bell-shaped, persist. Sta. 5, monadelph. in a cup. Boll of 5 woody, few-seeded carpels separating when ripe. Shrub fig-like, 6°-10° high; lvs. 5-7-lobed, bark mucilaginous. Cal. 3. **Cheirostemon platanoides**, **HAND FLOWER**. Fls. large, 2' long, rusty red. Calyx deeply 5-fid, leathery. Sta. 5, monadelph. one-third of their length (4 inches), bright red, resembling long-nailed fingers or claws. Style clavate. Boll 5-cornered; dehiscent. Lvs. plane-like, 5' wide. Ev. tree, 30°-40° high, making forests in Guatemala. Rare in Mex. Held sacred by Aztecs. **Tribe 2.** ♂. Pet. 5, concave or hooded, often produced. Boll. 9 gen., 94 spec., both worlds. 1. **Buettneria**. ☉ herbs, climbing ev. shrubs. 45 spec., trop. Asia, Af., Am. 2. **Theobroma**. Small ev. trees; fls. adventitious, sol. or clustered; boll large, 5-10-grooved, ∞-seeded, fleshy, indehisc.; sds. large; cotyledons ground are the *Choco-*

late of commerce. Perisperm 0. 8 spec., trop. Am. **T. Cacao**, finest spec. Fig. 135. **3. Ayènia**. Anth. 3-locular. Fls. small, sol. or clustered. Small shrubs, herbs. 8 spec., trop. Am. **A. pusilla**, 2, prostrate, 6'-12' long; fls. sol., purple; boll 5-lobed, 5-seeded, dehisc. W. Ind., S Fla. **Tribe 3.** ♂. Pet. 5, linear, marcescent. Boll. 1. **Walthèria**. 16 spec., shrubs, herbs, widely distributed. **W. americana**, shrub, 2°-3° high; fls. small, yellow, in hds. or spikes. Lvs. oblong. S. Fla. **2. Melòchia**. Fls. small, purple or white. Herbs, shrubs, small trees. 50 spec., both worlds. **3. Hermànnia**, fls. yellow, orange, red, panicled, racemed, fragrant. 77 spec., herbs, shrubs, Af., Asia; 3 in Mex., Tex. **Tribe 4.** Pet. 5. Sta. 10-40. Boll. 7 gen., 52 spec. Trees, shrubs, Asia, Af., Australia. **1. Dombèya**, showy, ev. small trees, shrubs; fls. white, rose, cymose, umbelled. 24 spec., Af., Mascarenes. **Tribe 5.** ♂. Pet. 5. Sta. ∞. Boll. 1 gen. **Eriolaèna**. Fls. large, yellow, panicled. Ev. trees, shrubs, 7 spec. E. Ind. **Tribe 6.** ♂. Pet. 5. Sta. 5-15. Boll with 5 carpels, or carpels free. 6 gen., 55 spec., trees, shrubs, both worlds. **1. Helicteres**, fls. white, yellow, purple. Carpels twisted, together, sometimes 2' long. 25 spec., ev. shrubs, both worlds. **Tribe 7.** ♂ ♀, ♂ ♂ ♀. Pet. 0. Calyx often colored. Rips carpels free. 5 gen., 62 spec., trees, both worlds. **1. Heritièra**, LOOKING-GLASS TREE. Fine pyramidal ev. trees; fls. small, red, panicled; lvs. large, silvery canescent beneath, shining like mirrors; trop. Asia, Af.; cult. in W. Ind. **2. Stercùlia**. Fls. showy, panicled, scarlet, purple, white, yellow, green. Ev. trees, 50 spec.; Asia, few in Af. and trop. Am. **S. Iwira**, fls. green, S. Am. **S. (Delabèchea) rupèstris**, BOTTLE TREE; trunk swollen, barrel-shaped. Australia.

Ord. 127. Malvæcæ.—Fls. reg., ♂, rarely ♂ ♀, usually calyculate; infl. various. Pet. 5-8-4; claws often adnate to staminal tube. Sta. monadelph. into a tube, its dilated base enclosing the ova.; fila. 5 or ∞; anth. 1-celled. Style entire, or branches as many as ova-cells. Ova. 3-4-5 or more carpels whorled around a central axis. Fr. a boll, or of several dry or fleshy carpels or cocci. Sds. often hairy; rarely pulpy. *Herbs, Shrubs, Trees*, often mucilaginous; wood soft, light. Lvs. simple, usually palm-ined or palm-lobed. About 57 gen., 700 spec., both worlds. 4 Tribes:

Tribe 1. Boll. Sds. often clothed with long silky hairs. Trees, usually ev., often lofty. 18 gen., 60 spec., tropics, both worlds. **1. Dûrio zibethinus**, monotypic. Pet. 5, fls. small, yellow. Boll, called *Dûrion*, large, berry-like, indehisc.; rind hard, muricate; pulp edible, delicious, but ill-scented. Ev. tree, 80° high. Lvs. simple. Malaysia. **2. Bómbax**, SILK-COTTON TREE. Fls. large, adventitious. Pet. 5. Ev. trees; lvs. simple. 10 spec.; 1 in Asia; 9 in S. Am.; one of which, **B. Mungûba**, fr. red, 8' long, 4' wide, tree 80°-100° high, Amazon River, S. Am., is found also on Rio Negro, W. Af. **3. Adansônia**. Pet. 5. Fls. large, sol., white, 6' in diam., pendulous, fragrant. Boll indehisc., large; rind woody, sds. embedded in edible pulp. Lvs. digitate. Immense trees, 70°-100° high, 80°-100° in circumference, 2 spec.: **A. digitata**, BAOBAB. Boll 12'-18' long, called *Monkey-Bread*. Peduncle 14' long. Af., in many parts. **A. Gregôrii**, boll smaller; peduncle short. N. Australia. **Tribe 2.** Boll. Styles as many as ova.-cells. 11 gen., 185 spec., both worlds. **1. Gossýpium**, COTTON. Pet. 5. Fls. calyculate, large, sol., yellow, pink, purple.

Boll 3-5-celled, dehisc. ; sds. clothed with *Cotton* ; also edible, and furnishing a fine oil for salads or for lamps. 3 original spec. ; many so-called spec. are mere varieties. ☽, rarely ☉ ; or shrubs. Trop. Asia and Am. *G. tricuspidatum*, ☽. E. Ind. Fig. 10. *G. arboreum*, ev. small tree ; cotton yellow ; staple short, of no value. E. Ind. *G. religiosum*, NANKEEN C. Cotton yellow, E. Ind., China. *G. herbaceum*, staple short. E. Ind. The *G. herbaceum*, or SHORT STAPLE, UPLAND C. (☉) of U. S. is a variety of *G. barbadense*, SEA-ISLAND, LONO-STAPLE C., ☽, W. Ind. Sd., Fig. 194 ; sd. hair, Fig. 216. *G. peruvianum*, S. Am. 2. **HIBISCUS**, ROSE-MALLOW. Pet. 5. Fls. calyculate, large, sol., showy. Shrubs, trees, often ev. 150 spec., both worlds. *H. esculentus*, OKRÁ, GUMBO. Boll long, mucilaginous, edible when unripe. E. Ind. *H. splendens*, ev. shrub, fls. pink ; New Holl. *H. syriacus*, decid. shrub, miscalled *Althæa* ; 12° high, fls. of various colors ; *H. Rosa-sinensis*, ev. tree, 30° high ; fls. large, usually scarlet ; E. Ind. *H. aculeatus*, fls. yellow ; *H. grandiflorus*, *H. Moscheutos*, fls. rose or white ; *H. militaris*, fls. flesh-color ; *H. coccineus*, fls. bright red, are ☽ tall, Am. spec., ranging from Penn. to Ill., S. to Gulf. 3. **Kostelétzkya**. Fls. calyculate, large, panicled, rosy or yellow. ☽ herbs, shrubs, 5-6 spec., trop. Am. *K. virginica*, ☽, 2°-4° high, fls. rosy, purple. Va. to Gulf.

Tribe 3. Styles 10. Carpels 5, separating from axis. 5 gen., 80 spec., both worlds. 1. **Malvaviscus**. Fls. large, calyculate, crimson. Fr. baccate, red or yellow. Ev. shrubs, 6 spec., W. Ind., Mex. *M. Drummondii*, fr. scarlet. Tex. 2. **Pavonia**, fls. scarlet, red. Ev. shrubs, ☽ herbs, 70 spec., both worlds. **Tribe 4.** Styles = ova.-cells. Carpels 5-∞, usually separating from axis. 25 gen., 355 spec., both worlds. 1. **Modiola**. Carpels 5-15 ; fls. calyculate, small, red. Prostrate herbs, ☉, ☽. Many spec. closely alike, trop. Am. (S. Af. ?) *M. multifida*, Va. to Gulf. *Calyculus* 0 : 2. **Abutilon**. Carpels 5-15, divergent at apex. ☉ ☽ herbs, shrubs ; 70 spec., both worlds. *A. striatum*, tall shrub, fls. orange or white, veined, pend. Brazil. *A. Avicennæ*, VELVET A. ☉, 3°-5° high ; fls. small, yellow ; lvs. large, cordate, velutinous. S. States. 3. **Sida**. Carpels of *A.*, but 1-seeded. ☉ ☽ herbs, shrubs. 80 spec., both worlds. *S. Napaëa*, ☽, 7° high ; fls. small, white, corymbose ; lvs. 5-cleft. Va. to Gulf. 4. **Napaëa**. Near *S.*, but fls. ♂ ♀ ; lvs. large, 5-7-parted. *N. dioica*, monotypic. Penn., Va., W. *Calyculate* : 5. **Callirhoë** (calyculus sometimes 0). Carpels beaked ; fls. large, crimson, mauve, rose, white. ☉, ☽, 2°-7° high. 7 spec., Tenn., N. C. to Gulf ; Nebraska, Wis., to Tex. 6. **Málva**, MALLOW. Carpels beakless ; fls. often large, showy. ☉, ☽ ; habits various ; 16 spec., both worlds. *M. Alcæa*, ☽, 2°-4° high ; fls. showy, racemed. Pollen-gr., Fig. 4, 5 ; fl., Fig. 134. Eur. *M. sylvestris*, MAUVE M. Fls. rich red-purple (mauve). ☽, 4° high. Fr., Fig. 174, D, C. *M. crispa*, CURLED M. ☉, 4°-6° high ; lvs. lobed and crisped. Syria. *M. rotundifolia*, CHEESE M. ☉, ☽, prostrate, lvs. and fls. small ; fr. depressed, like a flat cheese. Fl.-organs, Fig. 182. Eur., Asia, Egypt. Nat. in Am. 6. **Lavatera**. ☽, fls. showy ; 18 species, Eur., W. Asia. 7. **Althæa**. ☉, ☽, ☽, fls. showy. 12 species, both worlds. *A. rosea*, HOLLYHOCK. ☽, tall, hairy ; many varieties, China. *A. officinalis*, MARSH MALLOW, rt. ☽, stems 3°-4° high, woolly ; fls. large, purple. Eur. ; nat. in N. Eng. *Carpels* ∞, congested : 8. **Málope**. ☉, fls. showy ; 3 species, N.

Af. 9. *Kitaibèlia vitifolia*, monotypic; 2, 5° high; fls. white. Hungary.

Mångsteen Alliance.—Fls. ♂. Sep. and pet. each usually 4-5. Sta. usually ∞. Ova. 3-∞-celled, rarely 2-celled or of 1 carpel. Placentas on inner angles of cells. 128. **Chlenáceæ.** 129. **Dipterocárpeæ.** 130. **Camelliáceæ.** 131. **Guttiferæ.** 132. **Hypericáceæ.** 133. **Elatináceæ.** 134. **Podostemáceæ.**

Ord. 128. Chlenáceæ. CLOAK-FLOWERS. ♂. Sep. 3. Pet. 5-6. Sta. 10-∞, inserted within a cup. Ova. 3-celled, cells 2-∞-ovuled. Boll 3-valved, or by arrest 1-celled, 1-seeded. Fls. with large calyculus or involucl; cymose or paniced, showy; lvs. simple, alt.; stip. 0 or caducous. Elegant ev. *Trees, Shrubs*, Madagascar. 4 gen., 8 spec. 1. *Rhodolaëna altivola*, monotypic; high-climbing; pet. 6; fls. large, purple. 2. *Schizolaëna*. Pet. 5; fls. often adventitious. Small trees, 3 species. 3. *Leptolaëna multiflora*, monotypic. Pet. 5; calyculus fleshy. Small tree. 4. *Sarcolaëna*. Pet. 5; calyculus fleshy. Shrubs, 3 spec.

Ord. 129. Dipterocárpeæ.—Fls. ♂, reg., paniced, often fragrant. Calyx accrescent. Pet. 5, distinct or connate at base. Sta. 10-∞. Ova. 3- rarely 2-1-celled. Fr. free or rarely adnate partly to calyx; 1- rarely 2-seeded, indehisc., or 3-valved. Lvs. simple, alt., penninerved. Gigantic, resinous, fragrant, ev. *Trees* or *Shrubs*, rarely climbing. Damp, hot woods, Ind., Malaysia, Af. 12 gen., 112 spec. 1. *Shòrea*, timber trees; fls. yellow, fragrant. 25 spec. *S. robusta*, SÀL, SAUL T. 120° high. Ind. 2. *Vática*. Trees yielding *Indian Copal*; timber also valuable. 75 spec. Ind. 3. *Dipterocárpus*. 2 of the 5 sepals long and wing-like in fr. Fls. large, white or pink, fragrant. Lofty trees; resin and wood valuable. 25 spec. E. Ind., Malaysia. 4. *Dryobálanops Cámphora*, monotypic; tree 130° high, trunk with gigantic buttresses; yields *Borneo Cámphor*, the finest known. Lesson XXXII., 401. Fls. very fragrant; wood valuable. Sumatra, Borneo, Java. 5. *Ancistrócladus*. Climbing shrubs. 6 spec., trop. Asia, Af.

Ord. 130. Camelliáceæ.—Fls. ♂, rarely diclinous; reg.; peduncle jointed at base, bracteate or not; fls. usually large, handsome; sol., fascicled, racemed, paniced. Pet. 5, rarely 2-4-6-9-∞; distinct or connate at base; contorted in Tribe 1; imb. in the other Tribes. Sta. usually ∞, distinct or variously coherent, sometimes epipetalous. Ova. 2-3-4-5-celled. Fr. various. Perisperm present or 0. Sds. sometimes winged. *Trees, Shrubs*, chiefly tropical; juice watery; resinous; mucilaginous. Both worlds. 33 gen., 260 spec. 6 Tribes. Lvs. simple, except in Tribe 6.

Tribe 1. Pet. contorted. Boll dehisc. Erect ev. trees, rarely shrubs. Fls. in term. panicles or axil. racemes. 7 gen., 41 spec., chiefly Am. 1. *Kielmeyéra*. Pet. 5-6. Small ev. trees, 15 spec.; fls. white or pink. Brazil. 2. *Caraipa*. Pet. 5. Fls. white, fragrant. 8 spec., trees balsamiferous; trop. Am. 3. *Bonnétia*. Pet. 5. Fls. white, fragrant. 5 spec., small trees. Brazil, Peru. **Tribe 2.** Boll, dehisc. Trees or shrubs, erect, usually ev. 10 gen., 53 spec., both worlds. 1. *Thèa (Camèllia, Bentham and Hooker)*. Pet. 5-7-8. Fls. white or pink, fragrant. Boll 3-celled. Ev. shrubs or small trees; 5 spec., Ind., China, Japan. *T. sinénsis*, lvs. are the *Tea* of commerce. Fig. 78. All the varieties of *Tea* are differently prepared

lvs.—Green, Black, Oolong, etc. *Pèkoe* (Pay-ko, or Pee-ko) is made from the tenderest lvs. of 3-year-old plants gathered just after flowering. *Orange Pekoe* has the fls. of *Osmánthus* (*Olea*) *frágrans* added; *Flowering Chù-lan*, or *Cowslip Pekoe*, has the fls. of *Chloránthus inconspicúus* (*Chù-lan*) added. **2. Caméllia.** Near last, but sepals ∞ ; boll 5-celled; fls. usually scentless, large, white or colored. Ev. shrubs. 13 spec., many varieties. Ind., China, Japan, Malaysia. **C. reticuláta**, fls. red, 6'-7' in diam. Hong-Kong. **C. Sasánqua**, fls. small, white; lvs. tea-scented. Japan, China. **3. Gordónia.** Pet. 5, connate at base; sep. 5; both silky. Sta. ∞ , yellow. Boll 4-5-valved. Fls. large, sol., white, or cream-colored. Shrubs, trees, usually ev. 10 spec., trop. Am., trop. and subtrop. Asia. **G. Lasiánthus**, LOBLOLLY BAY. Fls. 2' in diam., cream-colored. Sta. pentadelphous. Ev. tree, 30°-60° high; swamps, Va. to Fla., W. to La. **G. pubéscens.** Fls. 3' in diam., white. Sta. distinct, epipetalous. Decid. tree, 30°-50° high; fls. fragrant. Fla. to La. **4. Stúartia.** Pet. 5-6, connate at base, crenulate; sep. 5-6; both silky. Sta. ∞ , ∞ -seriate, epipetalous. Boll 5-valved. Fls. large. Decid. shrubs; 3 spec.—1 Japan, 2 N. Am. **S. virginica**, pet. and sep. 5; styles connate; sta. purple. Fls. 2'-3' in diam. 8°-12° high, woods, N. C. to Fla. and La. **S. pentágyina**, similar, but styles distinct; pet. 5-6; sta. longer, white; fl. larger. Mts., Ky. to Ga.

Tribe 3. Fr. usually pulpy (berry), rarely subdehisc.; sds. ∞ , small. Ev., trees or erect or climbing shrubs. Ped. many-flowered. 3 lovely gen., 70 spec. **1. Stachyúrus.** Fls. 4-parted, small, spicate; sta. def. 2 spec.; trees, shrubs, Himálayas, Japan. **S. pruècox**, fls. pink, Japan. **2. Sauráuja**, near last; but pet. 5, sta. ∞ , fls. panicled or cymose; white, yellow, red. 60 spec.; trees, shrubs, trop. Asia and Am. **S. spectábilis**, fls. white, Mex. **S. (Draytónia) rubicúnda**, lvs. reddish, fls. red. Tree 50° high, Feejee Islands. **3. Actinidia.** Fls. diclinous, corymbose; berries showy. 8 spec., climbers; Himálayas, China, Japan. **Tribe 4.** Fr. rarely dehisc.; sds. usually few. Ped. 1-flowered. Ev. trees, shrubs. 8 gen., 83 spec., both worlds. **1. Eúrya.** Fls. diclinous, small, white, fascicled; berries small. Ev. shrubs, small trees; 30 spec. Ind., China, adjacent islands, Feejee Islands. **2. Ternstroémia.** Pet. 5, connate; sep. 5; sta. ∞ . Fls. white, red, purple. Showy trees, shrubs; 25 spec., trop. Asia, Am. **Tribe 5.** Pet. and sep. 2-3-5-6, distinct or connate; sta. 2-3-5-6 or more, free or connate, sometimes epipetalous. Fr. indehisc., or opening at top. Fls. umbelled, racemed, spiked. Ev. trees, shrubs, erect, climbing or epiphytal; trop. Am. 3 gen., 24 spec. **1. Noránteá.** Pet. 5, sep. 5, fls. racemed, purple, white, violet. 8 spec., epiphytal or scandent; rarely erect trees. **2. Marcgrávia.** Pet. connate into a cap circumscissile at base; sta. ∞ , or more than 12. Fls. umbelled, racemed, white or green. 8 spec., large climbers or creepers, almost epiphytal. **3. Ruýschia.** Pet. 5, connate at base; sta. 5. Fls. in long, terminal racemes. 8 spec., climbing, epiphytal. **R. clusiáfólia**, fls. purple. W. Ind. **Tribe 6.** Pet. imb., distinct or connate. Sta. ∞ . Fls. racemed. Ova. cells 1-ovuled. Perisperm 0 or scant. Rad. very large, bent or coiled; cotylédons minute. Fr. indehisc. Lvs. digitate. Large, often lofty, ev. trees; wood valuable. S. Am. 2 gen., 11 spec. **1. Anthodiscus.** Lvs. 3-foliolate, alt. or opp. Pet. 5, coherent. Ova. many-celled. Fls. racemed. 3 spec., trees, shrubs.

Guiana. 2. *Caryocâr* (or *Caryôcar*). Pet. 5-8, distinct. Sta. ∞ , polyadelph., often 4800 in a single fl.; fl. very large. Fr. (boll) large, woody, 4-celled. Sds. large, oily. 8 spec., large trees, trop. S. Am. *C. butyrôsum* (*Pêkea*), BUTTER-NUT TREE. Fls. white; sds. large, edible. Lfts. 5. Emb., Fig. 190. Guiana. *C. nuciferum* (*Rhizô-bolus*), CREAM-NUT T. Fls. and boll both immense, crimson-brown. Sds. very large, delicious. Lfts. 3. Tree 100° high. Guiana.

Ord. 131. *Guttiferæ*.—Fls. reg., ♂ ♀ ♀-♂ ♀ or ♀; infl. various. Pet. 4-2-6, rarely more; fls. white, red, yellow, fragrant. Sta. ∞ , rarely def.; free or connate, mon-polyadelph.; often with staminodes. Ova. 2-many—rarely 1-celled. Stig. = cells; sessile on a single style, or distinct on sepa. styles. Boll, drupe, berry. Perisperm 0. Sds. large, often arillate or strophiolate. Rad. often large, cotyl. minute or 0. Ev. *Trees, Shrubs*, sometimes climbing, epiphytal. Juice resinous, green or yellow; wood valuable. Lvs. simple, opp., rarely whorled; usually exstip. 24 gen., 230 spec., hot, damp tropics, both worlds. 5 Tribes:

Tribe 1. Cotyl. distinct, fleshy. Only gen. *Quina*. Trees, shrubs, 12 spec., trop. Am. **Tribe 2.** Cotyl. fleshy, conferruminate; 4 gen., 37 spec., both worlds. 1. *Mammêa*, 5 spec., trees; Asia, Af., Am. Drupe large, edible, called *Mammee Apple*. *M. americana*, 60° high; fls. white, showy. Drupe yellow, 8' in diam.; sds. 4, as large as a hen's egg. W. Ind. *M. africana*, similar, 40° high. Af. **Tribe 3.** Cotyl. 0 or minute. 4 gen., 62 spec., both worlds, chiefly Af, Asia. 1. *Garcinia*, trees yielding *Gamboge*; fls. 4-merous; drupe often edible. 36 spec., Asia, Af. *G. morélla* (*Hebradéndron gambogioides*) yields the finest gamboge. Fig. 169. Ceylon, Siam. *G. Mangostana*, fls. dull red, 1½' in diam. Drupe—called *Mangosteen*—large, red-brown; rind thick; pulp white, delicious. Malaysia. **Tribe 4.** Cotyl. 0. 5 gen., 13 spec., both worlds. 1. *Symphônia*, trees, shrubs; 6 spec.; 5, Madagascar; 1, trop Am. **Tribe 5.** Emb. fleshy; cotyl. minute at apex. 10 gen., 109 spec., trees, shrubs, trop. Am.; often epiphytal, scandent. 1. *Tovomita*, 20 spec.; 2. *Chrysochlâmus*, 12 spec.; 3. *Havétia*, monotypic; 4. *Clùsia*; fls. large, showy; pet. 4-8; boll dry or fleshy, dehisc. 60 spec., trees, shrubs, often parasitic; sending down rt.-supports like the Banyan. *C. Galactodéndron*, a Cow-tree of Venezuela, yields a fine milk. *C. álba*, *C. rôsea*, *C. fláva*, resinous trees, with fine large fls. W. Ind. *C. fláva* extends to S. Fla.

Ord. 132. *Hypericææ*.—Fls. reg., ♀. Panicle or cyme. Pet. 4-5 or more. Sta. usually ∞ , variously united or distinct. Ova. of 3-5-1 carpels; styles as many. Boll, berry. *Herbs, Shrubs, Trees*. Juice resinous or limpid. Lvs. simple, opp., rarely whorled; exstip. 8 gen., 210 spec., both worlds. 3 Tribes; types given: **Tribe 1.** 4 gen., 29 spec., Af., Am. 1. *Vismia*. Pet. 4-5. Sta. ∞ . Berry 5-celled. Fls. yellow or green. Ev. trees, shrubs, 20 spec., chiefly trop. Am.; 4, Af. Most of the Am. species yield gamboge. **Tribe 2.** 2 gen., 13 spec. 1. *Cratóxylon*. Pet. 5. Sta. 3-5-adelph. Fls. white, chocolate, red. Boll 3-celled; sds. alate. Ev. shrubs, small trees, 12 spec., trop. Am., Malaysia. **Tribe 3.** 2 gen., 165 spec., both worlds. 1. *Áscyrum*, ST. PETER'S-WORT. Pet. 4. Sta. ∞ , polyadelph. Boll 1-celled. Fls. large, yellow, sol. or in 3s. Small shrubs, usually ev. 5 spec., Am.; N. J. to N. Granada. *A. stáns*, N. J., S. *A. Crux-Ándreæ*, ST. ANDREW'S-CROSS. Spreading. N. Y. to Gulf. 2. *Hy-*

pericum, ST. JOHN'S-WORT. Pet. 5. Sta. ∞ , 3-5-adelph.; rarely few fls. yellow, cymose or sol. Boll, rarely fleshy. 160 spec., Ω herbs, shrubs, often ev. and resinous, widely distributed, both worlds. Numerous in U. S. *H. mutilum*, boll 1-celled; \odot , low; *H. corymbosum*, Ω , 2° high, boll 3-celled; N. Eng. to N. C., W. *H. aureum*, ev., 2° high, fls. sol., 2' wide, river-banks near mts. Ga., Tenn. *H. pyramidatum*, Ω , 2°-4° high, boll 5-celled, N. and W. *H. (Elodea) virginicum*, 1°-2° high; Ω ; marshes; fls. rose- or flesh-colored, clustered; *H. petiolatum*, similar, 2° high. Both common.

Ord. 133. Elatinaceæ. WATER-PEPPERS.—Fls. \S , 2-3-4-5-merous, iso-diplostemonous, minute. Boll ∞ -seeded. Lvs. opp. Small \odot Herbs or Undershrubs, stems creeping or spreading; often acid. Ditches, submerged shores, both worlds. 2 gen., 20 spec. 1. *Bergia*, WATER-FIRE. 14 spec. E. Ind., Java, Cape G. H. 2. *Elatine*, WATERWORT. 6 spec., both worlds. *E. hexandra*, pet. 3, sta. 6. *E. Hydropiper*, pet. 4, sta. 8; Eur. *E. americana*, MUD PURLANE; fls. 2-3-merous. U. S.

Ord. 134. Podostemaceæ.—Fls. \S or diclinous. Perianth 0, or 3-lobed, marcescent. Sta. 1 or more or ∞ , monadelph. or free; staminal nodes present or 0. Ova. and boll 1-3-celled, ∞ -seeded. Infl. various. *Water-plants*, with distinct simple or branched stem and lvs., or with all these confluent into fronds; often resembling Algæ and Hepaticæ. 21 gen., 120 spec., islands of E. Af., but chiefly in S. Am.; one spec. reaching U. S. 4 Tribes: **Tribe 1.** Fls. σ ρ . Perianth 0. Ova. 1-celled; carpels 2. Only gen. *Hydrostachys*. 9 spec., Af., Madagascar. **Tribe 2.** Fls. \S . 9 gen., 48 spec., both worlds. 1. *Podostemon*. Rhiz. various; often reduced to a disk-like process. Sta. 2. 20 spec., both worlds. *P. ceratophyllus*, lvs. horny, lobes linear. Bottoms of streams, U. S. **Tribe 3.** Fls. \S . 9 gen., 52 spec. 1. *Apinagia*, 16 spec.; 2. *Ligea*, 13 spec.; trop. Am. **Tribe 4.** Fls. \S . 2 gen., 11 spec. 1. *Terniola*, 7 spec.; trop. Asia. 2. *Tristicha*, 4 spec.; trop. Am., Af.

Pink Alliance.—Fls. reg., usually \S . Sep. 2-3-4-5, rarely 6, free or connate. Pet. usually as many, or 0. Sta. as many, or twice as many, rarely fewer or more. Ova. 1-celled or imperfectly 2-3-4-5-celled; placenta central, free, rarely parietal. Emb. usually curved. Perisperm floury, or rarely fleshy; rarely 0. 135. **Tamariscineæ.** 136. **Portulacaceæ.** 137. **Caryophyllaceæ.** 138. **Frankeniaceæ.**

Ord. 135. Tamariscineæ—Fls. reg. Pet. 5, pink, red, or white, iso-diplostemonous; fila. usually connate at base. Boll 1-sev.-celled; sds. hairy. Perisperm present or 0. Lvs. simple, rather fleshy, usually small; alt., exstip. *Shrubs*, small *Trees*. 5 gen., 40 spec., both worlds. Loving sands and open spaces. 3 Tribes: **Tribe 1.** Pet. 5, connate into a tube. Sds. flattened, bordered with long hairs, or alate. Only gen. *Fouquieria*. 3 spec., shrubs. Mex. *F. splendens*, 5°-15° high; branches reduced to spines, with lvs. sol. or fascicled in their axils. Stem wand-like, crowned with a mass of large, bright-scarlet fls. in panicles. Arizona, Mex. **Tribe 2.** Pet. distinct. Sds. hairy. 2 gen., 11 spec. Small shrubs. 1. *Reaumuria*. Fls. sol., showy. Lvs. small. 10 spec., Levant, salt plains, Asia. 2. *Hololachne*, monotypic. Cent. Asia. **Tribe 3.** Pet. almost or quite distinct. Fls. spiked or paniced. 2 gen., 55 spec. 1. *Myricaria*. Ev. shrubs.

4 spec., Eur., Caucasus. *M. germanica*, 8° high, lvs. narrow, flat; fls. pink, spicate. Eur. 2. *Tamarix* (*Myrica* of the Greeks). Lvs. and fls. minute; fls. in large, showy, paniced spikes. Small spreading ev. or decid. trees or shrubs. 20 spec. Medit. States, Asia. *T. gáltica*, decid. tree, fls. pale pink. Fig. 119. S. Eur. *T. orientális*, ev., 25° high, fls. pink, E. Ind. *T. mannífera*, secretes a saccharine matter (caused by the puncture of an insect) believed by some to be the Manna of the Israelites. Mt. Sinai, Arabia. Many varieties.

Ord. 136. Portulacáceæ.—Fls. ♀. Sepals 2, or calyx 2-partite or 2-3-fid. Pet. 5-4-3, hypog. or epig., distinct or connate. Sta. fewer or more than sep., alone or bundled, often connate at base. Ova. 1-celled. Boll 2-3-4-5-valved (pyxidium in *Portulaca*); few-sev.—∞-seeded. Emb. peripheric. Perisperm mealy. Lvs. alt. or opp., simple, various; often linear, spatulate; fleshy; sometimes stip. Succulent herbs, low, spreading; rarely ev. 15 gen., 125 spec., both worlds. 1. *Portulaca*. ☉, ♀, rarely ev. Fls. usually large, showy, of various colors, ephemeral, opening only in sunshine. 16 spec., both worlds, chiefly Am. *P. olerácea*, PURSLANE. Fls. small, pale yellow. ☉, Eur.; nat. in U. S. Used as a pot-herb and in salads. *P. pilósa*, fls. large, pink. ☉, S. U. S., S. Am. *P. grandiflora*, ♀, rt. tuberous; fls. large, of various colors. S. Am. 2. *Montia*, monotypic. Pet. connate. Small aquatics; fls. minute. *M. fontána*, WATER-BLINKS; widely distributed; common in Gt. Brit. 3. *Claytonia*, SPRING BEAUTY. ☉ or ♀, with tuberous or fleshy rts. Fls. small, pink or white, veined, racemed. 20 spec., Am. *C. virginica*, ♀, fls. pink; lvs. linear; *C. caroliniana*, similar, but smaller; lvs. broader. U. S. 4. *Talinum*. ☉, ♀; fls. pink, white, yellow, usually cymose. 11 spec., Am. *T. teretifolium*, ♀, fls. pink. On rocks, Penn. to Tenn., N. C., Ga. 5. *Calandrinia*. ☉, ♀; fls. large, of various colors. 60 spec., Am. *C. discolor*, lvs. rosulate; fls. rose-color, racemed on a scape. Chili. *C. Menziesii*, low, spreading, leafy stems; fls. crimson, racemed. Pacific States.

Intermediate Ord. Paronychiáceæ.—Leading to Caryophylláceæ. Close to *Portulacáceæ*; but pet. minute, squamiform or 0; calyx often petaloid and indurated; ova. 1-celled; fr. dry, small, usually a utricle. 17 gen., 90 spec., chiefly in Eur., N. Af., in sands and barren places. 4 Tribes, distinctions in infl., which is compound. **Tribe 1.** 2 gen., 11 spec., Old World. 1. *Scleranthus*. Calyx-tube hardened. 10 spec. *S. ánnuus*, KNAWEI; ☉, 2'-5' high. Eur. Introduced in U. S. *S. perénnis*, similar, but perennial; food of the Polish cochineal-insect. Eur. **Tribe 2.** 3 gen., 4 spec.—2 Af., 1 Canaries. 1. *Dicheranthus*, monotypic. Small ev. shrub; pet. 0; fls. in small corymbose term. cymes. Canaries. **Tribe 3.** 7 gen., 65 spec., both worlds. 1. *Corrigiola*, ☉, fls. white. *C. capénsis*, Cape G. H. *C. telephiifolia*, S. Eur. 2. *Anychia*, 2 spec., N. Am. *A. dichótoma*, FORKED CHICKWEED, ☉, low, branches forking, fls. in the forks; green. Can. to Gulf. 3. *Paronychia*, KNOTWORT. Stipules silvery, showy; fls. often hidden by large white scarious bracts; infl. cymose hds., or fascicles. 40 spec., both worlds; ☉, ♀, small cæspitose, spreading. *P. argyrócoma*, ♀, mts., N. H., Va., S. *P. dichótoma*, Harper's Ferry, S. and W. *P. brasiliana*, ev., Brazil; *P. hispánica*, ev., Spain; *P. itálica*, ev., Italy; *P. canariénsis*, ev., Tenerife; *P. bengalénsis*, ☉, Bengal. **Tribe 4.** 5 gen., 10 spec., both worlds. 1. *Ilícebrum*,

monotypic (Bentham and Hooker); fls. white. W. Eur., N. Af. 2. *Pentacraëna*, 2 or 3 spec., Oregon to Chili.

Ord. 137. *Caryophyllacæ*.—Characters of Alliance; but sep. 4-5, free or connate; pet. free; disk sometimes annular or raised into a gynophore. Boll dehisc. by valves or apical teeth; rarely pyxidium or berry. Emb. peripheric. Perisperm floury, fleshy, rarely 0. Infl. cymose. Lvs. opp., entire, 1-3-nerved, often fleshy. *Herbs*, rarely *Shrubs*. Mts., hedges, rocks, wastes, chiefly in temperate and cold regions, both worlds, usually low, spreading. About 35 gen.; about 800 spec. 3 Tribes:

Tribe 1. Pet. usually small; no claws nor scales. Style 3-2-fid above. Sta. 5 or fewer. Stip. scarious or 0. 11 gen., 62 spec., both worlds. 1. *Stipulicida setacea*, monotypic; ☉, low, tufted, forking; fls. small, white. Boll 3-valved. N. C., Ga. to Fla. 2. *Polycarpaëa*, 24 spec., both worlds; and 3. *Polycarpon*, 6 spec., both worlds; ☉, 2, low; fls. small, cymed or panicled, sepals showy. **Tribe 2.** Pet. sometimes 0; no claws nor scales. Styles distinct. Lvs. usually exstip. 13 gen., nearly 300 spec. 1. *Spergularia*. Pet. 5; sty. 3-5. Stip. showy. Fls. lilac, pink. 3 spec., small weeds, sea-coasts, both worlds. *S. rubra*, prostrate, ☉, fls. sol., red. Can. to Fla. 2. *Spergula*, SPURREY. Pet. 5. Sty. 5. Fls. white. ☉, low; making fine turf on lawns and good forage. 3 spec., Eur. *S. arvensis*, introduced into U. S., Can. to Fla. 3. *Arenaria*, SANDWORT. Pet. 5. Sty. usually 3. Small, ☉, 2; fls. white. 130 spec., widely distributed, both worlds. *A. serpyllifolia*, lvs. minute, ciliate. W. Eur.; common in U. S. *A. (Alsine) squarrosa*, N. Y. to Fla. *A. patula* (resembles *Gypsophila*); Va., Ky., Tenn. 4. *Sagina*, PEARLWORT. Pet. 4-5 or 0. Sty. 4-5. Low, ☉, 2. 8 spec., both worlds. *S. apétala*. Pet. 0. Low, ☉, cæspitose. Eur.; N. Y., Penn. to Ill., Tenn. (pavements of Nashville. *Gattinger*). *S. procumbens*. Pet. 4-5. 2, spreading; springs, damp rocks. Eur.; Maine to S. C. *S. Elliöttii*. Pet. 5. ☉, cæspitose, low; sands and dry woods. S. States. 5. *Stellaria*, CHICKWEED. Pet. 2-fid, 4-5-0. Sty. 3-4-5. Fls. white, showy. 70 spec., both worlds. *S. média*, ☉, spreading, flaccid; lvs. 1'-3' long. Eur.; nat. from N. Eng. to Fla. and La. *S. crassifolia*, lvs. fleshy. Springs, damp spots, Eur.; Ill., Ky., S. *S. (Sagina) fontinalis*. Pet. 0; sta. 4-6. Ky. 6. *Cerastium*. Near *Stellaria*; pet. sometimes entire. Usually ☉; hairy or glandular. 100 spec., both worlds. *C. vulgatum*, MOUSE-EAR CHICKWEED. 5'-10' high; pet. small, lvs. ovate. Eur.; common in E. and S. U. S. *C. arvense*, 2, 5'-10' high; pet. large, lvs. linear. Eur.; rocks, N. Eng. to Wis., S.

Tribe 3. Calyx monosep., 5-toothed or 5-lobed. Pet. and sta. hypog., on a gynophore, rarely sessile. Pet. with scales at top of claw, forming a corona, or with winged bands; rarely naked. Sty. distinct. Lvs. exstip. 11 gen., 410 spec., both worlds. 1. *Lýchnis*. Sty. 5-4. ☉, 2, 2. 30 spec., both worlds. *L. Flós-cuculi*, RAGGED ROBIN; 2, downy, glutinous; pet. 4-cleft; fls. red, panicled. Boll 5-toothed at apex. Eur. *L. (Melándrium) vespertina*; fls. usually ♂ ♀; white, vespertine. 2, Eur. *L. (M.) dioica*, similar; ♂ fl. (with abortive pistil), vert. sec., Fig. 174, A. Eur. *L. (Agrostemma) Githago*, CORN COCKLE; hairy; lvs. linear; fls. large, long-peduncled, showy, red-purple. Boll, Fig. 179, F; Fig. 197, E. Grain-fields, Eur.; nat. in U. S. 2. *Cucubalis báccifer*, CAMPION; monotypic.

Berry; red, turning black. Fls. small, white; stems trailing; lvs. ovate. Eur. 3. **Silène**. Sty. 3. ☉, ♀, often viscous. Boll dry, 6-toothed at apex. 200 spec., both worlds; fls. often showy. **S. stellata**, STAR CAMPION, ♀, 2°-3° high; fls. white, in large panicles; pet. fringed; calyx inflated. Lvs. in whorls of 4, ovate-lanceolate. U. S. **S. inflata**, BLADDER CAMPION, ♀, 1° high; fls. white, panicked; pet. 2-cleft; calyx inflated, showy. Gt. Brit. *Pet. crowned, colored; fls. cymose or clustered*: **S. acutis**, MOSS CAMPION, ♀, low, tufted; fls. large, purple; mts., Gt. Brit. **S. pennsylvanica**, ♀, low, fls. pink; **S. virginica**, FIRE PINK, ♀, slender, 1°-2° high; fls. deep crimson; **S. régia**, ♀, 3°-4° high; fls. deep scarlet; **S. rotundifolia**, ♀, fls. deep scarlet; lvs. and fls. large; U. S. **S. Arméria**, CATCHFLY; ☉, 18' high, viscous; fls. small, pink. Eng. 4. **Saponaria**, SOAPWORT. Near Silène, but sty. 2. 30 spec., ☉, ♀, saponaceous. Eur., Asia. **S. officinalis**, BOUNCING BET, ♀, 1°-2° high; lvs. green; fls. large, clustered, pale pink. Eur. Introduced U. S. 5. **Gypsophila**. Sty. 2; fls. small, white or pink, in diffuse cymose panicles. Elegant, low, slender, branching; lvs. grass-like, small. 50 spec., rocks, Eur., Asia. 6. **Drypis spinosa**, monotypic; lvs. ending in spines; fls. small, pink; *pyxidium* utricular, 1-seeded. Low, ev., 6'-10' high. S. Eur. 7. **Diáanthus**, PINK. Sty. 2; calyx bracteate; fls. showy, often fragrant; lvs. usually glaucous, grass-like. 200 spec., Eur., Asia, Af. *A. Fl. sol., term.*: **D. Caryophyllus**, CLOVE P., ♀, original of all the CARNATIONS. 2°-3° high. **D. plumarius**, GRASS P., PHEASANT'S EYE, ♀, low, tufted; petals fringed; fls. pink, white, or variegated. *B. Fls. sessile in a cluster*: **D. barbatus**, SWEET WILLIAM; lvs. oblong-lanceolate, green; fls. variously colored. ♀, 18' high. **D. Arméria**, DEPTFORD P. ☉; fls. pink, scentless. All European.

Ord. 138. Frankeniaceæ. SEA-HEATHS.—Close to Silène, in Caryophyllaceæ; but sty. filiform, with as many branches as placentas (3-4); pet. 4-5-6, sta. 4-5-6-∞. Boll 3-4-valved. Emb. straight, axile; perisperm floury. Lovely little evergreen shrubs or ♀ herbs, with the aspect of Heaths; loving sea-coasts. Only genus **Frankenia**. 30 spec., widely distributed, both worlds. Fls. ♂, sol. or cymose. **F. grandiflora**, fls. pink; stems prostrate, 6'-12' long. Cal., S. Nevada. **F. Jamesii**, Col., Tex. **F. laevis**, fls. flesh-color; Essex; **F. pulverulenta**, fls. red; Sussex, Eng. **F. hirsuta**, fls. lilac; Siberia. **F. intermedia**, fls. white; S. Eur. **F. corymbosa**, fls. red; Barbary. **F. nodiflora**, fls. flesh-color; Cape G. H. **F. ericifolia**, fls. red; Canaries. **F. mollis**, fls. red; Caucasus. **F. pauciflora**, fls. pink; New Holl.

Milkwort Alliance.—Fls. ♂. Sep. and pet. 5 each, rarely 4-3-1. Sta. as many or twice as many as pet. Sty. simple, rarely lobed. Ova. 2-1-more-celled; placentation usually parietal. Emb. straight. Perisperm fleshy, rarely 0. Lvs. exstip., or sometimes with small stip. in Vochysiaceæ. 139. **Vochysiaceæ.** 140. **Tremandraceæ.** 141. **Polygalaceæ.** 142. **Pittosporaceæ.**

Ord. 139. Vochysiaceæ.—Fls. irreg., often large; pet. 1-3-5; infl. various; often racemed or panicked; sep. 5-4; 1 sep. often large and spurred. Sta. 1-3-5, usually only 1 fertile. Ova. sometimes adh. Sty. simple. Boll 3-valved; or samara. Sds. 1, few or ∞, often winged, hairy or cottony. Perisperm 0, or fleshy. Lvs. simple, opp., whorled, rarely alt. *Trees*, ev., often gigantic; resinous; rarely erect or climbing *Shrubs*; wood valuable. 7 gen., 100 spec., trop. Am.

1. *Lightia*. Sta. all perfect. Ev. trees, 2 spec. (resembling *Chryso-balanus* Tribe in Rosaceæ). 2. *Trigônia*. Sta. all perfect; fls. panicled (resembling Papilionaceæ); lvs. opp. Ev. climbers, 25 spec. 3. *Vochysia*. Sta. 3, 1 fertile. Sep. 5, 1 large, spurred. Pet. 3, 1 large. Fls. usually orange, in large showy panicles; violet-scented. Boll triangular, 3-celled, 3-seeded; sds. winged. 40 spec., fine ev. timber trees. V. *rotundifolia*, ova., Fig. 179, E. V. *guianensis*, timber is called *Copai-yè*. 4. *Erisma*. Sta. 5, 1 fertile. Pet. 1, fan-shaped, clawed. Ova. adh., 1-celled. Fls. blue or yellow, panicled, primrose-scented. Fr. samaroid, often red, pear-shaped, large, crowned by the accrescent calyx-segments. Lvs. opp. or whorled. Magnificent ev. trees, 80°-120° high. 4 spec. E. *Japura*, 100°-120° high; fls. yellow, fr. red; sds. edible, beaten and made into butter. Brazil. 5. *Qualea*. Fertile sta. 1, rarely 2. Pet. 1, fan-shaped; calyx 5-fid, 1 segment spurred. Boll woody, angular, 3-celled, 3-seeded; sds. winged. Fls. large, yellow, white, blue, rose, variegated, in showy panicles; primrose-scented. 25 spec., ev. shrubs, trees, often 130° high. Q. *pulcherrima*, 50° high; fls. variegated blue, yellow, and red. Pet. 2½' wide. Brazil.

Ord. 140. *Tremandrææ*.—Close enough (Bentham and Hooker) to be included in *Polygalææ*; the differences being, in *Tremandrææ*, pet. 4-5, equal (reg.); sta. opp. pet.; fila. free; anth. extrorse. Fls. sol., axil., red, blue, purple, white, on slender peduncles. Ova. 2-celled, cells 1-2-3-ovuled. Boll 2-valved. Lvs. small, entire, usually whorled. Heath-like ev. shrubs. 3 gen., 23 spec., Australia. 1. *Tremandra*; pet. 5; fls. purple. 2 spec., W. Australia. 2. *Tetratheca*; pet. 4-5; fls. purple, yellow, white, opening only in sunshine. 20 spec., Tasmania, S. Australia. 3. *Platytheca galioides* (*Tremandra verticillata*), only spec.; fls. lilac, opening but once, only in sunshine. S. Australia.

Ord. 141. *Polygalææ*.—Fls. irreg., sol., racemed or spiked, rarely panicled. Sep. 5; 2 inner largest, often winged and petaloid. Pet. 3 or 5, hypog., 2 lateral free, or united at base with lower, concave or carinate, rarely 0; upper 2 sometimes = lateral, sometimes small, scale-like or 0. Sta. 8, rarely 5-4; fil. usually monadelph. Anth. 1- rarely 2-celled; dehisc., apical, porous. Ova. free, 2- rarely 1-3-5-celled; sty. term., curved, dilated at top, simple or 2-4-lobed. Ov. pend., usually sol. in each cell, rarely twin, rarely 2-6. Boll, drupe, samara. Sds. often velvety; hilum often strophiolate. Perisperm fleshy or mucilaginous, sometimes scant or 0. Lvs. usually simple. Herbs, Undershrubs, sometimes twining; sometimes climbing Shrubs, or Trees; usually bitter; rts. milky. About 15 gen., 400 spec., Cosmopolitan. 1. *Muraltia*. Sep. nearly equal. Fls. small, sol. Boll 4-horned. Low scrubby shrubs, lvs. stiff, needle-like, fls. sol. 50 spec., S. Af. 2. *Monnina*. 2 of the sep. large, wing-like. Pet. 3, 1 large. Fr. indehisc., 1-2-seeded, dry or drupaceous, often winged. Fls. usually small, racemed or spiked. Herbs, shrubs, trees; 50 spec. Pacific States, S. Am. M. *polystachya*, M *salicifolia*, Peru; bark of rts. saponaceous. M. *Wrightii*, ☉, erect; fls. small, greenish-purple, racemed; fr. small, winged irregularly; is found in Sanoita Valley, Arizona. 3. *Polygala*, MILKWORT. Prominent characters of Order. Low herbs or ev. shrubs; medicinal, sometimes poisonous; fls. often showy. 200 spec., both worlds. P. *paucifolia*, ♀, stems prostrate, rooting or

subterranean. Fls. dimorphous; cleistogamous fls. (and most fertile) spicate on subt. stems; complete fls. showy, carina fringed, on short erect leafy stems, racemed, purple or white. N. Eng., along mts. to Ga. *P. polygama*, similar, but ②; sands, N. Eng. to Fla. and La. *P. Senega*, SNAKEROOT. Fls. homomorphous, white, sol. ②; rhiz. knotty; *P. lutea*, ②; fls. bright orange (1 variety purple), in close oblong term. hds. *P. sanguinea*, ①; hds. similar to last, but fls. bright red-purple. Common, U. S. Many other U. S. spec. *P. thesioides*, ev. shrub, fls. blue, Valparaiso. *P. vulgaris*, ②, 6' high, fls. blue. Fig. 185. Pollen, Fig. 4, 2. N. Eur. *P. cordifolia*, *latifolia*, *oppositifolia*, handsome ev. shrubs, fls. purple, Cape of G. H. *P. venenata*, Java; intensely poisonous, even to the touch. 4. *Kraméria*. Sep. 4-5, irreg. Pet. 4-5; 3 inner small, clawed. Sta. 4-5 or fewer; ova. 1-celled, ov. 2, collateral. Fr. 1-seeded, indehisc., prickly. Fls. racemed. Lvs. silky, simple or trifoliate. ② herbs, small shrubs, spreading, branched. 12 spec. Am. *K. lanceolata*, ②, rhiz. woody; stems prostrate, 1° long. Tampa Bay, Fla. *K. parviflora*, Nevada, Ariz. *K. pauciflora*, ev. shrub, 4° high, fls. white, Mex. *K. triandra*, RHATANY. Rts. medicinal; juice making a blood-red infusion, used to adulterate port wine. Peru.

Ord. 142. *Pittosporaceæ*.—Fls. ♂, rarely ♂ ♀ ♀; reg., in raceme, corymb, cyme; rarely sol. Sep. 5, free or connate. Pet. 5, clawed, claws sometimes coherent; decid. Sta. 5, distinct. Ova. sometimes stipitate; 2-celled, or incompletely 2-5-celled; ov. 2-seriate; sty. simple. Boll or berry. Emb. minute. Perisperm fleshy. Lvs. simple, alt., exstip. Ev. *Trees, Shrubs*, often resinous. 9 gen. and 90 spec., chiefly in Australasia. 1. *Citriobatus*, ORANGE-THORN. Small thorny trees or shrubs; fls. small, sol.; berry yellow, 1½' in diam., edible. 2-3 spec., Austral. 2. *Billiardiæra*; fls. sol., yellow, blue, or purple. Berry blue or amber color. Climbing shrubs, 10 spec. Tasmania, Austral. 3. *Söllya*; fls. blue, cymose; berries papery. 3 spec., New Holl., Van D. L., Austral. 4. *Pronaya*. 3 spec.; fls. blue or white, racemes term.; berries round. Erect or climbing shrubs. W. Austral. 5. *Bursária*; fls. small, white, often pink-tinged; peduncle 3-flowered, or racemed. Boll like the silique of Shepherd's Purse. Shrubs, branches often spiny. 2 spec. *B. spinosa*, 10° high, New S. Wales. 6. *Pittosporum*; fls. small, in term. cymes or racemes. Boll 1-celled. Large shrubs, small trees. 50 spec., Old World. *P. Andersonii*, fls. yellow; New Holl. *P. bicolor*, fls. ebocolate; Van D. L. *P. crassifolia*, fls. crimson; New Z. *P. Tobira*, fls. white; Japan. *P. mauritianum*, fls. yellow; Mauritius. *P. viridiflorum*, fls. green; *P. capense*, fls. yellow, both Cape G. H. *P. coriaceum*, fls. blue; Madeira. *P. ferrugineum*, fls. yellow; Guiana.

Violet Alliance.—Æst. usually imb. Sta. ∞ or def. Carpels connate into a 1-celled ova. with parietal placentation; rarely spuriously 2-more-celled; rarely free; ova. sometimes regularly 3-more-celled. 3 Sections: 1. *Emb. straight or curved, usually large. Perisperm fleshy, sometimes 0*: 143. *Bixaceæ*. 144. *Canellaceæ*. 145. *Violaceæ*. 146. *Droseraceæ*. (See Ord. 96.) 147. *Cistaceæ*. 2. *Emb. large, usually curved. Perisperm 0*: 148. *Resedaceæ*. 149. *Moringaceæ*. 150. *Capparidaceæ*. 151. *Crucifereæ*. 3. *Emb. minute. Perisperm fleshy*: 152. *Fumariaceæ*. 153. *Papaveraceæ*. 154. *Sarraceniaceæ*.

Ord. 143. *Bixaceæ*.—Fls. reg., infl. various. Sep. 4-5, 2-6, free

or connate. Pet. 4-5, 2-6, or ∞ , or 0. Anth. dehisc. by slits, rarely apical pores. Ova. usually 1-celled, with 2- ∞ placentæ; sometimes sev.-celled. Styles = placentæ, connate or free. Disk often conspicuous, various. Drupe or boll. Lvs. alt., simple, rarely compound, sometimes palmilobed. Stip. minute or 0. Ev. *Trees* or *Shrubs*; 29 gen., 160 spec. Tropics, both worlds. 4 Tribes:

Tribe 1. 7 gen., 14 spec.; trop. Asia, Af. Fls. ♂ ♀. Pet. with scale at base. Few gen. 1. *Gynocardia odorata*, monotypic. Pet. 4-5. ♂ with more than 100 sta. Fls. adventitious, large, yellow, fragrant. Berry ash-colored, as large as a shaddock. Fine plane-like tree, lvs. entire. E. Ind. 2. *Pangium edule*, monotypic; ♂ racemed; ♀ sol. Lvs. ent. or 3-lobed. Tree; timber called *Pangi wood*. Lvs. and sds. poisonous. Java. **Tribe 2.** Fls. ♂ or ♂ ♀. Pet. 0 or = sep. 15 gen., 106 spec., both worlds. 1. *Flacourtia*. Pet. 0. ♂ with sta. ∞ . Shrubs, small trees, usually thorny; fls. white; berry plum-like, edible. 12 spec., trop. Asia, Af., Madagascar. 2. *Laëtia*. Pet. 5 or 0. Sta. ∞ . Fls. ♂ or ♂ ♀, racemed, yellow or white. Berry ovate or 3-gonous. Lvs. usually ent. Small trees; 10 spec., trop. Am. L. *Thámmia*, fls. white, W. Ind. L. *apétala*, wood resinous; New Granada. **Tribe 3.** Fls. ♂ or ♂ ♀ ♀; petalous. 4 gen., 22 spec., trop. Af., Am. 1. *Oncoba*. Fls. ♂ ♀ ♀; large, term., stig. radiate, fr. smooth; or small, axil., stig. minute, fr. echinate, resembling a horse-chestnut. Lvs. oblong; fls. racemed. Trees, 6 spec., trop. and subtrop. Af. 2. *Mayna*. Similar; 7 spec., trop. Am. **Tribe 4.** Fls. ♂, rarely ♂ ♀ ♀. Pet. large. Anth. with pores. Boll dehisc.; endocarp membranous. 3 gen., 15 spec., both worlds. 1. *Bixa*. Fls. corymbose or racemose; usually pink. Boll 2-valved, prickly. 1 (2?) spec., trees, trop. Am. B. *Orellana*, 20°-30° high; fls. pink. Boll 1½' long; sds. with red waxy pulp, the *Arnóttá* of commerce; used as paint by Caribs. Rts. violet-scented. Fig. 199. 2. *Amourexia*, ev. shrubs with showy fls. 3 spec., Mex., trop. Am. 3. *Cochlospermum*. Fls. large, yellow. Boll pear-shaped, 3-5-valved; sds. cottony. Lvs. palmilobed. Shrubs, trees, usually ev.; 11 spec., both worlds. C. *Gossypium*, ev. tree. Ind. C. *insigne*, rt. medicinal, Brazil.

Ord. 144. Canellææ.—Fls. ♀, reg., cymose. Floral bracts 3; sep. 4 or 5, fleshy. Pet. scale-like or 0. Sta. monadelphous into a tube; anth. 20 or fewer, adnate to its outer surface. Disk 0. Berry ∞ -seeded. Close to Bixææ. Lvs. alt., entire, exstip. Glabrous, ev., aromatic *Trees*, trop. Am. 2 gen., 4 spec., Am. 1. *Cinnamodéndron*. 2 spec., W. Ind., Brazil. 2. *Canella*. Fls. white or violet; bark pale yellow, spicy, medicinal. Fine trees, 2 spec. C. *alba*, fls. violet. S. Fla., W. Ind. C. *laurifolia*, S. Am.

Ord. 145. Violææ.—Fls. ♀, rarely ♂ ♀; more or less irreg. 5- rarely 4-merous; often cleistogamous, and then apét. Fila. sometimes connate; sty. simple, rarely 3-5-fid. Ova. 1-celled, placentæ 3, rarely 2-4-5. Boll or berry. *Herbs, Shrubs, Trees*; lvs. simple, alt., rarely opp.; stip. 21 gen., 336 spec., cosmopolitan. 4 Tribes: **Tribe 1.** Fls. reg. Pet. 5. Only tribe with 5- ∞ staminodes, free or connate, outside the sta., and valves of boll seminiferous on their edges. 4 gen., 21 spec., tropics. 1. *Sauvagèsia*. Fls. pink, white, red, racemed. ☉, ☽, small, showy; in grassy trop. meadows; mucilaginous; used as pot-herbs. 10 spec., Am. S. *erecta*, St. MARTIN'S

HERB; ☉; fls. pink; W. Ind., S. Am. *S. geminiflora*; ☉; fls. red; Mex. 2. *Lavrãdia*. Fls. white or pink, paniced. Small ev. shrubs, 6 spec., Brazil. 3. *Schuurmãnsia*. Fls. yellow, paniced. Sds. winged. Ev. trees, shrubs. 2 spec., Ind. Archipelago. **Tribe 2.** Pet. equal or sub-equal; claw short. Berry or boll. 7 gen., 53 spec., both worlds. 1. *Melicytus*. Fls. usually ♂ ♀; small, fascicled. Berry edible. 4 spec., large ev. shrubs or trees. New Z. 2. *Leônia*. Pet. 5. Sta. 4. Fls. small. Berry edible. Ev. trees; 2 spec., Peru, Brazil. *L. glyxicarpa*. Berry as large as an orange, yellow. 3. *Alsodéia*. Ev. trees, shrubs; 40 spec.; trop. Af., Asia, Am. **Tribe 3.** Pet. sub-equal; claws sub-coherent. Boll. 3 gen., 10 spec.; trop. Am., Sandwich Islands. 1. *Paypayrola*. Fls. in branching spikes or clusters. Ev. trees, trop. Am. 2. *Isodéndron*. Small trees, shrubs, Sandwich Islands. **Tribe 4.** Corolla irreg.; lower pet. dissimilar. Boll. 7 gen., 251 spec. 1. *Agátion*. Fls. small, greenish. Ev. shrubs, often climbing. 5 spec., Feejee Islands, N. Caledonia. 2. *Noiséttia*. Fls. fascicled or racemed. 2 spec., ev. shrubs, small, S. Am. 3. *Ionidium*. 1 pet. much larger than the others. Lvs. opp. 2 herbs, ev. shrubs, 40 spec., both worlds. Rts. emetic, purgative. **I. Ipecacuãna**, WHITE IPECAC. Trop. Am. 1. *capense*, fls. white; ev. shrub, Cape G. H. 1. *verbenaceum*, fls. blue; 2, low, Mex. 4. *Viola*. Pet. nearly equal, lower 1 spurred. Sta. 5, often monadelphous in a sheath around the ova.; 2 lower (and 2 lower sta.) often spurred. Lvs. usually cordate, sometimes 3-5-7-parted. Low 2, rarely ☉ ②, rarely suffrutescent. 200 spec., cosmop. Types given. *Cauléscent*: **V. (Solea) cóncolor**, fls. small, green, boll 1' long; 1°-2° high; **V. canadensis**, 1°-2° high, fls. whitish; **V. striata**, low, fls. cream-colored; **V. rostrata**, fls. purple; **V. hastata**, fls. yellow, U. S.; **V. tricolor**, PANSY, HEARTSEASE, ☉ ② 2; pet. of 3 colors. Eur. Fig. 204. Original of all varieties by crossing with **V. grandiflora**, Switzerland, **V. altàica**, Tartary. *Acaulescent*; 2. *Rhiz. erect.* Lvs. often parted: **V. pedata**, BIRD-FOOT V.; **V. delphinifolia**, **V. sagittata**, **V. cucullata**, fls. blue, U. S. *Rhiz. slender, creeping.* Lvs. often cordate: **V. blanda**, **V. primuleifolia**, **V. lanceolata**, fls. white; **V. rotundifolia**, fls. yellow, U. S. **V. odorata**, fls. blue, fragrant. Eur., Asia. Original of *Parma* and *Tree V.* One of the *Four Cordial Flowers*.

Ord. 146. Droseraceæ—Very near *Violacæ*, but nearer *Nepenthecæ* and *Sarraceniacæ*. See Ord. 96.

Ord. 147. Cistaceæ.—Fls. ♂, reg., sol., or in cymes, racemes. Pet. 5-3. Sta. ∞. Sty. simple. Boll 3-5-valved. Lvs. simple, opp., rarely alt. Stip. foliaceous or 0. *Herbs, Undershrubs, Shrubs.* 4 gen., 150 spec., S. Eur., N. Af., rare in Am. and Asia. *A. Boll 3-valved*: 1. **Léchea**. Pet. 3. 2 herbs; fls. small, green, racemed or paniced. 4 or 5 spec., N. Am. **L. major**, 1°-2° high; **L. minor**, **L. thymifolia**, smaller; common, U. S. 2. **Hudsonia**. Pet. 5. Low heath-like shrubs with crowded yellow fls. 3 spec. **H. ericoides**, **H. tomentosa**, Maine to Va.; latter along Great Lakes to Minn. **H. montana**, 2'-4' high. Table Rock, N. C. 3. **Hélianthemum**. Pet. 5, fugacious. Fls. sol. or racemed, showy. Ev., low shrubs, or suffrutescent, 6'-4° high. About 100 spec., both worlds. *Fls. yellow*: **H. vulgare**, BRITISH ROCK-ROSE. Sta. sensitive. Fig. 243. Eur. **H. canadense**, fls. dimorphous; earlier ones large, sol.; later small or apert., clustered. Can. to Gulf. **H. corymbosum**, fls. dimorphous; earlier large, sol., or

few in a cluster; later as in last. N. J. to Gulf. *H. carolinianum*, fls. large, sol., homomorphous. N. C. to Fla. and W. *H. scoparium*, Cal. *H. brasiliense*, 6' high, Brazil. *H. glomeratum*, Mex. *H. crassifolium*, Barbary. *H. formosum*, 4° high, Portugal. *H. canariense*, Canaries. *Fls. red*: *H. rhodanthum*, Spain. *Fls. white*: *H. erectum*, S. Eur. *B. Boll* 5-10-celled: 4. *Cistus*, True Rock Rose. Pet. 5, fugacious: fls. large, rose-like, white, pink, red, purple, rarely yellow. Ev. shrubs, 1°-4° high. About 40 spec., Old World. *C. creticus*, fls. purple, Crete; *C. ladanifera*, fls. white, Portugal; shrubs 4° high, yielding the gum *Lábdanum*. *C. sericeus*, fls. red, Spain.

Ord. 148. Resedáceæ.—Fls. usually ♂; irreg.; racemed or spiked. Calyx 4-8-partite. Pet. 4-8, rarely 2 or 0; open in æst. Sta. 3-40. Ova. sometimes stipitate; carpels 2-6, coherent, rarely distinct; ∞-rarely 1-2-ovuled. Disk rarely 0. Boll indehisc. or gaping at top; rarely a berry or follicle. Perisperm 0. *Herbs, Shrubs*, juice watery. Lvs. simple; entire or cut. Stip. minute, gland-like. 6 gen., 60 spec., both worlds. 1. *Ochradenus*. Low ev. shrubs; fls. yellow, spicate, peduncle becoming spiny. Berry 3-sided. Arabia, N. Af., Spain, Canaries. 2. *Reseda*. Fls. 4-6-merous, small, greenish, racemed, spiked. Boll bladdery, 3-6-horned, ∞-seeded; dehisc. apical. 26 spec., Old World. *R. odorata*; pet. 6; fls. fragrant. Ev. shrub, N. Af., Egypt; ☉ in more northern climates. *R. Lutæola*, DYER'S WELD. ☉, 2° high; pet. 4; fls. yellowish, scentless. Plant yields a fine yellow dye, and the paint called *Dutch Pink*. Fig. 122. Eur.

Ord. 149. Moringáceæ.—Fls. ♂, irreg., yellow, in paniced racemes. Calyx 5-partite; disk lining its base. Pet. 5, on calyx; linear, 2 posterior longest. Sta. 8-10, on disk; fila. connivent into a split tube; united above the middle, free above and below; anth. 1-celled. Ova. stipitate, 1-celled, with 3 parietal placenta. Sty. simple, thick, tubular, truncate. Ov. ∞, 2-seriate. Boll silique-like, 3-many-angled, torulose (swollen at intervals); sds. 1-seriate, separated by spongy septa. 3-gonous, angles sometimes winged; chalaza corky. Perisperm 0. Emb. straight; cotyledons plano-convex, fleshy; plumule many-leaved. Lvs. alt., 2-3-imparipinnate; lfts. very caducous. Stip. decid. Only gen. *Moringa*. Small *Trees*, pungent, aromatic. Sds. yielding the valuable *Ben-oil*, which never grows rancid. N. Af., trop. Asia, Madagascar. 3 spec.: *M. áptera*, *M. pterigospërma*, *M. polygona*.

Ord. 150. Capparidáceæ.—Fls. ♀, rarely ♂ ♀; rarely irreg.; infl. various. Sep. 4-8, free or connate. Pet. usually 4, rarely 0, very rarely 2-8; sessile or clawed; inserted on the torus, which is short or long, or discoid; various. Sta. usually 6, rarely 4-8, often multiples of 6-8; inserted at base or top of torus; fila. free or connate at base; anth. 2-celled. Ova. usually stipitate, 1- or spuriously 2-8-celled. Sty. 1, rarely 3, usually short or 0; stig. usually orbic. Ov. ∞, rarely sol. Boll siliquose, 2-valved; rarely berry or drupe. Perisperm usually 0. Emb. curved; cotyledons rarely flat. Lvs. alt., rarely opp.; petioled; simple or digitate. Stip. 0, or small, setaceous or spinescent. *Herbs*, ev. *Shrubs, Trees*, juice watery, pungent; chiefly tropical; both worlds. 23 gen., 300 spec. 2 Tribes: Tribe 1. 14 gen., 18 spec., both worlds. Berry or drupe. Shrubs or trees. 1. *Crataeva*. Pet. 4. Sta. 8-20. Fls. white. Ova. stipitate; berry, pulpy. Both worlds, 6 spec. *C. Tápia*, GARLIC PEAR; berry yel-

low, as large as a pear, garlic-scented. Brazil. *C. excelsa*, tree 4° in diam., wood valuable. Madagascar. *C. Nurvâla*, berries edible, acid. Tree, sacred; planted in graveyards. Society Isles, Malabar. **2. Căpparis**, CAPER. Pet. 4. Sta. ∞. Fls. white, showy. Ova. stipitate. Berry pungent, peppery; unripe berries and fl.-buds pickled in vinegar. Shrubs 4°-12° high; stip. spiny. 120 spec., both worlds. *C. spinôsa*, COMMON C.; bramble-like, on walls. Fig. 177. Mediterranean States; the "*Hyssop* that springeth out of the wall;" stems used in sprinkling the Passover blood on Hebrew door-posts; also believed to be the "reed" that held the sponge dipped in vinegar and offered in derision to Christ. *C. jamaicênsis*, 12° high; W. Ind., S. Fla. *C. acuminâta*, E. Ind. **3. Morisônia**. Pet. 4. Sta. ∞. Fls. white. Ova. stipitate. Berry succulent. 4 spec., trees, W. Ind., S. Am. **Tribe 2.** Boll 1-celled, usually siliquose. Herbs or small shrubs. 9 gen., 104 spec., both worlds. **1. Gynandrôpsis**. Pet. 4. Sta. 6, on the long stipe of the ova.; below the ova., far above the pet. Fls. white. 10 spec., ☉, both worlds. *G. pentaphylla*. Lfts. 5. Stem simple, 2°-3° high. Trop., both worlds; reaching through Gulf States to N. C. and Ga. **2. Clême**. Pet. 4. Sta. 6. Ova. stipitate. Fls. pink, purple, yellow, white; racemed. 70 spec., Am., Egypt, Arabia. ☉. *C. pungens*, SPIDER FLOWER, pet. long-clawed. 2°-4° high. Lfts. 7-9. S. Am.; wild in S. U. S. Sev. elegant spec., Nebraska to Cal. **3. Isômeris**, monotypic. Pet. 4. Sta. 6. Ova. stipitate. Fls. yellow; no claws. *I. arborea*, shrub; ill-scented. Cal. **4. Polanisia**. Sep. 4. Pet. 4, clawed; sta. 8-32. Ova. sessile. Fls. racemed, yellow, red, pink, often showy. ☉, low; lvs. digitate. 14 spec., warm regions, Asia, Am., Af. *P. graveolens*, fls. small, yellow. Conn. to Ky., W. to Colorado, New Mex.

Ord. 151. Cruciferæ.—Fls. ♂, racemed, rarely sol.; white, yellow, purple; rarely blue, pink. Sep. 4. Pet. 4, usually equal, arranged crosswise; rarely 0. Sta. 6, tetradynamous; rarely 2-4-∞; anth. rarely 1-celled. Carpels 2, connate, rarely 3-4. Ov. ∞-few-sol. Sty. simple; stig. 2, or united in 1. Silique or silicula, dehisce. or not. Sds. mucilaginous, campytropous. Emb. oily; curved, rarely straight. Perisperm usually 0. Lvs. simple (rarely compound), alt., rarely opp.; entire or cut; usually exstip. *Herbs*, rarely *Shrubs*, juice watery, pungent. Generally distributed, both worlds; most abundant in cold and temperate regions, especially in Eur. 172 gen., 1200 spec. 10 Tribes; types given:

Tribe 1. Silique long, 1-celled, indehiscent; or lomentaceous and dehisce. 9 gen., 26 spec., Eur., Asia, Af. **1. Răphanus**. 6 spec., Eur., Asia. *R. sativus*, RADISH. Fls. violet or white. ☉ ②. Egypt; probably a cultivated form of *R. Raphanistrum*, WILD R., fls. yellow; Levant. *R. caudatus*, silique 1° long, edible when unripe. Ind. **Tribe 2.** Silique transversely 2-jointed; short or long; always upright or nearly so. 11 gen., 40 spec.; Old World; 1 Am. **1. Căkile**. Silique 2-1-seeded, fleshy. Fls. lilac. Fleshy seaside herbs, ☉. *C. maritima*, SEA-ROCKET, Gt. Brit. *C. americana*, N. Atlantic States, U. S., and Great Lakes. **2. Crámbe**. 16 spec., Old World. *C. maritima*, SEA KALE, ♀; fls. white, honey-scented; lvs. fleshy, gray, glaucous, edible. Coasts, Gt. Brit. *C. tatàrica*, rt. large, edible, called *Tartar Bread*. Sandy plains, Hungary. **Tribe 3.** Silicle (rarely silique) indehisce.; no joint: often bony; 1- rarely 2-4-celled;

cells 1- rarely 2-seeded. Pedicels drooping in fr. 29 gen., 91 spec.; 1 Am. 1. **Búnias**. Low herbs. Fls. yellow, racemed; silique 4-sided, bony, often muriccate; 2-celled, 4-seeded. 4 spec., **Medit. States**. **B. orientális**, Emb., Fig. 191, D. 2. **Thysanocárpus**. ☉, low; fls. white or violet. Silicle orbic. or ovate; margin often winged. 8 spec., N. W. Am. **T. élegans**, wings of silicle perforated. 3. **Clypéola**, similar to last, but wing of silicle dentate. Fls. white or yellow. 8 spec., S. Eur., temp. Asia. 4. **Ísatis**. Silicle winged. ☉, ☽, ♀, fls. yellow, panieled. 30 spec., **Medit. States**, W. Asia. 1. **tinctória**, DYER'S WOAD; ☽, 1°-4° high; lvs. yield a blue dye, used by the ancient Britons for staining their bodies. Emb., Fig. 191, A.

Tribe 4. Silicle dehisce. Valves keeled, pouch-like, compressed at right angles to plane of the usually very narrow replum. Cotylédons accumbent, straight. 14 gen., 80 spec., both worlds. 1. **Ibérís**, CANDYTUFT. 2 outer pet. larger; fls. in flat corymbs, white, pink, lilac, often fragrant. Valves of silicle winged at top. 20 spec., ☉, ♀; low; often ev. Eur., N. Af., E. Asia. 2. **Megacarpaëa**. Sta. sometimes 10-16. Silicle very large, valves orbic. Fls. purple. ♀ herbs; 3 spec.; deserts, Cent. Asia. 3. **Cremólobus**. Valves of silicle orbic., winged at back; fls. yellow. Herbs, undershrubs. 5 spec.; Peru, Chili. **Tribe 5.** Silicle of Tribe 4; but cotylédons usually incumb. 22 gen., 140 spec., both worlds. 1. **Lepidium**. Sta. 6-4-2. Pet. sometimes 0. Silicle scale-shaped, often winged at top. Fls. small, white. ☉, ♀; 80 spec., both worlds. **L. sativum**, GARDEN CRESS, ☉, Eur. **L. ruderále**. Pet. 0. ☉. Eur.; wild in U. S. **L. virginicum**, PEPPERGRASS. Sta. usually 2. ☉, 1°-2° high, U. S. 2. **Capsélla**. Fls. white. Silicle heart-shaped; valves boat-like. 6 spec., ☉, Old World. **C. Bursa-pastóris**, SHEPHERD'S PURSE (so called from the silicle's likeness to an old form of purse); branching, 1° high. Silicle, Fig. 200, C. Eur.; but it has emigrated with its fellow-countrymen to all parts of the world. The remaining Tribes have the silicle or silique dehisce.; valves plane or concave, parallel to plane of replum.

Tribe 6. Cotylédons incumbent, conduplicate. 12 gen., 120 spec., both worlds. 1. **Sinápis**. ☉ ☽. Silique linear or oblong, beaked; sds. yield a fine oil. Fls. yellow. Cosmopolitan. **S. arvensis**, CHARLOCK; silique knotty. Eur.; wild in U. S. **S. álba**, MUSTARD; sds. pale; **S. nigra**, BLACK M.; sds. black. Eur. Near to, and by Benham and Hooker included in 2. **Brássica**. ☉, ☽. Fls. silique and sds. of **S. B. campéstris**, sds. yield Colza oil. Old World; original of all the varieties of Turnip. **B. olerácea**, WILD CABBAGE. Sea-cliffs, Eur.; original of all the varieties of cultivated Cabbage, Cauliflower, Bróccoli, Brussels-sprouts, Kale, Kohl-rabi. Emb., Fig. 191, C. **Tribe 7.** Cotylédons incumbent. Sds. 2-seriate. 13 gen., 44 spec., both worlds. 1. **Camélina**, monotypic. Silicle pear-shaped, large, ∞-seeded. **C. sativa**, GOLD-OF-PLEASURE, ☉, 2° high; fls. yellow, racemed. Sts. yield a flax-like fibre; sds. a good oil. Eur., W. Asia; introduced in U. S. 2. **Subulària aquática**, AWLWORT, monotypic. Silicle globular, or ovoid; fls. small, white; lvs. subulate. Stemless aquatic; sds. ripened under water. Shallow water, arctic and cold regions, Asia, Eur., N. E. Am. 3. **Tetrapóma barbaráfolia**, monotypic. Silicle 4-valved; placentas 4; sds. 4-seriate; replums incomplete; fls. yellow. ☽. Siberia; introduced, U. S. **Tribe 8.**

Silique long, narrow, often 4-6-sided. Sds. often 1-seriate. Cotylédons incumbent. 14 gen., 195 spec. 1. *Erysimum*. Fls. yellow or white. ☉, ②, ㊦. 100 spec., Asia, Eur., N. Am. *E. cheiranthoides*, TREACLE-MUSTARD; fls. yellow; Eur. Fig. 162. *E. arkansanum*, ②, ㊦, fls. large, yellow, showy. Ohio to Ill., S. 2. *Sisymbrium*. Fls. yellow, white. ☉, ②, ㊦. 80 spec., both worlds; weeds, except *S. Alliaria*, SAUCE-ALONE, used as salad; fls. white, Eur; and *S. Millefolium*, ev. shrub, 18' high, fls. yellow, Canaries. 3. *Malcolmia*. ☉, ②, fls. pink-purple, white. 20 spec., S. Eur. 4. *Hesperis*, ROCKET, ☉, ②, ㊦, fls. purple, lilac, white, yellow. 20 spec., Eur., Asia.

Tribe 9. Silicle (rarely silique) large; sds. 2-seriate. Cotylédons accumbent. 18 gen., 340 spec., both worlds. 1. *Cochlearia*. Silicle round, replum broad; fls. white. ㊦; 25 spec., Old World. *C. Armoracia*, HORSE RADISH; rhiz. pungent; stem tall, infl. profuse. Eur. *C. officinale*, SCURVY GRASS. Silicle ribbed; lvs. cordate. Low, small, used as salad. Eur. 2. *Draba*. Silicle flat, oval, oblong, or linear, often twisted; fls. white or yellow. 80 spec., both worlds. 3. *Erophila*. 5 spec., Eur., Asia. *E. verna*, WHITLOW GRASS. ☉ ②, fls. white; lvs. rad.; scapes 1'-3' high, fls. racemed; silicle oval. Fig. 200, B. Eur. 4. *Alýssum*. Silicle oval, flat, 2-4-seeded. Fls. yellow, white. 90 spec., Old World. *A. maritimum*, SWEET A. Fls. white, honey-scented. Eur. *A. saxatile*, ev. shrub, 1° high; fls. yellow. Hairs, Fig. 106, 6. Candia. 5. *Vesicaria*. Silicle orbicular, usually inflated. Fls. yellow. 20 spec., both worlds. *V. Shortii*, low herb, Mid. Ky. *V. Lescurii*, similar, but silicle flat, Mid. Tenn. *V. gracilis*, Tex. *V. cretica*, ev., Crete. 6. *Lunaria*. Silicle large, round, flat; replum persistent, satiny, showy. Fls. purple, white, large. 2 spec., S. Eur.; *L. biennis*, ②, 4° high; *L. rediviva*, ㊦, 3° high.

Tribe 10. Silique narrow, usually long; sds. often 1-seriate. Cotylédons accumbent. 23 gen., 335 spec., both worlds. 1. *Anastatica Hierochuntica*, ROSE OF JERICHO, MARY'S FLOWER; monotypic. ☉, low, branching; fls. small, white, spicate. Silicle short, with 2 ear-like projections at top, 2-seeded. Plant hygroscopic; after fruiting, the branches curl inward, forming a dry ball enclosing the silicles. Easily loosened from the sands in which it grows, the plant is blown hither and thither, often into the sea. When moistened, the branches unfurl, the silicles open, and the sds. fall, or often sprout on the old plant. Deserts, Syria, Algeria. 2. *Dentaria* (*Cardamine*). Silique broad, stalk flattened; fls. showy, purple, white, yellow; rts. dentate; ㊦, 1°-2° high. 10 spec., Eur., N. Am. *D. laciniata*, lvs. lacinate, N. Eng. to Ky., S. to Gulf. 3. *Cardamine*. Silique linear, flattened; fls. white, purple. ㊦, ②, ☉, 12'-18' high; lvs. often pinnate. 50 spec., chiefly Eur. *C. rhomboidea*, U. S. *C. pratensis*, CUCKOO-FLOWER, LADY'S SMOCK, Eur. 4. *Arabis*, WALL CRESS; near 3, but lvs. seldom divided; fls. usually white. 130 spec., both worlds. 5. *Barbarea*, WINTER CRESS; silique linear, often 4-sided; fls. yellow. 6 spec., Eur. 6. *Nasturtium*, CRESS; silique linear, or silicle globular; fls. yellow or white. Lvs. pinnate or pinnatifid. ☉ ②, ㊦, usually low, spreading. Aquatic or marsh plants. 20 spec., both worlds. *N. officinale*, WATER C.; creeping; fls. white. Eur. *N. palustre*, erect, 1°-3° high, fls. yellow, U. S. 7. *Cheiranthus*, WALL-FLOWER. ㊦ or ev. shrubs; fls. yellow, crimson, brown-yellow, white, showy. Medit. States, Canaries. 12 spec. *C. Cheiri*, S. Eur.

Emb., Fig. 191, B; ov., Fig. 181, D; silique, Fig. 200, A. **8. Matthiola**, STOCK, GÍROFLEE, GILLYFLOWER. Similar to 7 (which is called by same names), but sds. winged. 30 spec., Medit. States, Gt. Brit.

Ord. 152. Fumariaceæ.—Fls. ♀, rarely sol. Sep. 2, scale-like. Pet. 4, arranged cross-wise, free or connate; 2 outer larger, usually equal, often spurred or saccate at base; 2 inner smaller, rarely spurred at base; coherent by their tips and enclosing the stamens and pistil. Sta. 6, diadelphous in equal sets; anth. of inner sta. 1-celled, of 2 outer sta. 2-celled; sta. rarely 4, free. Boll siliqueose, 2-valved or lomentaceous; or vesicular; or an akaine. Sds. sometimes strophiolate. Lvs. much dissected or decomposed; alt., exstip. *Herbs*, often from bulbs or tubers; rarely *Shrubs*; stem brittle, rarely sarmentose; juice watery. Lovely Order. 7 gen., 142 spec. N. hemisphere; few at Cape G. H. **1. Fumária**, FUMITORY. 1 pet. swollen or spurred. Boll globular, 1-seeded, indehisc. Fls. small, tubular, clustered or spicate, pink, white. Weak climbers. Old World. 40 spec. **F. officinális**, ☉ low; fls. pink. Eur. Wild in U. S. **2. Corýdalis**. Near 1, but boll siliqueose; fls. of various colors, racemed. 70 spec.; both worlds, ☉ ②, ④, 6°–8° high, climbing, straggling. **C. aúrea**, ②, low, fls. yellow; Can. to Gulf. **C. glaucá**, ②, 4° high, fls. variegated. Can. to N. C. **C. claviculáta**, fls. white-yellow, ☉, 8° high; Gt. Brit. **3. Ceratocápnos (Corýdalis, B. and H.)**. All the pet. spurred. Beaked akaine, or lanceolate boll. Scrambling, shrubby. Syria, Algeria. **4. Dicéntra**. 2 pet. spurred or gibbous. Fls. racemed. Boll siliqueose. ④, usually stemless. Sev. spec., both worlds. **D. cucullária**, DUTCHMAN'S BREECHES. 2 pet. long-spurred. Lvs. from scaly bulb; scape 6'–10' high, fls. white. Can. to N. C., Tenn. **D. canadénsis**, SQUIRREL-CORN; stemless; tubers small, yellow; 2 pet. short-spurred; fls. purple, fragrant, small. Scape 6'–8' high. Can. to Ky. **D. exímia**, 2 pet. gibbous; fls. rose; scape 8'–12' high. N. Y. to N. C. **D. spectábilis**, BLEEDING HEART; fls. deep rose, large; ④, stem leafy, 3° high. N. China. **5. Adlúmia círrhósa**, ALLEGHENY FRINGE; only spec. Pet. connate into a cordate calyptra enclosing the stamens and ova. Fls. small, pale lilac, in large drooping panicles. Boll siliqueose. Lvs. decomposed, fringe-like. ②, climbing 8°–15° by the stalks of the lfts.

Ord. 153. Papaveráceæ.—Fls. ♀, reg., sol., cymose or paniced, often nodding. Pet. fugacious; usually 4, arranged cross-wise; rarely 3–6–8–12; rarely 0. Sep. caducous; 2, rarely 3; free, rarely connate. Sta. free, usually ∞, rarely 4–6. Carpels usually connate into a 1-celled ova.; placentas 2 or more, parietal. Sty. usually short or 0. Stig. = placentas; persistent; free or connate. Boll, often siliqueose; carpels rarely distinct. Sds. usually ∞; often strophiolate. Lvs. alt, simple, variously cut or lobed *Herbs*, rarely *Shrubs*; juice milky or watery, narcotic or acrid; colored. 17 gen., 50 spec., both worlds, chiefly Eur. 3 Tribes:

Tribe 1. 3 gen., 6 spec., Am. **1. Eschschóltzia** (pronounced *Eschóltzia*; see Lesson XXXV.). Pet. 4; sep. connate into a pointed calyptra; torus top-shaped. Sty. 0; stig. 4–6, unequal; placentas 2. ☉, bushy, branching; juice colorless; lvs. glaucous; fls. large, yellow or white. Boll long, slender. 4 spec., Cal. **2. Dendrómecon rígídum**, TREE POPPY, monotypic. Pet. 4; sep. 2; sty. 0; stig. 2.

Boll long. Fls. yellow. Low ev. shrub; lvs. glaucous. Santa Cruz Island, off Cal. coast. 3. *Hunnemánia fumaricefólia*, monotypic. Pet. 4; sep. 2; sty. 0; stig. 4. Fl. yellow. Boll 10-ribbed. ④, 2°-3° high. Mex. Tribe 2. 11 gen., 47 spec., both worlds. 1. *Chelidónium május*, CÉLANDINE (miscalled Greater C.; see Ficária); monotypic. Sep. 2; pet. 4; sty. nearly 0; stig. 2-lobed. Boll linear. Juice orange, poisonous. Fls. small, umbelled. Lvs. glaucous. ①, ②, ④; 1°-4° high. Eur.; introduced U. S. Ova., Fig. 181, ①; vessels, Fig. 221. 2. *Glaucium*, HORNED POPPY. Pet. 4; sep. 2; sty. 0; stig. 2-lobed. Boll 6'-10' long, curved. Lvs. glaucous. Fls. yellow, red, purple. 5 species, ① ②, 1°-2° high. S. Eur., Asia. G. *buteum (flávum)*, fls. yellow, ②, 2°. Eur.; introduced U. S. 3. *Boccònia*. Pet. 0; sep. 2, colored; sty. 0; stig. 2-lobed. Fls. small, in large, showy panicles. Boll few-seeded. Juice red. Foliage elegant. 3 spec. *B. cordàta*, ④, stem 5°-8° high; fls. pink or cream-white. China. *B. frutescens*, ev. shrub, 6° high; fls. pale yellow. W. Ind. *B. integrifólia*, ev. shrub, 4° high; fls. white. Mex. 4. *Sanguinària canadénsis*, BLOOD-ROOT, PUCCOON; monotypic. Pet. 8-12; sty. short; stig. 2-lobed. Boll oblong. Juice red. ④; rhiz. prostrate; lf. and large white fl. sol. U. S. 5. *Stylóphorum*. Pet. 4; sep. 2, hairy; sty. columnar; stig. 2-4-lobed. Boll bristly, 2-4-valved, dehisc. to base. ④, low; st. naked, few-1-leaved and few-1-flowered at top. 4 spec., 2 Am., 2 Asia. *S. diphýllum*, fls. large, yellow. Penn., W. 6. *Argemòne*, PRICKLY POPPY. Pet. 4-8; sep. 2-3, bristly; sty. nearly 0; stig. 3-6. Boll oblong, prickly, 3-6-valved, dehisc. at top. Lvs. often spotted with white. ① ②, prickly; juice yellow. 6 spec., Am. *A. mexicàna*, fls. yellow, rarely white. Trop. Am. Common. 7. *Papàver*, POPPY. Pet. 4-6; sep. 2-3; stig. 4-20, connate, radiate, sessile on a disk formed by the styles on the top of the ova. Boll short, dehisc. apical by 4-20 pores or chinks beneath the persistent stig. Herbs; juice milky, fls. sol., showy. ①, ④. Many spec. and varieties; Old World. *P. somniferum*, OPIUM P., ①, fl. white or purple; boll yields *Opium*; *P. Rhòeas*, CORN P., ①, fl. bright crimson; Eur. Boll, Fig. 197, E. Tribe 3. Sep. 3; pet. 6. 3 gen., 5 spec., Pacif. States, N. Am. 1. *Romnèya*, monotypic. ④; fls. large, white. Cal. 2. *Platystigma (Meconèlla)*. Sta. few. Boll 3-4-celled. ①. Dwarf, fls. small, yellow. 3 spec., N. W. Am. 3. *Platystèmon califórnicus*, monotypic. ①, spreading, hairy; fls. white or yellow. Cal. Var. smooth (*P. ochroleucus, leiocarpus*), Siberia.

Ord. 154. *Sarraceniaceæ*.—Fls. ♂, reg., large, nodding. Pet. 5, rarely 0. Sep. 4-5, persistent. Sta. ∞, distinct. Sty. term., short, dilated or lobed or divided at top. Ova. 3-5-celled, ∞-seeded. Boll 3-5-celled, 3-5-valved, ∞-seeded; sds. small. Lf. with petiole transformed to a pitcher with a longitudinal wing; the small blade making its lid; insectivorous. Stemless ④ *Herbs*; lvs. radical, rosulate; scape naked or with few bracts; fls. sol. or racemed. Bogs, N. and S. Am. 3 gen., 8 spec. 1. *Heliámphora nitans*, only spec. Pet. 0. Sep. 4-5, petaloid; pink or white, racemed. Boll 3-valved; stig. slightly 3-lobed. Pitchers rather short, stout; mouth open, tipped with the small lid. Mts., Guiana, Venezuela. 2. *Darlingtonia califórnicà*, only spec. Pet. 5, pale purple. Sep. 5, larger, straw-color. Stig. 5-lobed; boll 5-valved. Pitchers 12'-18' long, slender, twisted;

top vaulted, and saccate above the contracted mouth; lid 2-eared. Scape 2° - 4° high; fl. sol. Mts., Cal. 3. *Sarracenia*. Pet. 5, incurved. Sep. 5. Sty. dilated at top into a 5-rayed parasol, each ray ending in a minute stigma. Fl. sol. Boll 5-valved. 6 spec., N. Am. A. Lf. trumpet-shaped, erect. a. Fl. yellow. *S. variolaris*, SPOTTED TRUMPET-LEAF. Lf. 6'-18' high; wing broad, spotted; lid concave. Scape shorter; fl. 2' wide. N. C. to Fla., W. *S. flava*, YELLOW T. Lf. large, 2° - 3° high; wing narrow, lid erect, yellow. Scape 2° high; fl. 4'-5' wide. Same habitat as first. b. Fl. purple. *S. Drummondii*. Lf. 2° - 3° high; wing narrow; summit and erect lid white, variegated. Scape longer than lvs.; fl. 3' wide. *S. rubra*, RED T. Lf. 10'-18' high; wing narrow, lid erect; fl. red-purple. Ga. to Miss. B. Lf. pitcher-shaped, ascending; fl. purple: *S. psittacina*, PARROT PITCHER. Lf. 2'-4' long, slender; wing broad, variegated; lid beaked. Scape 1° high. Fla. to La. *S. purpurea*, SIDE-SADDLE, HUNTSMAN'S CUP. Lf. 4'-6' long, inflated; wing broad; mouth contracted; lid large, erect. Scape 1° high. Fig. 114. Can. to Gulf.

Crowfoot Alliance.—Æst. usually imb. Sta. ∞ , very rarely definite. Carpels free or immersed in the torus, very rarely connate. Micropyle usually inferior. Emb. usually minute in fleshy perisperm; rarely large, perisperm 0 (*Nelumbium*, *Calycanthaceæ*). 2 Sections: 1. *Sepals or petals 2-3-sev.-seriate; sometimes 0: 155. Nymphæaceæ. 156. Lardizabalaceæ. 157. Berberidaceæ. 158. Menispermaceæ. 159. Anonaceæ. 160. Myristicaceæ. 161. Monimiaceæ. 162. Magnoliaceæ. 163. Calycanthaceæ. 2. Sepals usually 5, or fewer. Petals 2-seriate: 164. Dilleniaceæ. 165. Ranunculaceæ.*

Ord. 155. Nymphæaceæ.—Fls. $\frac{3}{4}$, reg., large; peduncle long, 1-flowered. Pet. usually many or ∞ ; distinct, rarely connate at base. Sta. ∞ , rarely 6. Carpels ∞ or few, distinct or coherent when ripe. Sds. with perisperm and vitellus; or both 0. Lvs. simple, alt. or opp.; petiole long, blade usually large. Aquatic *Herbs*; rhiz. subterranean, fleshy, often tuberous; acaulescent, except in *Cabombaceæ*. Petioles and peduncles with many air-tubes. Both worlds. 8 gen., about 65 spec. 3 Sub-Orders:

Sub-Ord. 1. Nelumbiaceæ. LOTUS FLOWERS.—*Acaulescent*. Lvs. and fls. emerged. Sep. 4 or more, petaloid; pet. and sta. ∞ ; all hypog. at base of torus. Sta. with connective produced. Ova. between 10 and 20; 1-seeded, distinct, distant, sunk in pits on the top of the large obconic torus. Sty. short; stig. peltate, hollowed, like the lvs. Nuts acorn-like. Emb. large, plumule foliaceous. Perisperm and vitellus 0. Fr. the large torus with its sunken nuts. Rhiz. and sds. edible. Lvs. orbicular, large, centrally peltate, hollowed into bowls as they grow and emerge; blade velvety within; stomata only at centre, and set like a jewel; veins large, radiate. One gen., 2 spec.: *Nelumbium luteum*, YELLOW LOTUS, YONQUAPÈNE (*Yonkapane*, *Yonkapin*; the common S. and aboriginal name). Fls. yellow, 8'-11' wide. Connective hooked, linear. Lvs. 1° - 2° wide. Lakes, pools, N. C., Tenn., S. to Fla. and Tex. Isolated: below Philadelphia; near Lyme, Conn.; Sodus Bay, N. Y.; Miss. River, Wis. *N. speciosum*, SACRED LOTUS. Connective clavate; fls. usually deep rose-colored; large, but smaller than in *N. luteum*. Caspian Sea; Persia; India; China; Japan; Malaysia; Australia. No longer in

Egypt, but abundant there 2500 years ago and sacred to Isis; one of the two great types (Papyrus the other) of ancient Egyptian architecture and ornament. Whole plant still sacred in Ind.; the spiral fibres of the petioles are used as wick for the sacred lamps. See Lesson XII., Fig. 79. Sev. var. with white and blue fls. Introduced in private and public gardens, Eur., U. S.; fine specimens in Union Square, New York.

Sub-Ord. 2. Nymphæacæ. WATER-LILIES.—*Acaulescent.* Lvs. and fls. floating, rarely emerged. Carpels 8-30, whorled, coherent, enveloped by the torus; stigmas connate, radiate, as in Papaver. Fr. a large berry, ∞ -seeded; rind hard, bursting irregularly; rarely separating into distinct carpels. 5 gen., 30 spec. 1. *Victoria régia* (monotypic), MAIS DEL ÁGUA, WATER-MAIZE. Lvs. and fls. floating. Sep. 4, purple without; pet. ∞ (several hundred), passing into the ∞ sta.; and all epigynous. Fl. 12'-18' wide; outer pet. white, inner rose. Berry large, spiny. Sds. edible. Petiole spiny; blade 6°-12° wide, with boss-like eminences; orbicular; apparently centrally peltate, but slit at base to petiole; deep purple beneath; margin upturned as a rim. Slow waters, S. Am. 2. *Euryale ferox*, monotypic. Close to *Victoria*, but more spiny; fl. much smaller, purple; pet. 20-30; lf.-blade 1°-4° wide, rim 0. E. Ind. Sds. arillate, edible. 3. *Nymphaea*. Sep. 4, hypog., green without. Pet. ∞ , ∞ -seriate, passing into the ∞ epigynous sta. Berry ripened under water. Sds. arillate. 20 spec., still or slow waters, both worlds. N. *odorata*, lvs and fls. floating. Lvs. orbic., cordate-cleft to petiole at base, 9' wide. Fl. white, fragrant, 5' wide, opening only at morning. Common, U. S. Var. with pink and red fls. N. *alba*, similar, fls. large, white, sleeping under water at night. Eur., Asia. N. *tuberosa*, rhiz. with self-detaching tubers. Fls. white, 5'-9' wide; lf. 10'-15' wide. Great Lakes; W. and S. N. *Lötus*, lvs. and fls. emerged. Fl. white, large; sleeping under water at night. Lvs. serrate. Egypt. Var. in Guinea; Asia. N. *cærúlea*, fls. blue, large; Egypt, Ind.; sev. var. N. *blánda*, night-blooming, S. Am., W. Ind. N. *gigantæa*, fl. very large, blue, Moreton Bay, Australia. 4. *Barclaya*. Sep. 5, distinct, hypog. Pet. 5, epig., connate into a tube at base; sta. ∞ , epipet. Fl. red. Berry bristly. 2 spec., E. Ind. 5. *Núphar*, YELLOW WATER-LILY. Sep. 5-6 or more, large, yellow; pet. 10-18, minute, stamen-like or 0; sta. short, ∞ ; all hypog. Ova. on top of torus. Berry ripening under water. Lvs. large, cordate or sagittate, floating or emerged. 3-4 spec., Am., Eur., Asia. N. *lútea*, BRANDY-BOTTLES. Sep. 5; fls. yellow, brandy-scented. 2' wide. Eur., Asia; nat. below Phila. N. *ádvena*, BONNETS, SPATTERDOCK. Sepals 6. Fls. large, globular, yellow. Sd., Fig. 7, E. Can. to Gulf. N. *sagittæfolia*, fl. smaller; pet. 0. N. C., Tenn. to Gulf. N. *polysèpatum*, fls. very large, yellow; W. U. S.

Sub-Ord. 3. Cabombacæ. WATER-SHIELDS.—*Caulescent.* Stems slender, leafy, floating. Lvs. elliptic, centrally peltate. Lvs. and fls. floating. Ova. free, whorled, stigmatiferous at top (Cabomba) or throughout their length (*Hydropeltis*). Ripe carpels indehise. 2 gen., 3 spec. 1. *Hydropeltis purpurea* (*Brasènia peltata*), monotypic. Sep. 3-4. Pet. 3-4. Sta. 12-18; fls. small, purple. Ova. 4-18, 2-ovuled. Ripe carpels 2-1-seeded. Lvs. 2'-3' wide. Stem coated with mucilage. Ova., Fig. 179, G. Ponds, slow streams, Can. to

Gulf; Puget Sound; Japan; E. Ind.; Australia. 2. *Cabomba*. Sep. 3. Pet. 3. Sta. 6. Ova. 2-4. Ripe carpels 1-3-seeded. Submerged lvs. opp., dissected; floating lvs. alt., entire. Fls. small, in axils of floating lvs. 2 or 3 spec., Am. *C. caroliniana*, fls. white, pet. yellow at base. Lvs. small. Ponds, still waters, N. C., Tenn., S. to Gulf.

Ord. 156. *Lardizabalaceæ*.—Fls. ♂, ♂ ♀, or ♂ ♂ ♀, in sol. or fascicled racemes, 6-merous; pet. sometimes 0; brown, purple, or green. Ova. 3, or 6-9; distinct, sessile, 1-celled. Ov. ∞, rarely few. Ripe carpels baccate, indehisc. or rarely dehisc.; often edible; sds. buried in the pulp. Lvs. alt., compound, exstip. Ev. twining or rarely erect *Shrubs*. 7 gen., 13 spec., both worlds. 1. *Stauntonia*. ♂ ♀. Pet. 0. 2 spec., *S. sinensis*, China; *S. hexaphylla*, Japan. 2. *Decaisnea insignis*, monotypic; ♂ ♂ ♀; pet. 0; follicles filled with edible pulp. Erect shrub. Himalayas. 3. *Parvattia Brunoniæna*, monotypic; ♂ ♀; pet. 6. High-climbing. Khasia Mts. 4. *Holboëllia*. ♂; pet. 6, minute. Scandent. 2 spec. Ind. *H. latifolia*, berries edible. 5. *Akébia*. ♂. High-climbing; fls. fragrant. 4 spec., Japan, China. 6. *Bòquila trifoliata*, BÒQUIL-BLANCO; monotypic. ♂ ♀. Small, trailing; fls. white, sol. or two or four, axil.; berries edible. Chili. 7. *Lardizàbala*. ♂ ♀; ♂ racemed, ♀ sol. High-climbing, ornamental; berries edible. 2 spec., Chili. *L. biter-nata*, best known.

Ord. 157. *Berberidaceæ*.—Fls. ♂; reg., rarely achlamýd. Infl. various. Sep. 3-4-9, distinct. Pet. = or double the sep. Sta. = or double the pet. Stig. peltate or 2-lobed; rarely unilateral. Carpel sol. (3 in *Berberidopsis*), 1-celled, ∞-ovuled. Berry or boll. Lvs. compound, or 1-foliolate or palmilobed. *Herbs* or *Shrubs*; juice watery. Both worlds. 12 gen., 123 spec. Types given: 1. *Podophýllum*, MAY-APPLE. Pet. 6-9. Berry fleshy, large. Lvs. large, pinnate-lobed and peltate. ♀; rhiz. creeping; st. annual, 2-leaved; fl. large, nodding, axil. between the lvs. 2 spec., one in Himalayas; the other, *P. peltatum*, common in U. S. Berry yellow, edible; fl. white. 2. *Jeffersonia*. Sep. 4, large, petaloid; pet. 8, narrow. Lfts. 2, on a long petiole from a ♀ rhiz. Scape with 1 large white fl. Pyxidium, half dehisc. (fls. rarely in 3's or 5's). 2 spec.; 1 in Asia (Mantchuria); the other, *J. diphýllea*, U. S., common. 3. *Diphýllèia cymòsa*, UMBRELLA-LEAF; monotypic; fls. 6-merous, small, cymose; rhiz. ♀; lf. rad., long-petioled, peltate; fl.-stem 2-leaved; cyme term. Berries small, blue. U. S., Japan. 4. *Caulophýllum thalictroides*, COHOSH, PAPPOOSE ROOT; monotypic. Fls. 6-merous. Stig. unilateral. Ova. thin, early burst by the two growing sds., and perishing. Sds. fleshy, blue, drupe-like; funiculus stalk-like. Rhiz. ♀; rad. lf. small, 3-ternate; st. ☉, naked, terminated by a large 3-ternate lf. and a panicle of small green fls. Can. to Car., Tenn. 5. *Leóntice*. Sep. 6, petaloid; pet. 6, smaller. Boll bladdery-inflated, indehisc. Fls. small, yellow, racemed. Lvs. variously cut. Rhiz. ♀. 3-4 spec., Eur., Asia. *L. Leontopétalum*, LION'S LEAF, LION'S TURNIP. Lvs. large, long-petioled. Rt. tuberous, saponaceous. S. and E. Eur., Asia. 6. *Nandina domestica*, monotypic. Fls. 6-merous, in term. panicles. Berries red, globose. Lvs. 3-ternate. Ev. shrub, 6° high. China, Japan. 7. *Berberis*, BARBEARY. Sep. 6-9, colored. Pet. 6, bi-glandular at base. Stig. peltate. Fls. yellow, racemed. Berries bright

red, sometimes purple, white. Lvs. 1-foliolate or pinnate, often changed to spines. Shrubs, 6'-15° high; ev. or decid. 100 spec.; those called *Mahonia* (lvs. pinnate) very showy. Many fine spec., temp. Eur., Asia, Am. **B. vulgâris**, common B.; decid., 8° high. Ova., Fig. 5, 3. Eur. **B. canadensis**, decid., near last, but rac. fewer-flowered; pet. notched. Decid., 1°-3° high. Va., S. and W. Not in Canada. **B. Darwinii**, ev., 6° high, berries purple. Chiloe. **B. dealbata**, ev., 8° high, Mex. **B. ruscifolia**, ev., 5° high, Buenos Ayres. **B. Aquifolium**, lvs. paripinnate, spiny-toothed; berries purple. 6' high in New Mex., Colorado; 2°-6° high in Oregon. **B. Fremontii**, 5°-15° high; lvs. paripinnate, spiny-toothed; berries dark blue. N. Tex., New Mex., Utah. **8. Berberidopsis corallina**, monotypic, anomalous. Ova. with 8 parietal placentas; ov. almost orthot. Fls. long-stalked, crimson, in large pend. racemes; perianth globose; parts 9-15, colored; passing from bracts into sep. and pet. Lvs. 1-foliolate, spiny-toothed. Ev. climbing shrub, very showy. Chili.

Ord. 158. Menispermææ.—♂ ♀ or ♂ ♂ ♀. Fls. small, rarely sol. Sep. 6-4-2-10. Pet. 6-5-4-3, usually distinct; sometimes 0 in ♀ fl. Sta. = petals, rarely ∞; distinct or monadelph. Carpels usually 3, 1-ovuled. Drupe 1-seeded; often showy; sds. curved. Lvs. alt., exstip.; usually palminerved; ent. or palmilobed or peltate; rarely compound. Climbing, handsome, slender *Shrubs* or *Herbs*; bitter, narcotic, often poisonous. Trop., subtrop., both worlds; none in Eur. 31 gen., 300 spec. 4 Tribes Types given: **Tribe 1.** 9 gen., 51 spec., both worlds. **1. Hyperbaena**, ev.; fls. paniced. 3-4 spec., trop. Am., Mex. **Tribe 2.** 4 gen., 24 spec., both worlds. **1. Cissampelos**, ♂ ♀, ev.; 18 spec., both worlds; fls. paniced; drupes often scarlet. **C. Parèira**, VELVET-LEAF. Lvs. velvety; drupes scarlet, hairy; rt. the *Parèira brava* of pharmacy. W. Ind., Cent. Am., E. Ind. **2. Stephania**, ♂ ♀. Fls. umbelled or paniced. Lvs. usually peltate. 3 or 4 spec., ev.; trop. Asia, E. Ind., Af., Australia. **Tribe 3.** 8 gen., 26 spec., both worlds. **1. Menispermum**, MOON-SEED. ♂ ♀. Sep. 4-8. Pet. 6-8, small. Fls. white, paniced. Drupes small, black, compressed. Lvs. cordate, ent., or palmatilobed or angled. 2 spec.; 1 in Asia; the other, *M. canadense*, decid., 8°-12° high. Can. to Car., W. to the Miss. **2. Coccus**. ♂ ♀, ♂ ♂ ♀. Fls. 6-merous, small, white, racemed; ♂ racemes compound. Shrubs, usually ev., usually climbing, showy. 10 spec., Asia, Af., Am. **C. carolinus**, decid., twining, 10°-15°. Drupes red. Lvs. cordate or 3-angled. S. Ill. to Fla. and W. **Tribe 4.** 10 gen., 20 spec., both worlds. **1. Jateorhiza**. Near *Coccus*. Ev. climbers. **J. palmata**, lvs. large, deeply palmatilobed; rt. tuberos, the *Columbo* of pharmacy. 10° high, Mozambique; not from Columbo, as once supposed. **2. Anamirta Coccus**, monotypic; fls. in pend. panicles. Ev., climbing 20°. Sds. poisonous, used to adulterate porter. E. Ind.

Ord. 159. Anonææ.—Æst. valv. or imb. Fls. ♂, rarely dichinous; purple, brown, or yellow, sol. or fascicled. Sep. usually 3, rarely 2; distinct or connate. Pet. 6, 2-seriate, 3 outer larger; rarely 4 or 3; rarely connate; fls. usually sol. Sta. ∞, many-seriate on a thick torus; anth usually hidden by the overlapping top of the connective; rarely def., exposed. Fls. often fragrant. Carpels ∞, rarely def. or sol.; distinct, rarely coherent; sessile on top of torus. Style

short or 0. Stig. thick, various. Ov. 1-2- ∞ . Ripe carpels sessile or stipitate, distinct or united into a ∞ -celled fr. (*Anòna*), or 1-celled fr. (*Monodòra*); fr. various. Perisperm ruminant, copious. Lvs. alt., distichous, simple, entire, penninerved, exstip. *Trees, Shrubs*, sometimes climbing; generally ev. and aromatic, with bitter, peppery, or acrid juice. Chiefly trop., both worlds. About 40 gen., 400 spec. 5 Tribes: **Tribe 1.** 7 gen., 42 spec., both worlds. 1. *Bocàgea*. Fr. of 1-3 carpels, baccate, 3-seeded; sds. arillate. Ev. trees, shrubs, 7 or 8 spec., Brazil. **Tribe 2.** 5 gen., 120 spec., both worlds. 1. *Xylòpia*, BITTERWOOD. Carpels 2-15, baccate, 1-2-seeded; on a globular torus. Berries spicy or peppery, used as condiments. Wood intensely bitter. 30 spec., W. Ind., S. Am., W. Af., Malaysia; most numerous in Am. 2. *Anòna*, CUSTARD APPLE. Carpels ∞ , fused into a ∞ -celled fleshy fr. Ev. shrubs, trees, aromatic, spicy. 50 spec., trop. Am., Asia, Af. *A. reticulàta*, BULLOCK'S HEART; *A. muricàta*, SOUR SOP, Fig. 80; W. Ind.; *A. squamòsa*, SWEET SOP, Malaysia; *A. Cherimòlia*, CHERIMÓYER, Peru. All small ev. trees, with fine fr. **Tribe 3.** 9 gen., 42 spec., both worlds. 1. *Mitrèphora*, ev. trees, often tall. Trop. Asia, E. Ind. 2. *Monodòra*. Fl. large, sol., fragrant; fr. large, melon-like, pulpy. 3 spec., ev. shrubs, trees. W. and E. Ind., trop. Af. *M. Myristica*, CALABASH NUTMEG. Sds. used as nutmegs. Tree 30° high in Jamaica; probably brought by negroes from W. Af., where it is 50°-60° high. **Tribe 4.** 11 gen., 60 spec., both worlds. 1. *Astimina* (*Anòna*, Linnæus), N. AM. CUSTARD APPLE, miscalled Papaw. Pet. 6. Carpels 2-15, 1-celled, few-sev.-ovuled, fleshy in fr. Sds. arillate. Shrubs, small trees; 7 or 8 spec.; U. S., Mex., Cent. Am., Cuba; ev. in trop., decid. in U. S. *A. (Anòna) triloba*, fls. brown-purple; fr. large, yellow, banana-form, few-seeded, edible. 15°-30° high, N. Y. to Ill., S. to Gulf. Sd., Fig. 193, B. *A. parviflòra*, fl. and fr. smaller. 2°-5° high. N. C. to Fla., W. *A. grandiflòra*, *A. pygmaea*, fls. yellow, fr. small; low shrubs, Fla., Ga. 2. *Unòna*. Pet. 6-3. Carpels long, distinct, sev.-seeded, lomentaceous. Ev. shrubs, sometimes climbing. 18 spec.; 12 trop. Af.; 6 trop. Asia. **Tribe 5.** 8 gen., 104 spec., both worlds. 1. *Uvária*. Carpels ∞ , distinct, cylindric, sometimes grape-like. Fls. often very fragrant, fr. edible. Ev. climbers. 35 spec., W. Af. to Philippines. 2. *Guatèria*. Carpels distinct. Ev., handsome trees, shrubs; 50 spec., trop. Am., Asia. *G. virgàta*, LANCEWOOD, wood light, used by coach-builders. Jamaica.

Ord. 160. Myristicææ.—Est. valv. Fls. apert., ♂ ♀; in racemes, hds. glomerules, panicles; small, white or yellow. Sep. 3-2-4-fid; fila. monadelph. into a compact column, cylindric or turbinate, or dilated into a disk. ♀: Carpel sol. (rarely 2, one sterile), free, 1-celled, 1-ovuled. Boll fleshy, 2-valved. Sd. with lacinate fleshy aril. Perisperm ruminant, copious. Ev. lofty *Trees, Shrubs*, aromatic; juice turning red in air. Lvs. alt., nearly distichous, simple, entire, penninerved, coriaceous, exstip. Malaysia, trop. Am., Pacific Islands, Madagascar. Only gen. *Myristica*. Sd. the *Nutmeg*, its aril the *Mace* of commerce. Numerous spec. *M. moschàta* (*fràgrans*), fine tree; fr. peach-like, but dehisc., yields the finest nutmegs. Fig. 196. Malaysia. *M. (Virola) sebifera*, 60° high. Antilles, Guiana. *M. fátua*, *M. Otòba*, *M. bicuibà*, *M. officinàlis*, S. Am. *M. (Pyrrhòsa) tingens*, Amboyna.

Ord. 161. Monimiaceæ.—Æst. imb. Fls. ♂, ♂ ♀, ♂ ♀ ♀, rarely ♀; usually yellow; sol., or in racemes, cymes, panicles. Pet. 0. Perianth a torus-cupule, spreading, or fig-like, or rarely capsular, usually accrescent, on which 4-5-8-∞ sepals are inserted (and imb.). Sta. usually ∞ (rarely few), lining the wall of the cupule in the ♂, its throat only in the ♀. Carpels usually ∞, rarely few; 1-celled, distinct, superficial or sunk in the cupule. Fr. drupe, or akaine, often with plumose persistent style. Fr. often edible. Lvs. simple, opp. or whorled, rarely alt.; often pellucid-punctate, glabrous, silky, cottony, or scaly; exstip. Ev. *Trees, Shrubs*, aromatic. 22 gen., 180 spec., chiefly in S. hemisphere. 2 Tribes. Types only given:

Tribe 1. Ov. erect, rarely pend. *A. Perianth spreading. Akaines.*
1. Laurélia. Fls. ♂ ♀, racemed. 2 spec. *L. sempervirens*, tall tree; sds. called *Plume Nutmegs*. Chili. *L. nova-zelandiæ*, 100°-150° high, 7° in diam., with buttresses 15° thick. New Z. **2. Atherosperma moschata**, monotypic. Fls. ♂ ♀ ♀, sol. Gigantic tree, New Holl. *B. Perianth fig-like. Drupc with nut free.* **3. Siparuna (Citrosma).** Fls. ♂ ♀ ♀-♂ ♀, rarely ♂. Cymes. Shrubs, small trees. 60 spec., S. Am., widely distributed. **Tribe 2.** Ov. pend. *A. Perianth spreading. Drupes.* **1. Boldoa (Peumus) fragrans**, monotypic. Chili. **2. Mollinédia.** Fls. ♂ ♀, ♂. Cymes, racemes, panicles. Trees, shrubs; 30 spec.; 3 or 4 in Australia, rest from Brazil to Mex. *B. Perianth fig-like.* **3. Kibara.** Fls. ♂, rarely ♂ ♀. Cymose. Trees, 10 spec., trop. Asia, Malaysia, Australia. **4. Ambora (Tambourissa).** Fls. ♂, adventitious; racemed or sol. Trees, 14 spec.; and **5. Monimia.** Fls. ♂. Racemed, paniced. Trees, shrubs, 3 spec.; Mauritius, Madagascar, Cape Comorin, Mascarene Islands.

Ord. 162. Magnoliaceæ.—Æst. imb. Fls. ♂, ♂ ♀ ♀-♂ ♀, ♀, usually large, sol., lily-like; rarely racemed, fascicled; rarely achlamýd. Sep. 3, or 6, or 2-4, usually petaloid; free. Pet. 6-∞, at base of the long torus (gonophore); 1-2-∞-seriate. Sta. ∞, sev.-seriate, above the petals, on the gonophore; anth. adnate, extrorse or introrse; dehisc. various. Ova. always 1-celled; ∞ or few; ∞-seriate, occupying the upper part of the gonophore (which thus becomes a gynophore), or whorled at its top; distinct, rarely coherent. Style continuous with ova., stigmatiferous within and near the top. Ov. 2 (rarely more), pend.; or 1, erect. Fr. various. Carpels free or coherent; follicular, or baccate, or samaroid, or woody and pyxidial (breaking transversely) at base. Emb. minute. Lvs. alt., simple, entire, rarely lobed or dentate; coriaceous; exstip.; or stipules membranous, caduc., convolute, often connate into a sheath in veneration. *Trees, Shrubs*, often ev. and aromatic. 11 gen., 72 spec., N. and S. Am., Asia, and Islands, Australia. None in Af. or Eur. 4 Tribes:

Tribe 1. Fls. ♂, sol., small, ax., usually scented. Sep. and pet. 9-12-15, 3-∞-seriate; passing gradually from small outer to larger petaloid inner. ♂: Sta. ∞, or 5-15; fila. short, thick; distinct or united in a globular mass; anth.-cells short, rounded. ♀: Carpels ∞; in a head on the gynophore (Kadsura), or on a cone-like gynophore, which elongates into a spike in fr. (Schizandra). Carpels 2-3-ovuled, becoming berries, indehisc. Lvs. ent. or dentate, often pellucid-punctate; sub-coriaceous; exstip. Climbing shrubs, usually ev.; trop. and E. Asia; one spec. N. Am. 2 gen.: **1. Kadsura**, ev.; fls. white or red; berries distinct, in a hd. 7 spec., trop. Asia, Japan. **2.**

Schizandra (including the Asiatic ev. *Sphærostëma*). Fls. red, yellow, white. Sds. reniform; berries distinct, distant, on the long gynophore. 6 spec., 5 in trop. Asia; 1, *S. coccinea*, decid., high-climbing, fls. crimson, berries red, S. C. to Fla. and La.

Tribe 2. Magnolias. Fls. ♂, usually large, fragrant. Sep. and pet. colored alike. Sep. 3, often petal-like (or 0). Pet. 6-9-12. Carpels imb., many-seriate on the gynophore and with it ripening into a cone-like fruit. Lf.-bud covered by pointed caducous calyptriform sheaths, each sheath formed by 2 connate stipules; each sheath, in succession, covering the entire lf.-bud and releasing only its proper lf., which is conduplicate (reclinate also in *Liriodendron*) and applied to the sheathed lf.-bud above it. 5 gen., handsome trees, aromatic; wood valuable. 1. *Liriodendron Tulipifera*, TULIP TREE. Monotypic. Fls. large, yellow. Sep. 3, reflexed; pet. 6, tulip-like. Anth. extrorse. Samaras 1-2-seeded, in a cone 2'-3' long. Lvs. large, truncate, slightly 4-lobed, decid. Magnificent columnar tree, 100°-150° high, 5°-9° in diam., solvent only near top. Can. to Gulf; finest in States bordering on the Lower Ohio and Miss. Rivers, especially Ky. and Tenn. 2. *Michëlia*. Near *Magnolia* (which see), but follicles several-seeded, loosely arranged in the cone; fls. ax. Lvs. entire, large. Ev. trees, usually lofty; wood very valuable. 12 spec., Ind., Eastern Archipel. *M. Champaca*, CHÁMPAK; fls. large, rich orange, very fragrant; sacred to Vishnu. Ind. 3. *Mangliëtia*. Nearer *Magnolia*, with fls. term., showy; but follicles several-seeded. Lvs. ent., large. Fine ev. trees, very fragrant and valuable. 5 spec., 3 in Asia; 1, *M. insignis*, fls. pink-white, both Asia and Java; and 1, *M. glauca*, fls. yellow, Java.

4. *Magnolia*. Fl. terminal, with a latent lf.-bud beside it, and both sheathed in a common sheath, as the above-described lf. and lf.-bud; but with this difference: the fl. has, besides this common sheath, its own proper sheath, leathery, caducous, spatha-like, dehisce. by 1 suture only, or indehisc. and rupturing irregularly as the fl. unfolds (*M. grandiflora*). The fl.-sheath in the Asiatic species opens normally, and often develops a lf. midway (*M. Campbëlli*, *M. conspicua*). The lf.-bud, still sheathed beside the fl., remains latent until the fr. ripens or until the following spring; then it adjusts itself almost completely on the apex, like a terminal bud, thus lengthening the crooked branch and repeating the story. Follicles fleshy, persist., 2-seeded, dehisce.; cone oblong, usually rose-colored; showy. Sds. with fleshy testa, red or brown; suspended outside the cell by extensile cobwebby funicular threads. Lvs. large, long, ent.; usually crowded, as if whorled around the large fl. at the end of the flowering branches. Splendid trees, rarely shrubs; 14 spec., N. Am., Asia, China, Japan.

A. N. Am. a. Decid. Cones 3'-4'-5' long, usually rose-colored, with scarlet sds. Fls. white, except in 2. spec. *M. Fraseri* (*auriculata*), 40°-45° high; fl. 6' wide, fragrant. Lvs. 8'-12' long. Va., Ky., S. to Fla. *M. macrophylla*, 20°-35° high; fl. 8'-12' wide, fragrant. Lvs. 18'-3° long. Ky., Tenn., S. to Gulf. *M. cordata*, 40°-50° high; fl. 4'-6' wide, yellow. Lvs. long-petioled, 4'-6' long. Ga., Car. *M. umbrella*, 30°-35° high; fl. 7'-8' wide; cone 4'-6' long, very showy. Lvs. 1°-2° long. N. Y. to O., S. to Gulf. *M. acuminata*, CUCUMBER TREE, 60°-80° high; 5° in diam.; fl. 3'-5' wide, bluish or yellowish. Cone 3' long, cucumber-like. Lvs. dark green, 6'-9' long. N. Y.,

W.; and S. to Gulf States. *b. Ev. Fls. white, fragrant. M. glauca*, SWEET BAY; 8°-20° high; fl. 2'-3' wide; pet. 9. Cone 1'-1½' long, red-brown. Lvs. 3'-5' long, dark green. Fig. 133. Mass. to La. *M. grandiflora*, majestic columnar tree, 60°-120° high, 2°-3° in diam., hd. conical; fl. 6'-10' wide, white, fragrant. Sep. 0. Pet. 9, 3-seriate, middle series much larger than the similar inner and outer; blooming in spring and all summer. Cone 3'-4' long, red-brown. Lvs. 8'-12' long, dark green, coriaceous, shining above, often ferruginous beneath. N. C., Tenn., to Gulf. Many fine var. in Eur. gardens. *B. Asiatic. a. Ev. Fls. fragrant: M. fuscata*, fls. brown-purple, small, sweet; *M. anonæfolia*, fls. red; *M. pumila*, fls. white, are shrubs 5°-15° high, China. *M. Kobus*, 20° high, fls. white, Japan. *b. Decid.: M. conspicua*, YU-LAN (Chinese, meaning *Lily Tree*); fls. large, white or rose-tinted, before lvs. in spring. 40°-50° high; China. *M. purpurea*, fls. large, purple, fragrant, 10°-25° high; Japan. *M. Campbelli*, fls. large, crimson, before lvs. in spring. Splendid tree, 150° high. Sikkim.

5. Talauma. Sep. 3. Pet. 6-∞, 2-∞-seriate. Carpels 2-ovuled, fused in a cone, but becoming pyxidial and falling, leaving the prehensile sds. Otherwise like *Magnolia*. Fls. large, fragrant. Handsome ev. trees, shrubs; 14 spec.; 4 trop. Am, rest in trop. Asia, Japan; **T. (Aromadendron) elegans**, Java.

Tribe 3. Fls. ♂, ♂ ♀, ♂ ♂ ♀. Carpels whorled, or 1-seriate, or sol. Lvs. exstip. 2 gen. **1. Illicium**, STAR-ANISE. Fls. ♂. Sep. 3-6. Pet. 9-∞, 3-∞-seriate, yellow or purple, sol. Carpels ∞, 1-seriate, whorled, 1-ovuled, compressed follicular, dehisce., star-like in fr. Ev. anise-scented shrubs or small trees. 5 spec., N. Am., E. Asia. **1. floridanum**, pet. 20-30, fl. purple, 1' wide; 6°-10° high. Fla. to La. **1. parviflorum**, pet. 6-12, fl. smaller, yellow. Shrub. S. Ga., E. Fla. Others in Asia, Japan. **2. Drimys** (including *Tasmannia* of Australia, which has sol. carpel). Fls. ♂, ♂ ♂ ♀, ♂ ♀. Sep. 2-3. Pet. 6-∞, 2-∞-seriate, small, green, yellow, rosy, or white. Carpels baccate, ∞, whorled, or few, or sol.; 1-∞-seeded. Trees, shrubs, aromatic, often with taste of black pepper. 5 spec., 1 S. Am., 2 Australia, 1 New Zealand, 1 Borneo. **D. Winteri**, WINTER'S BARK; tree; Chili to Magellan.

Tribe 4. Achlamyd. Fls. ♂, ♂ ♂ ♀-♂ ♂. Carpels whorled. 2 gen. **1. Trochodendron aralioides**, monotypic. Fls. ♂. Sta. ∞. Ova. 5-8, sev.-ovuled. Lvs. whorled, persistent 3 years. Carpels baccate, connate. Ev. tree, Japan. **2. Euptelea**. ♂ ♂ ♀-♂ ♀, fls. before lvs. Carpels free. 2 spec., decid. trees; fls. appearing before lvs. 1 Japan, 1 Assam.

Ord. 163. Calycanthaceæ.—Fls. ♂, reg., sol., term., or ax., appearing with or before the lvs. in spring. Pet. 0. Sep. ∞, distinct, ∞-seriate, imb. on an urceolate torus-cupule; alike (*Calycanthus*), or outer bract-like, inner petaloid (*Chimonanthus*). Sta. ∞, 4-merous (*Calycanthus*), or 10, 5-merous (*Chimonanthus*); on a fleshy ring lining the cupule-throat; outer fertile, inner sterile; distinct or coherent at base; fila. short, anth. extrorse. Carpels ∞, 1-2-ovuled. Sty. and stig. term. Fr. fig.-like, of ∞ akaines included in the accrescent torus-cupule. Perisperm 0. Emb. with foliaceous convolute cotyl. Lvs. simple, ent., petiolate, exstip. Decid. Shrubs, usually aromatic. 2 gen., 5 spec. **1. Calycanthus**. Fls. usually term. on leafy branches;

blooming all spring and summer. *C. flóridus*, SWEET SHRUB, CAROLINA ALLSPICE. Pubescent. 5°-8° high; fls. brown-purple, 1'-1½' wide, strawberry-scented. Fr. 2' long. Lvs. oblong or ovate, 2'-3' long. Fig. 176. Banks of streams, Va. to Miss. River, S. to Gulf. *C. lævigátus*, similar, but smoother; fl. 2' wide, scentless. Same habitat; reaching to Penn. *C. glaucus*, similar, but smooth; fl. 2' wide; lvs. 4'-7' long. Mts., Tenn., N. C., Ga. (Two last perhaps var. of first.) *C. occidentális*, similar to last, but lvs. cordate; fls. brick-red, 3' wide, scentless. Cal. 2. *Chimonánthus frágrans*, JAPAN ALLSPICE; monotypic. Sta. 10; 5 fertile. Petaloid sepals waxy, pale yellow; in one var. the inner chocolate-colored, in another mottled with red. Lvs. rough; branches long, half scandent. Fls. 1' wide, very sweet-scented; sessile in the ax. of fallen lvs., and appearing in winter, long before the lvs. Japan. Hardy in U. S., S. of Penn.

Ord. 164. Dilleniáceæ.—Fls. ♂ or ♀, rarely ♂ ♀; racemed or paniced; rarely sol., usually yellow. Sep. 5, rarely fewer or ∞; persist., often accrescent and covering the fr. Pet. 5, rarely fewer or ∞; decid. Sta. ∞, rarely def.; usually distinct, rarely mon- polyadelph.; anth. introrse or extrorse, often separated and overtopped by the connective; dehisc. vert. or by an apical pore. Ova. sev., distinct or coherent, sometimes sol.; styles terminal or sub-dorsal; stigmas simple or sub-capitate. Ov. 2 or sev., 2-seriate; ascending; rarely sol., erect. Carpels dehisc. or indehisc. Fr. crustaceous or baccate. Sds. sol. or few, arillate except in *Dillénia*. Emb. minute. Lvs. alt., rarely opp. (*Hibbértia*), entire or dentate, rarely pinnatifid or trifid; usually very rough. Stip. 0 or adnate to petiole and caduc. *Shrubs*, often climbing, or *Trees*; rarely 2 *Herbs*. Juice astringent. 17 gen., 180 spec., chiefly in S. hemisphere. 3 Tribes, differences in sta.

Tribe 1. 6 gen., 92 spec., both worlds. 1. *Crossósoma*, monotypic. Only spec. with sep. connate into a cup at base. Small shrub, fls. white. Cal. 2. *Hibbértia*. Ev. heath-like shrubs, 3°-6° high; often climbing; fls. yellow, showy, ill-scented. 70 spec., Mascarenes, Australia. **Tribe 2.** 5 gen., 34 spec., all in Asia but 1. *Wórmia*, lofty ev. trees, 9 spec., of which 1 is in Australia, 1 in Mascarenes, the rest in trop. Asia. 2. *Dillénia*, lofty trees, ev. or decid.; fls. showy, yellow or white. 9 spec., trop. Asia. *D. speciósá*, ev., fls. white, 9' wide. *D. pentágyna*, decid., fls. yellow, 1' wide; lvs. 2° long; 4°-5° long on young trees. **Tribe 3.** 6 gen., 60 spec. 1. *Tetrácerá*, 24 spec., climbing shrubs, rarely trees, both worlds. 2. *Delima sarmentósa*, monotypic, ev. climber, fls. yellow, Ceylon. 3. *Doliocárpus*, fls. white or yellow, boll or berry red; 18 spec.; 4. *Davilla*, fls. yellow; 14 spec.; are shrubs, often climbing; trop. Am.

Ord. 165. Ranunculáceæ.—Fls. ♂, rarely ♂ ♀ (*Clématis*, *Thalictrum*). Sep. 3, usually 5; or 3-∞; free; rarely herbaceous and persist., usually petaloid; imb. rarely valv. Pet. = sep. or more, hypog., distinct, various, often 0. Sta. usually ∞, ∞-seriate, hypog.; fila. filiform, distinct; anth. term., 2-celled; cells adnate, extrorse or lateral. Carpels few or ∞, rarely sol. (*Actæa*), distinct, rarely coherent (*Nigélla*); sty. simple; stig. on its inner surface at top, or sessile; ov. various. Akaines, pointed or feathered; or follicles, which are rarely united into a boll (*Nigélla*); or a berry, ∞-seeded (*Actæa*). Sds. erect, pend. or horizontal. Emb. minute. Perisperm horny (fleshy

in Pæonia). Lvs. radical or alt., rarely opp. (Clématis), simple or compound, petiole often dilated or amplexicaul; rarely with stipule-like appendages. Juice acid; watery. *Herbs*, rarely *Shrubs* or shrubby climbers. 5 Tribes:

Tribe 1. Sep. 5, imb., unequal, leafy, persist. Pet. 5, large. Sta. ∞ , usually changed to pet. in cultivation. Ova. 2-5, ∞ -ovuled; girt below with a fleshy disk. Stig. sessile. Follicles leathery, ∞ -seeded. Lvs. large, pinnatisect or decompound. Only gen. *Pæonia*, ΠÆΟΝΥ. Herbs; rhiz. 2, fusiform; one spec. a shrub. 4 spec., N. hemisphere. *P. Moután*, TREE P. Shrub 3°-4° high. Carpels 5, encircled by the disk. Fls. 6' wide, white or rose, fragrant. China. *P. albiflora*, 2, 3° high; stem with sev. fls. white or rose, fragrant; N. Asia. *P. officinalis*, COMMON P. 2, stems 1-flowered, fl. very large, red, white, rose Eur. *P. Brownii*, 2, fls. brown-purple, Nevada. **Tribe 2.** Fls. reg. or irreg. Sep. imb., petaloid. Pet. small; or irreg., spurred; or 0. Carpels sev.-ovuled. Follicle, berry, boll. 17 gen., 133 spec., both worlds. **1. Xanthorrhiza apiifolia**, YELLOW-ROOT; monotypic. Sep. 5, decid. Pet. 5, small, 2-lobed, clawed. Sta. 5-10. Carpels 5-10, 2-3-ovuled. Follicles usually 1-seed. Fls. small, dark purple, paniced; appearing with lvs.; often ♂ & ♀. Lvs. long-petioled; lfts. 5, 2'-3' long, dentate. Low shrub; juice yellow, bitter. River-banks, N. Y. to Guif States. **2. Cimicifuga**, BUGBANE. Sep. 4-5, decid. Pet. small, 1-8, clawed, or 0. Sta. ∞ , white. Follicles 1-8. Lvs. decompound. Fls. white; racemes 1°-3° long. 2, 8 spec., Eur., Asia, N. Am. *C. cordifolia*, 3°-5° high, racemes paniced. Mts., N. C. *C. americana*, 3°-6° high; racemes long-paniced. Mts., Penn. to Tenn., N. C. *C. racemosa*, 6°-8° high, racemes in a plume-like panice. Can. to Ga. **3. Actæa**, BANE BERRY. Near Cimicifuga, but carpel 1, becoming a berry; raceme small. 2 spec. *A. alba*, 2° high, raceme oblong, berries white. Can. to Ga. *A. spicata*, raceme short, berries red. 2° high, Can. to Penn. W. to Rocky Mts. **4. Aconitum**, MONKSHOOD, ACONITE. Sep. 5, unequal; posterior large, hooded, covering 2 of the petals; the other petals being minute or 0. Carpels 3-5; follicles ∞ -seeded. Lvs. palmilobed or -sect. Fls. blue, purple, yellow, white, racemed, paniced. Herbs; 2 rhiz. 18 spec., N. hemisphere. Showy, but poisonous. *A. Napellus*, 4° high, fls. blue; Eur., Asia. *A. Lycotomum*, WOLFSBANE; 3° high, fls. purple. Styria. Sd., Fig. 9, 2. *A. reclinatum*, trailing, stems 4°-8° long, fls. white. Va., mts., S. *A. uncinatum*, slender, erect, hut weak; 2° high, fls. large, purple. N. Y. to Ga., mts. **5. Delphinium**, LARKSPUR. Sep. 5, unequal; posterior spurred. Pet. 2-4, small; 2 upper spurred, cucullate, included in sepal-spur; 2 lower often 0. Follicles 1-5, ∞ -seeded. Lvs. palmatilobed or dissected. 2, ☉; fls. showy, racemed. 40 spec., N. hemisphere. Am. 2: *D. azureum*, 1°-2° high; *D. tricomé*, 3° high; *D. exaltatum*, 4°-5° high; all fls. blue. Widely spread, U. S. *D. cardinale*, 2° high, fls. scarlet, Cal. *Foreign*: *D. grandiflorum*, *D. sinense*, *D. sibiricum*, 2° high; *D. elatum*, 6° high, are BEE LARKSPUR; fls. blue, petals with yellow hairs on inner surface, simulating a bee: 2, Asia. *D. Staphisagria*, STAVESACRE. ②, 2° high, fls. azure. S. Eur. *D. Consolida*, fls. blue; *D. Ajacis*, fls. pink; ☉, 1°-2° high. Eur. *D. pinnatifidum*, Asia; hairs, Fig. 106, 1. **6. Aquilegia**, COLUMBINE. Sep. 5, reg., decid. Pet. 5, equal, like a horn or hood, spurred; attached by margin of limb. Follicles

5, ∞ -seeded. Fls. showy, blue, yellow, scarlet, particolored, sol. or panicled. \mathcal{Q} , erect, branched; lvs. very decomposed. 6 spec., rocks, N. hemisphere. *Am.*, spur straight: *A. cærulea*, 2° high, fls. 3' long, sep. blue, pet. white, spur, 2' long; Rocky Mts. *A. canadensis*, 18' high, fls. 2' long, scarlet and orange; Can. to Gulf. *A. Skinneri*, similar, 2° high, fls. 3' long; Mex. *Foreign*, spur hooked or curved: *A. vulgaris*, 1°-3° high, fls. large, blue. Eur. Fig. 154; follicle, petal, Fig. 9. *A. glandulosa*, *A. sibirica*, fls. deep blue, pet. tipped with white. 2° high. N. Asia. 7. **Nigella**, FENNEL-FLOWER. Sep. 5, reg., decid. Pet. 5, clawed; blade small, 2-fid. Fls. white, blue, yellow. Follicles 3-10, ∞ -seeded, more or less coherent; sds. spiey. Lvs. finely pinnatisect. \odot , \odot , rarely \mathcal{Q} ; 1°-2° high. 10 spec., Medit. States, W. Asia. *N. sativa*, \odot , fls. yellow. S. Eur., Levant, Egypt. Called *Toute-épice*, *Quatre-épices*, *Nutmeg-Flower*; the *Fitches* of Isaiah. *N. Damascena*, \odot , fls. pale blue, veiled by a large pinnatisect involucrel lf. Common names (which the cynic may term synonyms) *Love-in-a-mist*, *Ragged-Lady*, *Devil-in-the-bush*. Levant. 8. **Anemonopsis macrophylla**, monotypic. Sep. 9. Pet. 10. Fls. like Anemone. Follicles 3-5. Lvs. like Actæa. Erect herb, handsome; Japan. 9. **Isopyrum**. Sep. 5-6, reg., decid. Pet. 6, very short or 0. Fls. sol. or panicled, white. Follicles 2-3-6-20, 2-3- ∞ -seeded. Lvs. decomposed. \mathcal{Q} , slender, low; 7 spec., N. hemisphere. 1. *bitermatum*, pet. 0; sep. 5. Ohio, Ky., W. 1. *thalictroides*, S. Eur. Sev. in Asia. 10. **Coptis**, GOLD-THREAD. Sep. 5-6, decid. Pet. 5-6, small, yellow. Carpels ∞ , stipitate, distinct. Follicles ∞ -seeded. Fls. (sep.) white. Scape naked, 1-3-flowered. Lvs. 1-2-ternate, rad. Rhiz. \mathcal{Q} , thread-like, yellow, bitter. 6 spec., N. Eur., N. Asia, N. Am. *C. trifoliata*, bogs, Can. to Va., W. to Oregon; N. Eur. 11. **Eranthis**. Sep. 5-8, reg., decid. Pet. small. Follicles ∞ , stipitate, ∞ -seeded. Low; rhiz. \mathcal{Q} , tuberous. Lvs. palmatisect, rad.; 1 cauline, involucrel below the sol. yellow fl. 2 spec. *E. hyemalis*, WINTER ACONITE, sep. 6-8; blooming at close of winter. Cent. and S. Eur. *E. sibirica*, sep. 5. E. Siberia. 12. **Helleborus**, HÉLLEBORE. Sep. 5, reg., sometimes sub-herbaceous, usually persist. Pet. small. Follicles ∞ , ∞ -seeded, distinct or coherent at base. Erect; rhiz. \mathcal{Q} . Lvs. rad., large, palmatisect or -lobed, or digitate; cauline lvs. few, involucreliform. Fls. (sep.) large, white, green, yellow, or livid; sol. or panicled. Poisonous. 11 spec., Eur., W. Asia. *H. niger*, BLACK H.; rhiz. dark; fl.-stalk 1-2-flowered, fls. white or pink; blooming in winter, and called *Christmas Rose*. Greece, Asia Minor. *H. foetidus*, BEAR'S-FOOT. Fls. green, sep. pink-edged; panicled. W. Eur. *H. viridis*, GREEN H., fls. yellowish-green, few. Eur. Nat. in N. Atlantic States, U. S. 13. **Tröllius**, GLOBE FLOWER. Sep. 5- ∞ , reg., decid. Pet. 5-8, small. Follicles ∞ , ∞ -seeded. Erect; rhiz. \mathcal{Q} . Lvs. palmatilobed or -sect. Fls. sol. or few, large, usually globular; yellow or lilac. 9 spec., Eur., Asia, N. Am. *T. europæus*, Eur., fls. yellow. *T. asiaticus*, Asia; fls. dark orange; both globular. *T. laxus*, sep. pale-greenish-yellow, spreading, not showy. Swamps, N. H. to Del., W. to Mich. 14. **Hydrastis canadensis**, YELLOW PUCCOON; monotypic. Sep. 3, reg., decid. Pet. 0. Carpels 12 or more, baccate, 1-2-seeded, forming a crimson blackberry-like fr. Fl. sol., small, white. Lvs. palmatilobed or dissected. Rhiz. \mathcal{Q} , thick, yellow; 1 rad. leaf; stem 1° high; lvs. 2; fl. term. Rich woods,

Can. to Car., Ky. **15. *Glaucidium palmatum***, monotypic. Sep. 4, reg., decid. Pet. 0. Carpels 1 or few, slightly coherent at base. Follicles square, ∞ -seeded; dehisc. dorsal; raphe prominent. Erect, \mathcal{Q} ; lvs. palmatilobed. Fl. sol., large, lilac or pink. Japan. **16. *Calathodes palmata***, monotypic. Sep. 5, reg., decid. Pet. 0. Carpels many, 8-10-seeded. Fls. yellow, sol. Lvs. cauline, palmatilobed or dissected. Erect, \mathcal{Q} . E. Himàlayas. **17. *Caltha***. Sep. 5- ∞ , equal, caduc. Pet. 0. Follicles few or many, many-seeded; raphe prominent. Fls. sol. or few, yellow or white. Lvs. rad., palminerved, ent. or crenulate, cordate or auricled; cauline few or 0. \mathcal{Q} , glabrous; tufted or with perenn. rhiz. 9 spec., Eur., Asia, Am., Australia, New Zealand. **C. *palustris***, MARSH MARIGOLD. Stems stout, hollow; fls. showy. Eur., W. Asia, N. Am., Can. to Car., W. to Oregon. *May-Blobs* of English rustics; fl.-buds used as capers. The other spec. similar; 4 in S. hemisphere.

Tribe 3. Sep. imb. Pet. with nectariferous claw, rarely 0. Carpels 1-ovuled; ov. ascending, raphe ventral. Akaines dry. Lvs. rad. or alt. 4 gen., 165 spec., both worlds. **1. *Oxygraphis***. Sep. 5, persist. Pet. 10-15. Akaines many, beaked by the persist. style. Lvs. rad., ert., from \mathcal{Q} rhiz. Scapes naked; fls. sol., golden-yellow. 2 spec., mts., extra-trop. Asia. **2. *Hamadryas***. Fls. σ ρ by suppression. Sep. 5-6, caduc., or sub-persist. Pet. 10-12, with basal scale. Akaines many, each tipped by its short style; in a hd. on the gynophore. Low; rhiz. \mathcal{Q} ; like *Ranunculus*, but σ ρ . 4 spec., Antarctic Am. **3. *Ranunculus***. Sep. 3-5, caduc. Pet. 3-5 or more, with basal pit or scale. Akaines many, each beaked by its short style; in a hd. or spike on the gynophore. Lvs. ent. or cut. Fls. yellow, white, red, sol. or panicled. \mathcal{Q} , \odot , 6'-2° high, rarely taller. 160 spec., almost cosmopolitan. **R. *repens***, BUTTERCUP, CROWFOOT. Lvs. 3-5-cleft, or divided; gynophore globular. Fls. yellow. \mathcal{Q} , creeping. Moist places, U. S., Eur. **R. *asiaticus***, tuberous, \mathcal{Q} , 9' high, fls. 2' wide, yellow, various other colors; Levant. **R. *bulbosus***, KING-CUP, tuberous, \mathcal{Q} , 1° high; fls. large, yellow. Eur.; introduced in U. S. **R. *aconitifolius***, 18' high, fls. white; Alps. Full double, cultivated, called *Fair Maids of France*. **R. *acris***, GOLD-CUP; fls. golden-yellow. \mathcal{Q} ; stem 1°-3° high; Eur.; introduced in U. S. Fl., fr., Fig. 9. Cultivated, full double, called *Bachelor's Buttons*. **R. *salsuginosus***, \mathcal{Q} , 12° high, fls. yellow; Siberia. **R. *Lingua***, GREATER SPEARWORT, \mathcal{Q} , 2°-4° high, fls. large, yellow; lvs. ent., lanceolate. Moist places, Gt. Brit.; **R. *Flammula***, LESSER S., similar, 18' high; Gt. Brit.; also in N. Atlantic U. S. **R. *aquatilis***, \mathcal{Q} , st. filiform, 1°-2° long, submerged lvs. circular in outline; submerged lvs. finely dissected; upper plane, floating; not developed in swift streams; fls. long-peduncled, white. Young cells, Fig. 215. Swift or slow streams, Eur.; Greenland; Arctic Am. to Cal. and Fla. **R. *multifidus* (*Pürshii*)**, similar, but larger, and fls. large, bright yellow. Slow streams, Can., U. S. **R. *Ficaria***, LESSER CELANDINE. Pet. 9. \mathcal{Q} , tuberous; lvs. glossy green; fls. golden-yellow. 6' high, Gt. Brit. **R. (*Ceratocephalus*) *falcatus***. Pet. 5. \odot , small, cottony; lvs. rad., dissected; fls. small, yellow; scape 1-flowered. Akaines gibbous at base, and produced at apex into long falcate horns. S. Eur. **R. *orthoceras***, similar, horn straight. Caucasus. **4. *Trautvetteria palmata***, monotypic. Sep. 4, sometimes 3-5, concave, caduc. Pet. 0. Akaines

membranous, 4-angled, compressed, inflated; in a hd. Lvs. palmately-lobed; cauline few. Fls. white, corymbose. Rhiz. \mathcal{Q} ; stem 2° - 3° high; rad. lvs. large, 5-9-lobed. Mts., Va., Ky., W. to Ill.

Tribe 4. Sep. imb., usually petaloid, sometimes spurred (Myosùrus). Pet. 0; or plane, claw nectariferous (Myosùrus, Calliánthemum), or not nectariferous (Adònis). Carpels 1-ovuled; ov. pend., raphe dorsal. Akaines dry, rarely fleshy (Knowltonia). Lvs. all rad.; or cauline alt. Stem erect. 6 gen., 182 spec., both worlds. 1. **Myosùrus**, MOUSETAIL. Sep. 5-6-7, spurred below their insertion. Pet. = sep., narrow; claw nectariferous at top. Akaines minute, on a long gynophore, imitating the tail of a mouse; style short, persist. Lvs. ent., linear-spatulate, erect, all rad. Fl. minute, yellow. Scape 1-flowered. 2 spec., \odot ; Eur., Asia, Af., Australasia, Am. **M. minimus**, scape 3' high; Gt. Brit., U. S., meadows, prairies, bottomlands. **M. aristata**, similar; styles longer, divergent. Chili, Nevada, Utah. 2. **Calliánthemum**. Sep. 5, herbaceous, decid. Pet. 5-15, nectariferous pit at base. Akaines many, in a hd. Style short, persist. Alpine, low; rhiz. \mathcal{Q} . Rad. lvs. decomposed; cauline few or 0; fls. white. 2 spec., Eur., Asia.

3. **Adònis**. Sep. 5-8, colored, decid. Pet. 5-16, often spotted at base. Akaines many, in a hd. or spike; style short, persist., straight or hooked. Lvs. pinnatifid, multifid. Fls. sol., large, yellow or red. \odot \mathcal{Q} , 1° - $18'$ high. 3 spec., Eur., Asia. Many fine varieties. **A. autumnalis**, fl. crimson; **A. xestivalis**, fl. scarlet, \odot ; called *Pheasant's Eye*, *Blood-Drop*, *Flos-Adonis*. Eur. **A. sibirica**, \mathcal{Q} , fls. yellow. Siberia. 4. **Knowltonia**. Sep. 5, herbaceous, decid. Pet. 5-16. Akaines fleshy or pulpy, in a hd.; style decid. Rad. lvs. stiff, decomposed; cauline small or bract-like, or 0. Fls. greenish or yellowish; peduncles often irregularly umbellate. Erect; 1° - 2° high; rhiz. 4. Very acrid. Aspect of Umbelliferae. 5 spec., Cape G. H. 5. **Anemone**. Sep. 4-20, petaloid. Pet. 0 or represented by stipitate glands. Akaines numerous, in a hd., each tipped by the persist. naked or bearded style. Lvs. rad., lobed or dissected. Scape hairy, naked, except for an involucre of 3 lvs. below the sol. fl. Fls. of all colors. Rhiz. \mathcal{Q} . 70 spec., both worlds. 3 Sections: *Sec. 1. Hepatica*. Involucre close to fl. **A. Hepatica** (*H. triloba*), sep. 6-9. Fl. sol., blue, purple, white. 4'-6' high. Sta., Fig. 168, G. Eur.; introduced U. S. **H. acutiloba**, similar, lobes of lf. acute. Sep. 7-9, fl. pale purple, pink, white. Vt., N. Y. to Wis. *Sec. 2. Anemone, WIND FLOWER*. Involucre far below fl. Lvs. often ternate. Akaines beaked with a short point; fl. sol., long-peduncled. Many fine spec. and var. in cultivation; fls. of all colors. **A. nemorosa**, WOOD ANEMONE. Lvs. long-petioled, 3-5-foliolate. Scape 8'-10' high. Rad. lf. sol. Involucre of 3 lvs. Fl. 1' wide; sep. 4-7, white, rosy-purple outside. Akaines 15-20. Eur. Introduced U. S. **A. ranunculoides**, similar, fls. yellow. Eur. **A. pennina**, similar, fls. blue. S. Eur. **A. virginiana**. Lvs. long-petioled, 3-parted. Primary scape involucre; producing 2 secondary scapes, with 2-leaved involucres, thus branching and flowering all summer. 2° - 3° high. Akaines ∞ , in a dense hd. Common, U. S. **A. cylindrica**. Lvs. long-petioled, 3-cleft. Scape with 2-6 fls. sol. on long peduncles springing from a common involucre; lvs. of involucre 2 or 3 times as many as peduncles; fls. greenish white, small. Fr. of last. Mass. to Iowa. **A. multifida**, similar, lvs.

many-cleft; scape 2-peduncled; fls. red; Can., Magellan. *A. caroliniana* (*decapitata*). Lvs. 3-partite, segments ent. Rhiz. tuberous. Sep. 15-20. Scape 6'-10', with 1 large, fragrant fl., white or rosy. Involucre 2-3-leaved. Car. to New Mex., Arizona. Sev. other Am. species; *A. hortensis*, *A. coronaria* (*Poppy Anémone*), similar to *A. caroliniana*; S. Eur., Levant; original of the Garden Anemones; fls. red, scarlet, blue. *Sec. 3. Pulsatilla*. Inner pet. (outer sta. of some authors) gland-like. Akaine with feathery tail. *A. Pulsatilla*. Lvs. thrice-pinnatifid. Scape 1° high; fl sol., 2' wide, violet (var. red, white). Eur. Introduced, U. S.; *A. patens*, similar, but lvs. twice or thrice palmatifid, segments ternate. Scape hairy, 3'-6' high; fl. 2'-3' wide, violet; appearing before rad. lvs. III., Wis., W. to Rocky Mts. **6. Thalictrum**. Involucre 0. Fls. often ♂ ♀. Sep. 4-5, petaloid. Pet. 0. Carpels more or less numerous on a narrow torus. Style short, decid., or 0. Akaines often stipitate, ribbed, nerved, or winged. Fls. usually small; green, yellow, purple, whitish; paniced or racemed. Usually bold-growing; handsome; sta. conspicuous. 50 spec., both worlds. *T. flavum*, MEADOW RUE; lvs. 2-ternate; fls. orange, paniced; 3° high. Gt. Brit. *T. aquilegifolium*, PLUME COLUMBINE. Lvs. 3-ternate; fls. paniced; 2° high; Ger. *T. dioicum*, similar, but ♂ ♀, fls. lilac, lvs. decomposed; all on general petioles. 1°-2° high; *T. purpurascens*, near last, but lvs. not on general petioles; fls. purple; 2°-4° high; *T. Cornuti*, similar; 4°-8° high; fls. white, paniced; are widespread spec., U. S. Sev. others, U. S.

Tribe 5. Sep. valv., petaloid. Pet. 0, or narrow, flat, shorter than sep. Fls. often ♂ ♀; in cymes, panicles, or sol. Carpels 1-ovuled; ov. pend., raphe dorsal. Akaines numerous, often terminated by a plumose tail. Lvs. opp. 2. Stem herbaceous or woody; climbing. 2 gen., 102 spec., both worlds. **1. Naravelia**. Pet. linear or clavate. Akaines many, beaked by the bearded style; stipitate on a hollow torus. Lvs. 2-foliolate, petiole cirriform, fls. yellow. 2 spec., ev. climbers, trop. Asia. **2. Clematis**. Fls. often ♂ ♀ ♂-♂ ♀; sol. or paniced. Pet. 0. Outer sta. often petaloid. Sep. 4, rarely more. Akaines many, in a hd.; each tipped by the style, which is naked, or bearded, or a plumose tail. Lvs. sev.-foliolate, rarely 1-foliolate; petiole often twining. Stem woody, climbing; rarely erect, herbaceous. 100 spec., nearly cosmopolitan. 4 Sections: *Sec. 1. Atragene*. Involucre 0. Outer sta. petaloid. Akaine with plumose tail. Lvs. 3-foliolate. Peduncle 1-flowered; fl. large, usually purple. Sev. spec., decid. climbing shrubs, N. hemisphere. *C. alpina*, sep. 4, fls. blue. 8°. Mts, S. Eur. *C. sibirica*, sep. 4, fls. white. 12°. Siberia. *C. verticillaris*, sep. 4, fl. blue-purple, 3' wide. 15°. Can. to Car., W. to Rocky Mts. *Sec. 2. Cheirópsis*. Akaine with plumose tail. Ped. 1-flowered; involucre of 2 bracts just below the sol. whitish fl. Ev. climbing shrubs. *C. bœdærica*, lvs. ternate. 12°. Minorca. *C. cirrhosa*, lvs. ternate, lower 1-foliolate. 12°. S. Eur., N. Af. *Sec. 3. Viticella*. Involucre 0. Pet. 0. Akaine with short tail, not plumose. Peduncle 1-flowered; fl. large. Lvs. ternately decomposed. Decid. climbing shrubs. *C. campaniflora*, fl. bell-shaped, sep. 4, white. 10°. Portugal. *C. Viticella*, sep. 4, blue, purple; fl. open, 3'-4' wide. Spain, Portugal. *C. florida*, sep. 6 or more, white, purple; fl. 3'-4' wide. 10°. Japan. *Sec. 4. Flammula*. Involucre 0. Pet. 0. Akaine with plumose tail. *A. Peduncle 1-flowered; sep. 4. u. Climb-*

ing; lvs. pinnate or ternate: *C. graveolens*, fl. yellow, 1½' wide, scented. Decid. 15°. Thibet. *C. Vidrna*, sep. leathery; fl. bell-shaped, purple, 1'-2' long. Decid. 15°. Ohio to Car., Fla. *C. reticulata*, fl. bell-shaped, purple, large. Decid. 8°. Fla., S. C. *b. 2* herbs, lf. 1-foliolate: *C. integrifolia*, fl. blue, 1' long. 2° high. Hungary. *C. ochroleuca*, silky; fl. yellow. 12'-18' high. N. Y. to Ga. *B. Peduncle many-flowered; fls. small, usually white; panicled. Lvs. pinnate or ternate. C. erecta*, 2 herb, 3°-4° high. Austria. *Climbing shrubs: C. Flammula*, fls. fragrant. Decid. 20°. France. *C. Vitálba*, OLD MAN'S BEARD, TRAVELLER'S JOY, VIRGIN'S BOWER; fls. fragrant. Decid. 20°-30°. S. Eur., N. Af. *C. virginiana*, near *Vitálba*, but ♂ ♀. 10°-15°. Can. to Gulf. Sev. other Am. spec., and many var. of foreign spec. in cultivation.

SYNOPTICAL TABLE OF THE VEGETAL KINGDOM.

Numerical estimates of Orders, Genera, and Species vary, as different (and equally good) authorities unite or separate them. All estimates, however, are approximate; the flora of the globe is not yet half explored. No settled estimates in Cryptogamia have been made except in the Fern Alliance; this most important part of botanical work is yet to be done. The data below are conjectural; but at any rate they are within the safe limits of understatement. The estimates in the Manual are after De Jussieu, Le Maout et Decaisne, W. J. Hooker, Lindley, Balfour, Berkeley, Müller, Rabenhorst, and other high authorities. The estimates given below for Phanerogamia are compiled from the *Genera Plantarum* of Bentham and Hooker. By comparison with the data of the Manual, the student will see what the differences are, and that they arise mainly from slightly changed arrangements. For example: the Orders here italicized are made Tribes or Genera of Liliaceæ by Bentham and Hooker; the genus *Leitneria* (consisting of ♂ ♀ apetalous shrubs of the Gulf coast of Florida and Texas), long tossed between Myricaceæ and Euphorbiaceæ, is made an Order and placed near Juglandaceæ; *Balanops* (consisting of ♂ ♀ apetalous trees and shrubs of New Caledonia) is also made an Order and placed next to Euphorbiaceæ. Other and like changes have been made, but there is not space to name them here. In the Synopsis given below, the numerals in the first column refer to Orders; in the second, to Genera; in the third, to Species. Orders are grouped, as in the Manual, in their respective alliances.

The student will please bear in mind that the work of which this brief Manual is the Second Part is not a local Flora, but a Class-Book of Botany treating of all the known Orders in the world, and that therefore only an outline of each Order could possibly be given within such limits. Local details must be sought in local Floras at home and abroad; and the author modestly trusts that the search will be the

more safe and intelligible with such a guide as the immortal DE JUSSIEU, whose system is set forth in these pages.

Cryptogamia.	24. Pandanaceæ.. 6, 65	20. Platanaceæ.... 1, 6
Thallogens :	25. Palmaceæ.... 132, 1100	21. Betulaceæ.... 6, 58
1. Algæ..... 350, 7000	26. Naiadaceæ.... 16, 120	22. Urticaceæ..... 107, 1500
2. Fungi..... 350, 3000	27. Alismaceæ.... 12, 60	23. Proteaceæ..... 49, 950
3. Lichènes..... 250, 2000	28. Triurideæ..... 3, 16	24. Eleagnaceæ... 3, 16
Acrogens :	29. Hydrochari- deæ..... 14, 40	25. Thymelaceæ 38, 360
1. Hepaticæ..... 50, 800	30. Dioscoreaceæ 8, 160	26. Hernandiaceæ 1, 8
2. Músci..... 360, 7000	31. Vellosiaceæ.. 2, 68	27. Lauraceæ..... 33, 890
3. Characeæ..... 5, 200	32. Hæmodoraceæ 17, 84	28. Cynocram- baceæ..... 1, 1
4. Filices..... 76, 2800	33. Amarylli- daceæ..... 62, 580	29. Chenopodi- aceæ..... 80, 620
5. Equisetaceæ.. 1, 25	34. Iridaceæ..... 57, 700	30. Amaranthá- ceæ..... 48, 480
6. Marsileaceæ.. 4, 50	35. Taccaceæ..... 2, 10	31. Polygonaceæ. 30, 600
7. Lycopodiaceæ 6, 350	36. Burmanni- aceæ..... 10, 54	32. Phytolaccææ 19, 60
Phanerogamia.	37. Apostasiaceæ 2, 7	33. Nyctagiaceæ 23, 215
Gymnospermæ :	38. Orchidaceæ... 332, 5000	34. Labiataæ..... 136, 2600
1. Cycadaceæ... 9, 76	39. Bromeliaceæ. 27, 350	35. Verbenaceæ.. 63, 920
2. Coniferæ..... 32, 300	40. Scitamineæ... 36, 450	36. Acanthaceæ... 120, 1350
3. Gnetaeæ..... 3, 40		37. Bigoniaceæ.. 65, 500
Angiospermæ.		38. Gesneriaceæ.. 71, 700
Endogens :	Exogens :	39. Columelliaceæ 1, 2
1. Graminaceæ.. 298, 3200	1. Balanopho- raceæ..... 14, 35	40. Orobanchaceæ 11, 150
2. Cyperaceæ.... 61, 2200	2. Santalaceæ... 27, 216	41. Lentibulari- aceæ..... 4, 180
3. Restiaceæ..... 24, 260	3. Loranthaceæ. 15, 604	42. Scrophulari- aceæ..... 157, 1900
4. Eriocaulo- naceæ..... 6, 325	4. Cupuliferaæ ... 4, 540	43. Solanaceæ.... 69, 1275
5. Flagellari- aceæ..... 3, 8	5. Juglandaceæ. 6, 30	44. Boraginaceæ.. 68, 1200
6. Xyridaceæ.... 2, 50	5a. Leitneriaceæ. 1, 2	45. Convolvulaceæ 29, 875
7. Comnely- naceæ..... 26, 309	6. Rafflesiaceæ.. 7, 22	46. Polemoniaceæ 8, 150
8. Phylodraceæ.. 3, 4	7. Arietolochi- aceæ..... 5, 200	47. Hydrophyl- laceæ..... 16, 150
9. Pontederiaceæ 4, 35	8. Nepenthaceæ 1, 31	48. Gentianaceæ. 49, 520
10. Rapateaceæ... 6, 20	9. Ceratophyl- laceæ..... 1, 1	49. Loganiaceæ... 30, 350
11. Juncaceæ..... 9, 154	10. Chlorantbá- ceæ..... 3, 26	50. Asclepiadaceæ 146, 1300
12. Xerotidæ... 5, 46	11. Saururaceæ... 3, 6	51. Apocynaceæ.. 103, 900
13. Roxburghi- aceæ..... 3, 8	12. Piperaceæ.... 6, 1000	52. Salvadoraceæ 3, 9
14. Asteliaceæ... 2, 13	13. Lacistemaceæ 1, 16	53. Oleaceæ..... 18, 280
15. Gillesiaceæ.. 2, 6	14. Geissolomá- ceæ..... 1, 1	54. Styracaceæ... 7, 220
16. Conaunthe- raceæ..... 6, 13	15. Peneaceæ..... 3, 19	55. Cyrtillaceæ... 4, 8
17. Eriospemaceæ 1, 25	16. Euphorbi- aceæ..... 197, 3000	56. Ebenaceæ..... 6, 250
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19. Ophiopogo- naceæ..... 4, 23	17. Salicaceæ.... 2, 300	58. Myrsinaceæ... 23, 35
20. Aspidiastreæ. 4, 9	18. Casuarinaceæ 1, 23	59. Primulaceæ... 21, 250
21. Lemnaceæ... 2, 20	19. Myricaceæ.... 2, 36	60. Plumbagi- naceæ..... 8, 200
22. Araceæ..... 98, 900		61. Plantagiaceæ 3, 200
23. Typhaceæ.... 2, 16		62. Lennoaceæ... 3, 4
		63. Diapensiaceæ 6, 8
		64. Ericaceæ..... 113, 1650
		65. Lobeliaceæ... 23, 500
		66. Campanulaceæ 20, 530

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69. Compósitæ....	766, 9800	101. Connaraceæ..	12, 140	135. Tamariscinæ	5, 40
70. Dipsacæ.....	5, 120	102. Anacardiaceæ	46, 450	136. Portulacaceæ.	15, 125
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73. Rubiaceæ.....	537, 4100	105. Vitaceæ.....	3, 230	137. Caryophyll-	
74. Caprifoliaceæ	13, 200	106. Rhamnaceæ... 37, 430		laceæ.....	35, 800
75. Cornaceæ.....	12, 75	107. Stackhousi-		aceæ.....	1, 30
76. Araliaceæ.....	38, 340	aceæ.....	1, 20	139. Vochysiaceæ..	7, 100
77. Umbelliferae..	152, 1300	108. Celastraceæ.. 39, 400		140. Tremandraceæ	3, 24
78. Ficoidæ.....	22, 450	109. Empetraceæ..	3, 4	141. Polygalaceæ..	15, 400
79. Cactaceæ.....	13, 1000	110. Illiciaceæ..... 3, 150		142. Pittosporaceæ	9, 90
80. Datisceæ.....	3, 4	111. Olacineæ.....	36, 170	143. Bixaceæ.....	29, 160
81. Begoniaceæ... 2, 350		112. Chailletiaceæ.	3, 38	144. Canellaceæ....	2, 4
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83. Passifloraceæ.	19, 250	114. Burseraceæ... 18, 145		146. Droseraceæ (see 96).	
84. Turneraceæ... 3, 76		115. Ochnaceæ.....	12, 140	147. Cistaceæ.....	4, 60
85. Loasaceæ.....	9, 100	116. Simarubaceæ.	30, 112	148. Resedaceæ....	6, 60
86. Samydateæ... 17, 150		117. Rutaceæ.....	83, 650	149. Moriogaceæ... 1, 3	
87. Ooagræceæ.... 22, 300		118. Geraniaceæ... 20, 750		150. Capparidaceæ	23, 300
88. Haloragææ.... 9, 80		119. Batideæ.....	1, 1	151. Cruciferae.....	172, 1200
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SUMMARY.—We have then,—

For Cryptogamia . . .	1,452 genera,	23,225 species.
For Phanerogamia . . .	7,844 " "	97,139 "
Total	9,096 " "	120,364 "

Most authors give to Compositæ 1000 genera, 12,000 species, and increase in like manner the genera and species of many other Orders; making, for all at present known of the Vegetal Kingdom, 10,000 genera, 150,000 species. Bentham and Hooker, as we see in this Table, make the genera nearly one thousand less, the species nearly thirty thousand less, than the usual estimate.

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- Potato and extensively cultivated in Eur. long before the introduction of the Irish (or white) Potato; and it is still far more extensively cultivated and feeds a much greater number of human beings in both worlds. It is *Patàta* in Spanish, Portuguese, and Italian; *Patàte* in French.)
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