

AN INTRODUCTION

TO

B O T A N Y .

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## CONTENTS OF VOL. II.

### ORGANOGRAPHY (*Continued.*)

CHAP. II. ( <i>Continued.</i> )	PAGE
Fruit . . . . .	1
Classification of Fruits . . . . .	16
Seed . . . . .	25
Albumen . . . . .	54
Embryo . . . . .	59
Germination . . . . .	60, 62
Naked Seeds . . . . .	69
Morphology of Floral Organs . . . . .	70
CHAP. III. Compound Organs in Flowerless Plants, or Acrogens . . . . .	82
Ferns . . . . .	93
Lycopodiaceæ . . . . .	98
Marsileaceæ . . . . .	101
Equisetaceæ . . . . .	114
Mosses and Andræaceæ . . . . .	106
Jungermanniaceæ and Hepaticæ . . . . .	114
Lichens . . . . .	117
Fungaceæ . . . . .	119
Algaceæ . . . . .	122

### BOOK II.—PHYSIOLOGY.

CHAP. I. General Considerations . . . . .	132
CHAP. II. Vitality . . . . .	144
CHAP. III. Chemical Constitution of the Elementary Organs . . . . .	162
CHAP. IV. Elementary Organs . . . . .	171
CHAP. V. Root . . . . .	180

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BOOK I.

ORGANOGRAPHY ; OR, OF THE STRUCTURE OF PLANTS.

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CHAPTER II.

OF THE COMPOUND ORGANS IN FLOWERING PLANTS—*continued.*

14. Of the Fruit.

The *fruit* (figs. 136. to 168.) is the ovary or pistil arrived at maturity. But, although this is the sense in which the term is strictly applied, yet in practice it is extended to whatever is combined with the ovary when ripe. Thus the pineapple fruit consists of a mass of bracts, calyxes, corollas, and ovaries; that of the nut; the acorn, and many others, of the superior dry calyx and ovary; that of the apple of a succulent superior calyx, corolla, and ovary; and that of the strawberry-blite of a succulent inferior calyx and dry ovary.

The fruit being the matured ovary, it should exhibit upon some part of its surface the traces of a style or stigma; and this mark will, in many cases, enable the student to distinguish minute fruits from seeds. Many fruits were formerly called *naked seeds*, such as those of Umbellifers, Labiates, and Borageworts, and the grain of corn; but now that attention has been paid to the gradual development of organs, such errors have been corrected. In cases where a trace of

the style cannot be discovered, anatomy will generally show whether a minute body is a seed or fruit, by the presence, in the latter case, of two separable and obviously organically distinct coatings to the nucleus of the seed; but in other cases, where the pericarp and the integuments of the seeds are combined in a single covering, and where no trace of style remains, as sometimes happens, nothing can be determined as to the exact nature of a given body without following it back in its growth to its young state. This, however, may be stated, that naked seeds, properly so called, are not known to exist, unless accidentally, in more than three or four orders in the whole vegetable kingdom; viz. in Conifers and Cycads, where the ovules also are naked, and in *Peliosanthes Teta* and *Leontice*, in which the ovules, originally enclosed in an ovary, uniformly rupture it at an early period after fertilisation, and subsequently continue naked until they become seeds.

Such being the case, it follows that all the laws of structure which exist in the ovary are equally to be expected in the fruit; and this fact renders a repetition in this place of the general laws of formation unnecessary. Nevertheless, as, in the course of the advance of the ovary to maturity, many changes often occur which contribute to conceal the real structure of the fruit, it is in all cases advisable, and in many absolutely necessary, to examine the ovary, in order to be certain of the exact construction of the fruit itself. These changes are caused by the abortion, non-development, obliteration, addition, or union of parts. Thus the three-celled six-ovuled ovary of the oak and the hazel becomes, by the non-development of two cells and five ovules, a fruit with one seed; the three-celled ovary of the cocoa-nut is converted into a one-celled fruit, by the obliteration of two cells and their ovules; and the two-celled ovary of some *Pedaliads* becomes many-celled, by a division and elongation of the placenta. In *Cathartocarpus Fistula* a one-celled ovary changes into a fruit having each of its many seeds lodged in a separate cell, in consequence of the formation of numerous horizontal membranes which intercept the seeds. A still more extraordinary confusion of parts takes place in the fruit of the

pomegranate after the ovary is fertilised; and many other cases might be mentioned.

Every fruit consists of two principal parts, the *pericarp* and the *seed*, the latter being contained within the former. When the ovary is inferior, or coheres with the calyx, the latter and the pericarp are usually so completely united as to be inseparable and undistinguishable: in such cases it is usual to speak of the pericarp without reference to the calyx, as if no such union had taken place. Botanists call a fruit, the pericarp of which adheres to the calyx, an inferior fruit (*fructus inferus*); and that which does not adhere to the calyx, a superior fruit (*fructus superus*). But Desvaux has coined other words to express these ideas: a superior fruit he calls *autocarpic*; an inferior fruit, *heterocarpic*; terms unnecessary and unworthy of adoption.

Everything which in a ripe fruit is on the outside of the real integuments of the seed, except the aril, belongs to the pericarp. It consists of three different parts, the *epicarp*, the *sarcocarp*, and the *endocarp*; terms contrived by Richard, and useful in practice.

The *epicarp* is the external integument or skin; the *endocarp*, called *putamen* by Gærtner, the inner coat or shell; and the *sarcocarp*, the intermediate flesh. Thus, in the peach, the separable skin is the epicarp, the pulpy flesh the sarcocarp, and the stone the endocarp or putamen. In the apple and pear the epicarp is formed by the cuticle of the calyx, and the sarcocarp is confluent with the remainder of the calyx in one fleshy body.

The *pericarp* is extremely diversified in size and texture, varying from the dimension of a single line in length to the magnitude of two feet in diameter; and from the texture of a delicate membrane to the coarse fabric of wood itself, through various cartilaginous, coriaceous, bony, spongy, succulent, or fibrous gradations.

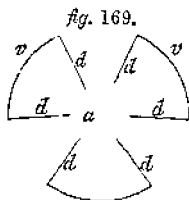
The *base* of the pericarp is the part where it unites with the peduncle; its *apex* is where the style was: hence the organic and apparent apices of the fruit are often very different, especially in such as have the style growing from

their sides, as in Rosaceæ and Chrysobalanaceæ, Labiatae and Boraginaceæ.

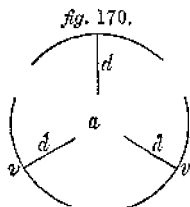
When a fruit has arrived at maturity, its pericarp either continues perfectly closed, when it is *indehiscent*, as in the hazel nut; or separates regularly round its axis, either wholly or partially, into several pieces: the separation is called *dehiscence*, and such pieces *valves*; and the axis from which the valves separate, in those cases where there is a distinct axis, is called the *columella*.

When the dehiscence takes place through the dissepiments, it is said to be *septicidal*; when through the back of the cells, it is called *loculicidal*; if along the inner edge of a simple fruit it is called *sutural*; if the dissepiments are separated from the valves, the dehiscence is named *septifragal*.

In *septicidal* dehiscence the dissepiments divide into two plates and form the sides of each valve, as in *Rhododendron*, *Menziesia*, &c. Formerly botanists said that in this sort of dehiscence the valves were alternate with the dissepiments, or that the valves had their margins turned inwards. This may be understood from *fig. 169.*, which represents the



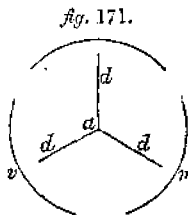
relative position of parts in a transverse section of a fruit with septicidal dehiscence; *v* being the valves, *d* the dissepiments, and *a* the axis.



In *loculicidal* dehiscence the dissepiments form the middle of each valve, as in the lilac, or in the diagram 170.,

where the letters have the same value as above. In this it was formerly said that the dissepiments were opposite the valves.

In *septifragal* dehiscence the dissepiments adhere to the axis and separate from the valves, as in *Convolvulus*; or in the diagram 171., lettered as before.



In *sutural* dehiscence there are no dissepiments, the fruit being composed of only one carpel, as the Pea.

Besides these regular forms of valvular dehiscence, there is a very anomalous mode which occurs in a very few plants, and is called *circumscissile*. This takes place by a transverse circular separation, as in *Anagallis*; in *Jeffersonia* it only takes place half round the fruit. In some cases, as in lomentaceous legumes, the transverse disarticulation may be supposed to have some relation to the pinnate leaves, whose modification, in those instances, forms the carpel. In other cases the explanation is far less obvious, and must be at least very different. Perhaps the best account of transverse dehiscence is that of Mr. Hincks, as reported in the *Annals of Natural History*, vol. xvii.

“In the fruit, as in the calyx, this author believes that horizontal disruption arises from the force of cohesion of the parts of the circle, the absence of any of the causes favourable to dehiscence along the midrib of the carpellary leaf, and the operation of some force pressing either from without or from within on one particular line encircling the fruit. In the circumscissile capsule of *Anagallis*, he states that the central free receptacle with the seeds upon it continuing to enlarge in both diameters after the envelope has ceased to grow, and having occupied from the first the entire cavity, it is

naturally to be expected, since the chief extension of the interior parts is upwards (the natural direction of growth), while the enlargement of the seeds in the lower half tends to press back the parts of the lower hemisphere, that uniform and regular pressure will resolve a nearly spherical capsule into two equal hemispheres. This remark he applies to *Centunculus* also, but confesses himself at a loss to give any reason why the opening of *Trientalis*, which depends on the same general causes, should be irregular. For the separation of the lid of the capsule in *Hyoscyamus* he accounts by the contraction and rigidity of the throat of the calyx exercising a gradually increasing pressure around the upper part of the capsule, and thus causing its separation by the first of the general principles laid down. *Lecythis*, he thinks is to be explained by the third of his general principles. In illustration he refers to a monstrosity of the common Tulip. In this monstrosity, the upper leaf, being unusually developed, cohered by its edges so firmly as to imprison the flower, and this constraint occurring at a period when the stalk was increasing in length, and previous to any considerable enlargement of the flower-bud, the force applied was chiefly vertical, and carried off the upper part of the leaf in the form of a calyptra, leaving the lower part in the shape of a cup, from the centre of which the stem appeared to rise. The separation of the lid of the capsule of *Lecythis*, Mr Hincks believes to be effected in an analogous manner; the septa which form the two or four cells into which the fruit is divided, meet in a thickened axis, and the outer part of the fruit becoming (partly from its natural texture, and partly from the adherence of the torus and calyx) hard, solid, and fully grown, while the axis continues slowly to extend, and thus to press upwards that portion of the capsule which rests upon it, causes that portion first to become slightly prominent, and finally by a strain upon the vessels of that particular part to fall off in the shape of a lid. In *Couroupita* the pressure is sufficient to mark the surface of the fruit with a prominence, but from the partitions giving way early, and from the abundant juices produced in the interior, there has not been sufficient pressure to occasion disruption. In all the species



of *Lecythis*, the extent of the loose cover corresponds with the extent of the axis, and what remains of the latter continues attached to it. As regards Lomentaceous fruits in general, the author believes that the intervals between the seeds being sufficient to admit of the sides of the fruit cohering (which is promoted in particular instances by special causes), the swelling of the seeds afterwards stretches the parts over them in a degree which this coherence prevents from being equally distributed, drags the tissue forcibly from the junctures which are fixed points, and thus there being a strain in each direction from the middle line of the juncture the contraction of drying in the ripening of the fruit effects the separation."

Valvular dehiscence, which is by far the most common mode by which pericarps open, must not be confounded with either *rupturing* or *solubility*,—irregular and unusual contrivances of nature for facilitating the dispersion of seeds. In valvular dehiscence the openings have a certain reference to the cells, as has been already shown; but neither rupturing nor solubility bear any distinct relation to the cells. *Rupturing* consists in a spontaneous contraction of a portion of the pericarp, by which its texture is broken through, and holes formed, as in *Antirrhinum* and *Campanula*. *Solubility* arises from the presence of certain transverse contractions of a one-celled pericarp, through which it finally separates into several closed portions, as in *Ornithopus*.

For the nature of the placenta and umbilical cord see the observations under ovary. Of these parts, which are mere modifications of each other, the former often acquires a spongy dilated substance, occasionally dividing the cells by spurious dissepiments, and often giving to the fruit an appearance much at variance with its true nature.

In some seeds, as *Euonymus europæus*, it becomes exceedingly dilated around each seed, forming an additional envelope, called *aril*. The true character of this organ was unknown till it was settled by Richard: before his time the term was applied, not only in its true sense to an enlargement of the

placenta, but also to the endocarp of certain Cinchonads and Rueworts, to the seed-coat of Jasminum, of Orchids, and others, and even to the perianth of Carex. A very remarkable instance of the aril is to be found in the nutmeg, in which it forms the part called the *mace* surrounding the seed. It is never developed until after the fertilisation of the ovule. It will be further and much more particularly treated of, when speaking of the *seed*.

Having thus explained the structure of the pericarp, it is in the next place necessary to inquire into the nature of its modifications, which in systematic botany are of considerable importance. It is, on the one hand, very much to be regretted that the terms employed in this department of the science, which is that of Carpology, have been often used so vaguely as to have no exact meaning; while, on the other hand, they have been so exceedingly multiplied by various writers, that the language of carpology is a mere chaos. In practice but a small number of terms is actually employed; but for collections of fruits, or minute carpological arrangements, a large number is desirable; and it cannot be doubted that, if it were not for the excessive inconvenience of overburdening the science with words, it would conduce to clearness of description if botanists would agree to make use of some precise and uniform nomenclature.

What, for instance, can be more embarrassing than to find the term *nut* applied to the superior plurilocular pericarp of Verbena, the gland of Corylus, and the achenia of Rosa and Borago: and that of *berry* to the fleshy envelope of Taxus, the polyspermous inferior fruit of Ribes, the succulent calyx of Blitum, and several other things?

So much discordance, indeed, exists in the application of terms expressive of the modifications of fruit, that it is quite indispensable to give the definitions of some of the most eminent writers upon the subject in their own words, in order that the meaning attached by those authors to carpological terms, when employed by themselves, may be clearly understood.

In the phraseology of *writers antecedent to Linnæus*, the

following are the only terms of this description employed; viz. :—

1. *Bacca*, a berry : any fleshy fruit.
2. *Acinus*, a bunch of fleshy fruit : especially a bunch of grapes.
3. *Cachrys*, a cone : as of the pine tree.
4. *Pihula*, a cone like the Galbulus of modern botanists.
5. *Folliculus* (Fuchs), any kind of capsule.
6. *Grossus*, the fruit of the fig unripe.
7. *Siliqua*, the coating of any fruit.

In his *Philosophia Botanica*, LINNÆUS gives the following definitions of the terms he employs :—

1. *Capsula*, hollow, and dehiscing in a determinate manner.
2. *Siliqua*, two-valved, with the seeds attached to both sutures.
3. *Legumen*, two-valved, with the seeds attached to one suture only.
4. *Conceptaculum*, one-valved, opening longitudinally on one side, and distinct from the seeds.
5. *Drupa*, fleshy, without valves, containing a nut.
6. *Pomum*, fleshy, without valves, containing a capsule.
7. *Bacca*, fleshy, without valves, containing naked seeds.
8. *Strobilus*, an amentum converted into a pericarp.

GÆRTNER has the following, with definitions annexed to them :—

1. *Capsula*, a dry, membranous, coriaceous, or woody pericarp, sometimes valveless, but more commonly dehiscing with valves. Its varieties are,—
  - a. *Utriculus*, a unilocular one-seeded capsule, very thin and transparent, and constantly valvular ; as in *Chenopodium*, *Atriplex*, *Adonis*.
  - b. *Samara*, an indehiscent, winged, one- or two-celled capsule ; as *Ulmus*, *Acer*, *Liriodendron*.
  - c. *Folliculus*, a double one-celled, one-valved, membranous, coriaceous capsule, dehiscing on the inside, and either bearing the seed on each margin of its suture, or on a receptacle common to both margins ; as *Asclepias*, *Cinchona*, and *Vinca*.
2. *Nux*, a hard pericarp, either indehiscent or never dividing into more than two valves ; as in *Nelumbium*, *Boraginæ*, and *Anacardium*.

3. *Coccum*, a pericarp of dry elastic pieces or *coccules*, as in Diosma, Dictamnus, Euphorbia.
4. *Drupa*, an indehiscent pericarp with a variable rind, very different in substance from the *putamen*, which is bony, as in Lantana, Cocos, Sparganium, Gaura, &c.
5. *Bacca*, any soft pericarp, whether succulent or otherwise; provided it does not dehisce into regular valves, nor contain a single stone adhering to it. Of this the following are kinds:—
  - a. *Acinus*, a soft, succulent, semi-transparent, unilocular berry, with one or two hard seeds; as the Grape, Rivina, Rhipsalis, Rubus, Grossularia, &c.
  - b. *Pomum*, a succulent or fleshy, two- or many-celled berry, the disseminents of which are fleshy or bony, and coherent at the axis; as Pyrus, Cratægus, Cydonia, Sapota, and others.
  - c. *Pepo*, a fleshy berry, with the seeds attached at a distance from the axis, upon the parietes of the pericarp; as Cucumis, Stratiotes, Passiflora, Vareca, and others.

To the term *bacca*, all other succulent fruits are referred which do not belong to *Acinus*, *Pomum*, or *Pepo*; as *Garcinia*, *Caryophyllus*, *Cucubalus*, *Hedera*.

6. *Legumen*, the fruit of Leguminosæ.
7. *Siliqua* and *Silicula*, the fruit of Cruciferae.

WILLDENOW defines those employed by him in the following manner:—

1. *Utriculus*, a thin skin enclosing a single seed. Adonis, Galium, Amaranthus.
2. *Samara*, a pericarp containing one seed, or at most two, and surrounded by a thin membrane, either along its whole circumference, or at the point, or even at the side. Ulmus, Acer, Betula.
3. *Folliculus*, an oblong pericarp bursting longitudinally on one side, and filled with seeds. Vinca.
4. *Capsula*, a pericarp consisting of a thin coat containing many seeds, often divided into cells, and assuming various forms. Silene, Primula, Scrophularia, Euphorbia, Magnolia.

5. *Nux*, a seed covered with a hard shell which does not burst. *Corylus*, *Quercus*, *Cannabis*.
6. *Drupa*, a nut covered with a thick succulent or cartilaginous coat. *Prunus*, *Cocos*, *Tetragonia*, *Juglans*, *Myristica*, *Sparganium*.
7. *Bacca*, a succulent fruit containing several seeds, and not dehiscing. It encloses the seeds without any determinate order, or it is divided by a thin membrane into cells. *Ribes*, *Garcinia*, *Hedera*, *Tilia*. *Rubus* has a compound bacca.
8. *Pomum*, a fleshy fruit that internally contains a capsule for the seed. It differs from the celled berry in having a perfect capsule in the heart. *Pyrus*.
9. *Pepo*, a succulent fruit which has its seeds attached to the inner surface of the rind. *Cucumis*, *Passiflora*, *Stratiotes*.
10. *Siliqua*, a dry elongated pericarp consisting of two valves held together by a common permanent suture. *Cruciferae*. *Silicula* is a small form of the same.
11. *Legumen*, a dry elongated pericarp consisting of two valves externally forming two sutures. *Leguminosæ*.
12. *Lomentum*, a legumen divided internally by spurious dissepiments, not dehiscing longitudinally, but either remaining always closed, as in *Cathartocarpus fistula*, or separating into pieces at transverse contractions along its length, as in *Ornithopus*.

The following are enumerated as *spurious fruits* :—

13. *Strobilus*, an amentum the scales of which have become woody. *Pinus*.
14. *Spurious capsule*. *Fagus*, *Rumex*, *Carex*.
15. *Spurious nut*. *Trapa*, *Coix*, *Mirabilis*.
16. *Spurious drupe*. *Taxus*, *Anacardium*, *Semecarpus*.
17. *Spurious bacca*. *Juniperus*, *Fragaria*, *Basella*.

By this author the names of fruits are, perhaps, more loosely and inaccurately applied than by any other.

LINK objects to applying particular names to variations in anatomical structure; observing, "that botanists have strayed far from the right road in distinguishing these terms by characters which are precise and difficult to seize. Terms are

only applied to distinct parts, as the leaf, peduncle, calyx, and stamens, and not to modifications of them. Who has ever thought of giving a distinct name to a labiate or papilionaceous corolla, or who to a pinnated leaf?" But this reasoning loses its value, when it is considered that the fruit is subject to infinitely greater diversity of structure than any other organ, and that names for these modifications are useful, for the sake of avoiding a minute explanation of the complex differences upon which they depend. Besides, to admit, as Link actually does, such names as *capsula*, &c., is abandoning the argument; and when the following definitions, which this learned botanist has proposed, are considered, I think that little doubt will exist as to whether terms should be employed in the manner recommended by himself, or with the minute accuracy of the French. According to Professor Link, the following are the limits of carpological nomenclature:—

1. *Capsula*, any dry, membranous, or coriaceous, pericarp.
2. *Capsella*, the same, if small and one-seeded.
3. *Nux*, externally hard.
4. *Nucula*, externally hard, small, and one-seeded.
5. *Drupa*, externally soft, internally hard.
6. *Pomum*, fleshy or succulent, and large.
7. *Bacca*, fleshy or succulent, and small.
8. *Bacca sicca*, fleshy when unripe, dry when ripe, and then distinguishable from the capsule by not being brown.
9. *Legumen*,
10. *Siliqua*, } the pericarps of certain natural orders.
11. *Amphispermium*, a pericarpium which is of the same figure as the seed it contains.

In more recent times there have been three principal attempts at classing and naming the different modifications of fruit; namely, those of Richard, Mirbel, and Desvaux. These writers have all distinguished a considerable number of variations, of which it is important to be aware for some purposes, although their nomenclature is not much employed in practice. But, in proportion as the utility of a classification of fruit consists in its theoretical explanation of structure

rather than in a strict applicability to practice, it becomes important that it should be founded upon characters which are connected with internal and physiological distinctions rather than with external and arbitrary forms. Viewing the subject thus, it is not to be concealed, that, notwithstanding the undoubted experience and talent of the writers just mentioned, their carpological systems are essentially defective. Besides this, each of the three writers has felt himself justified in contriving a nomenclature at variance with that of his predecessors, for reasons which it is difficult to comprehend.

If a complete carpological nomenclature is to be established, it ought to be carried farther than has yet been done, and to depend upon principles of a more strictly theoretical character. I have accordingly ventured to propose an arrangement, in which an attempt has been made to adjust the synonymes of carpological writers, and in which the names that seem to be most legitimate are retained in every case, their definitions only being altered; previously to which I shall briefly explain the methods of Richard, Mirbel, and Desvaux.

#### THE ARRANGEMENT OF RICHARD.

Class 1. Simple fruits.

§ 1. Dry.

\* Indehiscent.

\* \* Dehiscent.

§ 2. Fleshy.

Class 2. Multiplied fruits.

Class 3. Aggregate or compound fruits.

#### THE ARRANGEMENT OF MIRBEL.

Class 1. Gymnocarpian. Fruit not disguised by the adherence of any other organ than the calyx.

Ord. 1. *Carcerular*. Pericarpium indehiscent, but sometimes with apparent sutures, generally dry, superior or inferior, mostly unilocular and monospermous, sometimes plurilocular and polyspermous.

Ord. 2. *Capsular*. Pericarpium dry, superior, or inferior, opening by valves, but never separating into distinct pieces or cocci.

Ord. 3. *Dieresilian*. Pericarpium superior or inferior, dry, regular, and monocephalous (that is, having one common style), composed of several distinct pieces arranged systematically round a central real or imaginary axis, and separating at maturity.

Ord. 4. *Etarionar*. Pericarps several, irregular, superior, one- or many-seeded, with a suture at the back.

Ord. 5. *Cenobionar*. A regular fruit divided to the base into several acephalous pericarpia; that is to say, not marked on the summit by the stigmatic scar, the style having been inserted at their base.

Ord. 6. *Drupaceous*. Pericarpium indehiscent, fleshy externally, bony internally.

Ord. 7. *Baccate*. Succulent, many-seeded.

Class 2. *Angiocarpian*s. Fruit seated in envelopes not forming part of the calyx.

#### THE ARRANGEMENT OF DESVAUX.

Class 1. Pericarpium dry.

Ord. 1. Simple fruits.

§ Indehiscent.

§ § Dehiscent.

Ord. 2. Dry compound fruits.

Class 2. Pericarpium fleshy.

Ord. 1. Simple fruits.

Ord. 2. Compound fruits.

In explanation of the principles upon which the classification of fruit which I now venture to propose is founded, it will of course be expected that I should offer some observations. In the first place, I have made it depend primarily upon the structure of the ovary, by which the fruit is of necessity influenced in a greater degree than by anything



else, the fruit itself being only the ovary matured. In using the terms simple and compound, I have employed them precisely in the sense that has been attributed to them in my remarks upon the ovary; being of opinion that, in an arrangement like the following and those which have preceded it, in which theoretical rather than practical purposes are to be served, the principles on which it depends should be conformable to the strictest theoretical rules of structure. A consideration of the fruit, without reference to the ovary, necessarily induces a degree of uncertainty as to the real nature of the fruit; the abortion and obliteration to which almost every part of it is more or less subject, often disguising it to such a degree that the most acute carpologist would be unable to determine its true structure, from an examination of it in a ripe state only. In simple fruits are stationed those forms in which the ovaries are multiplied so as to resemble a compound fruit in every respect except their cohesion, they remaining simple. But, as the passage which is thus formed from simple to compound fruits is deviated from materially when the ovaries are placed in more than a single series, I have found it advisable to constitute a particular class of such, under the name of aggregate fruit. Care must be taken not to confound these with the fourth class containing collective fruits, as has been done by more carpologists than one. While the true aggregate fruit is produced by the ovaries of a single flower, a collective fruit, if aggregate, is produced by the ovaries of many flowers; a most important difference. As the pericarp is necessarily much affected by the calyx when the two adhere so as to form a single body, it is indispensable, if a clear idea is to be attached to the genera of carpology, that inferior and superior fruits should not be confounded under the same name: for this reason I have in all cases founded a distinction upon that character.

In order to facilitate the knowledge of the limits of the genera of carpology, the following analytical table will be found convenient for reference. It is succeeded by the characters of the genera in as much detail as is necessary for the perfect understanding of their application.

## CLASS I. Fruit simple. APOCARPI.

## One- or two-seeded :

Membranous, . . . . .	UTRICULUS.
Dry and bony, . . . . .	ACHENIUM.
Fleshy externally, bony internally, . . . . .	DRUFA.

## Many-seeded :

## Dehiscent :

One-valved, . . . . .	FOLLICULUS.
Two-valved, . . . . .	LEGUMEN.
Indehiscent, . . . . .	LOMENTUM.

## CLASS II. Fruit aggregate. AGGREGATI.

## Ovaria elevated above the calyx :

Pericarpia distinct, . . . . .	ETERIO.
Pericarpia cohering into a solid mass, . . . . .	SYNCARPIUM.

Ovaria enclosed within the fleshy tube of the calyx, . . . . .	CYNARRHODUM.
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## CLASS III. Fruit compound. SYNCARPI.

## Sect. 1. Superior :

## A. Pericarpium dry externally :

## Indehiscent :

One-celled, . . . . .	CARYOPSIS.
-----------------------	------------

## Many-celled :

## Dry internally :

Apteros, . . . . .	CARCERULUS.
--------------------	-------------

Winged, . . . . .	SAMARA.
-------------------	---------

Pulpy internally, . . . . .	AMPHISARCA.
-----------------------------	-------------

## Dehiscent :

By a transverse suture, . . . . .	PYXIDIUM.
-----------------------------------	-----------

By elastic cocci, . . . . .	REGMA.
-----------------------------	--------

By a longitudinal suture, . . . . .	CONCEPTACULUM.
-------------------------------------	----------------

## By valves :

Placentæ opposite the lobes of the stigma :

Linear, . . . . .	SILIQUA.
-------------------	----------

Roundish, . . . . .	SILICULA.
---------------------	-----------

Placentæ alternate with the lobes of the stigma :

Valves separating from the replum, . . . . .	CERATIUM.
--	-----------

Replum none, . . . . .	CAPSULA.
------------------------	----------

## B. Pericarpium fleshy :

## Indehiscent :

Sarcocarpium separable, . . . . .	HESPERIDIUM.
-----------------------------------	--------------

Sarcocarpium inseparable, . . . . .	NUCULANIUM.
-------------------------------------	-------------

Dehiscent, . . . . .	TRYMA.
----------------------	--------

## Sect. 2. Inferior :

## A. Pericarpium dry :

## Indehiscent :

Cells two or more, . . . . .	CREMOCARPIUM.
------------------------------	---------------

Cell one :

- |                                      |             |
|--------------------------------------|-------------|
| Surrounded by a cupulate involucrem, | GLANS.      |
| Destitute of a cupula,               | CYPSELA.    |
| Dehiscent or rupturing,              | DIPLOTEGIA. |
| B. Pericarpium fleshy :              |             |
| Epicarpium hard :                    |             |
| Seeds parietal,                      | PEPO.       |
| Seeds not parietal,                  | BALAUSTA.   |
| Epicarpium soft :                    |             |
| Cells obliterated, or unilocular,    | BACCA.      |
| Cells distinct,                      | POMUM.      |

CLASS IV. Collective fruits. ANTHOCARPI.

Single :

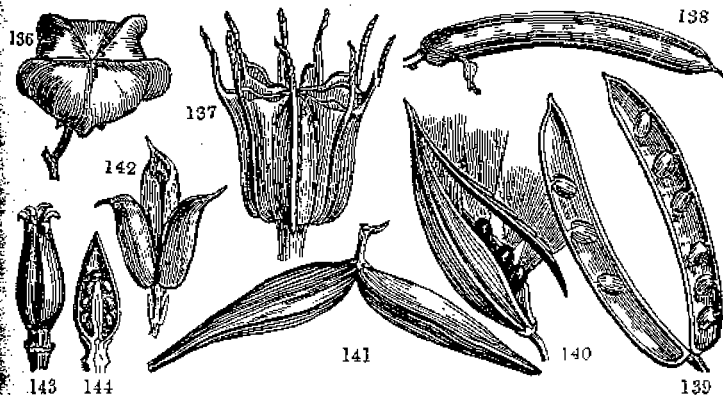
- |                            |              |
|----------------------------|--------------|
| Perianthum indurated, dry, | DICLESUM.    |
| Perianthum fleshy,         | SPHALEROCAR- |

Aggregate :

- |         |          |
|---------|----------|
| Hollow, | SYCONUS. |
|---------|----------|

Convex :

- |                       |            |
|-----------------------|------------|
| An indurated amentum, | STROBILUS. |
| A succulent spike,    | SOROSIS.   |



136. Syncarpous Capsule of *Euonymus*. 137. Apocarpous Capsule of *Nigella*. 138. Legumen.  
 139. Legumen with the two valves opened. 140. Folliculus. 141. Conceptaculum, or  
 Double Folliculus. 142. Apocarpous Capsule of *Delphinium*. 143. Capsule of *Lychnis*.  
 144. Capsule of *Lychnis* cut through, and showing the free central placentas.

CLASS I. Fruit simple. APOCARPI.

*Ovaria strictly simple ; a single series only produced by a single flower.*

I. UTRICULUS, *Gartner*. (*Cystidium*, *Link.*)

One-celled, one- or few-seeded, superior, membranous, frequently dehiscent by a transverse incision. This differs from the *pycidium* in texture, being strictly simple, *i. e.* not proceeding from an ovarium with obliterated dissepiments.

*Example.* *Amaranthus*, *Chenopodium*.

II. ACHÆNIUM. (*Akenium, of many* ; *Spermidium* ; *Xylodium, Desv.* ; *Thecidium, Mirb.* ; *Nux, Linn.*)

One-seeded, one-celled, superior, indehiscent, hard, dry, with the integuments of the seed distinct from it.

Linnaeus includes this among his seeds, defining it "semen tectum epidermide ossea." I have somewhere seen it named *Spermidium* ; a good term if it were wanted. M. Desvaux calls the nut of *Anacardium* a *Xylodium*.

*Examples.* *Lithospermum, Borago.*

III. DRUPA. *Drupe. fig. 165.*

One-celled, one- or two-seeded, superior, indehiscent, the outer coat (*nucum*) soft and fleshy, and separable from the inner or *endocarpium* (the stone), which is hard and bony ; proceeding from an ovarium which is perfectly simple. This is the strict definition of the term *drupa*, which cannot strictly be applied to any compound fruit, as that of *Cocos*, certain *Verbenaceæ*, and others, as it often is. Fruits of the last description are generally *carcerules* with a drupaceous coat. The *stone* of this fruit is the *Nux* of Richard, but not of others.

*Examples.* Peach, Plum, Apricot.

IV. FOLLICULUS. *Follicle. (Hemigyris, Desvaux ; Plopoparium, Desv.) fig. 141.*

One-celled, one- or many-seeded, one-valved, superior, dehiscent by a suture along its face, and bearing its seeds at the base, or on each margin of the suture. This differs from the *legumen* in nothing but its having one valve instead of two. The *Hemigyris* of Desvaux is the fruit of *Proteaceæ*, and differs from the *follicle* in nothing of importance. When several *follicles* are in a single flower, as in *Nigella* and *Delphinium*, they constitute a form of fruit called *Plopoparium* by Desvaux, and admitted into his *Etærio* by *Mirbel*.

*Examples.* *Pæonia, Banksia, Nigella.*

V. LEGUMEN. *Pod. (Legumen, Linn. ; Gousse, Fr.) fig. 138, 139.*

One-celled, one- or many-seeded, two-valved, superior, dehiscent by a suture along both its face and its back, and bearing its seeds on each margin of the ventral suture. This differs from the *follicle* in nothing except its dehiscing by two valves. In *Astragalus* two spurious cells are formed by the projection inwards of either the dorsal or ventral suture, which forms a sort of dissepiment ; and in *Cassia* a great number of transverse diaphragms (*phragmata*) are formed by projections of the placenta. Sometimes the *legumen* is indehiscent, as in *Cathartocarpus*, *Cassia fistula*, and others ; but the line of dehiscence is in such species indicated by the presence of sutures. When the two sutures of the *legumen* separate from the valves, they form a kind of frame called *replum*, as in *Carmichaelia*.

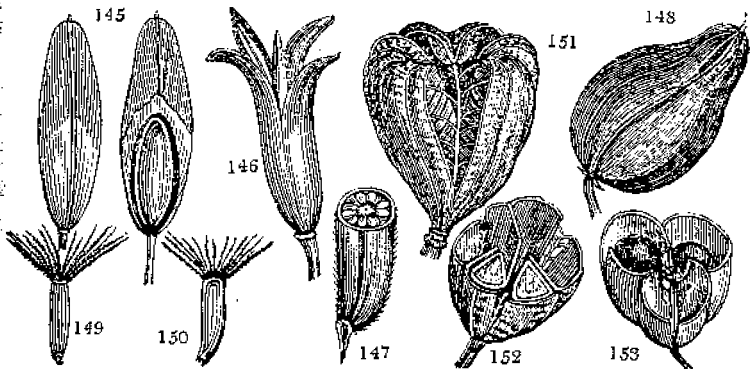
*Examples.* Bean, Pea, Clover.

VI. LOMENTUM. (*Legumen lomentaceum, Rich.*)

Differs from the *legumen* in being contracted in the spaces between such seed, and there separating into distinct pieces ; or indehiscent, but divided by

internal spurious dissepiments, whence it appears at maturity to consist of many articulations and divisions.

*Example.* Ornithopus.



145. Samara. 146. Capsule of *Rhododendron*. 147. Capsule of *Rhododendron* divided across. 148. Capsule of *Staphylea*. 149, 150. Cypselæ of *Compositæ*. 151. Capsule of *Aristolochia*. 152. Capsule of *Aristolochia* cut across. 153. Capsule of *Staphylea* cut across.

## CLASS II. Fruit aggregate. AGGREGATI.

*Ovaria strictly simple; more than a single series produced by each flower.*

### VII. ETÆRIO, *Mirb.* ("Polychorion, *Mirb.*;" Polysecus, *Desvaux*; Amalthea, *Desv.*; Erythrostomum, *Desvaux.*) *fig.* 163.

Ovaries distinct; pericarpia indehiscent, either dry upon a dry receptacle, as *Ranunculus*, dry upon a fleshy receptacle, as *Strawberry*, or fleshy upon a dry receptacle, as *Rubus*. The last is very near the syncarpium, from which it differs in the ovaria not coalescing into a single mass. It is *Desvaux's Erythrostomum*. This term is applied less strictly by *M. Mirbel*, who admits into it dehiscent pericarpia, not placed upon an elevated receptacle, as *Delphinium* and *Pæonia*; but the fruit of these plants is better understood to be a union of several follicules within a single flower. If there is no elevated receptacle, we have *Desvaux's Amalthea*. The parts of an *Etærio* are *Achenia*.

*Examples.* *Ranunculus*, *Fragaria*, *Rubus*.

### VIII. SYNCARPIUM. (*Syncarpium*, *Rich.*; *Asimina*, *Desv.*)

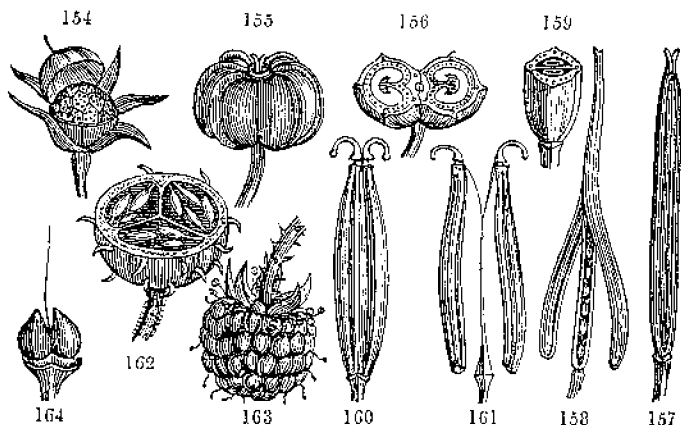
Ovaries cohering into a solid mass, with a slender receptacle.

*Examples.* *Anona*, *Magnolia*.

### IX. CYNARRHODUM. (*Cynarrhodum*, *Officin.* *Desvaux.*)

Ovaries distinct; pericarpia hard, indehiscent, enclosed within the fleshy tube of a calyx.

*Examples.* *Rosa*, *Calycanthus*.



154. Pyxidium of Anagallis. 155. Cremocarpium of Apiaceae. 156. Cremocarpium of Apiaceae cut across. 157. Siliqua of Cruciferae. 158. Siliqua of Cruciferae with the valves separating. 159. Siliqua of Cruciferae cut across. 160. Cremocarpium of Apiaceae. 161. Cremocarpium of Apiaceae with the halves separating from their axis. 162. Bucca. 163. Elaterio of Rubus. 164. Elaterio of Boraginaceae.

### CLASS III. Fruit compound. SYNCARPI.

#### *Ovaria compound.*

#### Sect. 1. Fruit superior.

##### A. Pericarpium dry.

#### X. CARYOPSIS. (Cariopsis, *Rich.*; Cerio, *Mirb.*)

One-celled, one-seeded, superior, indehiscent, dry, with the integuments of the seed cohering inseparably with the endocarpium, so that the two are undistinguishable; in the ovarium state evincing its compound nature by the presence of two or more stigmata; but nevertheless unilocular, and having but one ovulum.

*Examples.* Wheat, Barley, Maize.

#### XI. REGMA, *Mirb.* (Elaterium, *Rich.*; Capsula tricocca, *L.*)

Three or more celled, few-seeded, superior, dry, the cells bursting from the axis with elasticity into two valves. The outer coat is frequently softer than the endocarpium or inner coat, and separates from it when ripe; such regmata are drupaceous. The cells of this kind of fruit are called *cocci*.

*Example.* Euphorbia.

#### XII. CARCERULUS, *Mirb.* (Dieresilis, *Mirb.*; Cœnobio, *Mirb.*; Synochoriou, *Mirb.*; Sterignum, *Desvaux*; Microbasis, *Desvaux*; Poloxostylus, *Mirb.*; Sarcobasis, *Dec., Desv.*; Baccularius, *Desv.*)

Many-celled, superior: cells dry, indehiscent, few-seeded, cohering by a common style round a common axis. From this the Dieresilis of Mirbel does not differ in any essential degree. The same writer calls the fruit of *Labiata* (*fig. 162.*), which Linnaeus and his followers mistake for naked seeds,

Cœnobio; it differs from the Carcerulus in nothing but the low insertion of the style into the ovaria, and the distinctness of the latter.

*Examples.* Tilia, Tropæolum, Malva.

XIII. SAMARA, *Gœrtn. Key.* (*Pteridium, Mirb.; Pterodium, Desr.*) *fig.* 145.

Two or more celled, superior; cells few-seeded, indehiscent, dry; elongated into wing-like expansions. This is nothing but a modification of the Carcerule.

*Examples.* Fraxinus, Acer, Ulmus.

XIV. PYXIDIUM. (*Pyxidium, Ehr., Rich., Mirb.; Capsula circumscissa, L.*) *fig.* 154.

One-celled, many-seeded; superior, or nearly so; dry, often of a thin texture; dehiscent by a transverse incision, so that when ripe the seed and their placenta appear as if seated in a cup, covered with a lid. This fruit is one-celled by the obliteration of the dissepiments of several carpella, as is apparent from the bundles of vessels which pass from the style through the pericarpium down into the receptacle.

*Example.* Anagallis.

XV. CONCEPTACULUM. (*Conceptaculum, Linn.; Double Follicule, Mirb.*) *fig.* 141.

Two-celled, many-seeded, superior, separating into two portions, the seeds of which do not adhere to marginal placentæ, as in the folliculus, to which this closely approaches, but separate from their placentæ, and lie loose in the cavity of each cell.

*Examples.* Asclepias, Echites.

XVI. SILIQUA, *Linn.* *fig.* 157, 158, 159.

One- or two-celled, many-seeded, superior, linear, dehiscent by two valves separating from the replum; seeds attached to two placentæ adhering to the replum, and *opposite* to the lobes of the stigma. The dissepiment of this fruit is considered a spurious one formed by the projecting placentæ, which sometimes do not meet in the middle; in which case the dissepiment or phragma has a slit in its centre, and is said to be *fenestrate*.

*Examples.* Cheiranthus, Arabis.

XVII. SILICULA, *Linn.*

This differs from the latter in nothing but its figure, and in containing fewer seeds. It is never more than four times as long as broad, and often much shorter.

*Examples.* Thlaspi, Lepidium, Lunaria.

XVIII. CERATIUM. (*Capsula siliquiformis, Dec.; Conceptaculum, Desr.*)

One-celled, many-seeded, superior, linear, dehiscent by two valves separating from the replum; seeds attached to two spongy placentæ adhering to the replum, and *alternate* with the lobes of the stigma. Differs from the siliqua in the lobes of the stigma being *alternate* with the placentæ, not *opposite*. This, therefore, is regular, while that is irregular, in structure.

*Examples.* Glaucium, Corydalis, Hypecoum.

XIX. CAPSULA. *Capsule. fig.* 146, 147, 151, 152, 156, 157.

One- or many-celled, many-seeded, superior, dry, dehiscent by valves, always proceeding from a compound ovarium. The valves are variable in their

nature: usually they are at the top of the fruit, and equal in number to the cells; sometimes they are twice the number; occasionally they resemble little pores or holes below the summit, as in the *Antirrhinum*.

*Examples.* *Digitalis*, *Primula*, *Rhododendron*.

XX. AMPHISARCA. (*Amphisarca*, *Desv.*)

Many-celled, many-seeded, superior, indehiscent; indurated or woody externally, pulpy internally.

*Examples.* *Omphalocarpus*, *Adansonia*, *Crescentia*.

B. Pericarpium fleshy.

XXI. TRYMA. (*Tryma*, *Watson*.)

Superior, by abortion one-celled, one-seeded, with a two-valved indehiscent endocarpium, and a coriaceous or fleshy valveless sarcocarpium.

*Example.* *Juglans*.

XXII. NUCULANUM. (*Nuculanium*, *Rich.*; *Bacca*, *Desvaux*.)

Two or more celled, few- or many-seeded, superior, indehiscent, fleshy, of the same texture throughout, containing more seeds than one, improperly called *nucules* by the younger Richard. This differs scarcely at all from the berry, except in being superior.

*Examples.* *Grape*, *Achras*.

XXIII. HESPERIDIUM. (*Hesperidium*, *Desv.*, *Rich.*)

Many-celled, few-seeded, superior, indehiscent, covered by a spongy separable rind; the cells easily separable from each other, and containing a mass of pulp, in which the seeds are embedded. The pulp is formed by the cellular tissue, which forms the lining of the cavity of the cells: this cellular tissue is excessively enlarged and succulent, is filled with fluid, and easily coheres into a single mass. The external rind is by M. De Candolle supposed to be an elevated discus of a peculiar kind, analogous to that within which the fruit of *Nelumbium* is seated; and perhaps its separate texture and slight connexion with the cells of the fruit seem to favour this supposition. But it is difficult to reconcile with such a hypothesis the continuity of the rind with the style and stigma, which is a sure indication of the identity of their origin; and it is certain that the shell of the ovarium and the pericarpium are the same. The most correct explanation of this structure is to consider the rind a union of the epicarp and sarcocarp, analogous to that of the drupa.

*Example.* *Orange*.

Sect. 2. Fruit inferior.

A. Pericarpium dry.

XXIV. GLANS. (*Glans*, *Linn.*, *Desv.*; *Calybio*, *Mirb.*; *Nucula*, *Desvaux*.)  
*fig.* 166.

One-celled, one- or few-seeded, inferior, indehiscent, hard, dry; proceeding from an ovarium containing several cells and several seeds, all of which are abortive but one or two; seated in that kind of persistent involucre called a cupule. The pericarpium is always crowned with the remains of the teeth of the calyx; but they are exceedingly minute, and are easily overlooked.



Sometimes the gland is solitary, and quite naked above, as in the common oak; sometimes there is more than one completely enclosed in the cupule, as the beech and sweet chesnut.

*Examples.* Quercus, Corylus, Castanea.

XXV. CYPSELA. (*Akena*, Necker; *Akenium*, Rich.; *Cypsela*, Mirb.; *Stephanoum*, Desv.) fig. 149, 150.

One-seeded, one-celled, indehiscent, with the integuments of the seed not cohering with the endocarpium; in the ovarium state evincing its compound nature by the presence of two or more stigmata; but nevertheless unilocular and having but one ovulum. Such is the true structure of the Achenium; but as that term is often applied to the simple superior fruits, called Nux by Linnaeus, I have thought it better, in order to avoid confusion, to adopt the name Cypsela.

*Examples.* All Composites.

XXVI. CREMOCARPIMUM. (*Cremocarpium*, Mirb.; *Polakenium*, or *Pentakenium*, Rich.; *Carpadelium*, Desv.) fig. 155, 160, 161.

Two- to five-celled, inferior; cells one-seeded, indehiscent, dry, perfectly close at all times; when ripe separating from a common axis. M. Mirbel confines the application of cremocarpium to Umbelliferae; but it is better to let it apply to all fruits which will come within the above definition. It will then be the same as Richard's Polakenium, excluding those forms in which the fruit is superior. The latter botanist qualifies his term Polakenium according to the number of cells of the fruit: thus when there are two cells it is *diakenium*, three *triakenium*, and so on. M. De Candolle calls the half of the fruit of Umbelliferae *mericarp.*

*Examples.* Umbellifers, Aralia, Galium.

XXVII. DIPLOTEGIA. (*Diplotegia*, Desv.)

One- or many-celled, many-seeded, inferior, dry, usually bursting either by pores or valves. This differs from the capsule only in being adherent to the calyx.

*Examples.* Campanula, Leptospermum.

#### B. Pericarpium fleshy.

XXVIII. POMUM. *Apple*, or *Pome.* (*Melonidium*, Rich.; *Pyridium*, Mirb.; *Pyrenarium*, Desvaux; *Antrum*, Mœnch.) fig. 167.

Two or more celled, few-seeded, inferior, indehiscent, fleshy; the seeds distinctly enclosed in dry cells, with a bony or cartilaginous lining, formed by the cohesion of several ovaria with the sides of the fleshy tube of a calyx, and sometimes with each other. These ovaria are called Parietal by M. Richard. Some forms of Nuculanium and this differ only in the former being distinct from the calyx.

*Examples.* Apple, Cotoneaster, Crataegus.

XXIX. PEPO. (*Peponida*, Rich.)

One-celled, many-seeded, inferior, indehiscent, fleshy; the seeds attached to parietal pulpy placentae. This fruit has its cavity frequently filled at maturity

with pulp, in which the seeds are embedded; their point of attachment is, however, never lost. The cavity is also occasionally divided by folds of the placenta into spurious cells, which has given rise to the belief that in *Pepo macrocarpus* there is a central cell, which is not only untrue but impossible.

*Examples.* Cucumber, Melon, Gourd.

XXX. *BACCA*. *Berry*. (*Bacca*, *L.*; *Acrosarcum*, *Desvaux.*) *fig.* 162.

One or more celled, many-seeded, inferior, indehiscent, pulpy; the attachment of the seeds lost at maturity, when they become scattered in the substance of the pulp. This is the true meaning of the term berry; which is, however, often otherwise applied, either from mistaking nucules for seeds, or from a misapprehension of the strict limits of the term.

*Example.* *Ribes*.

XXXI. *BALAUSTA*. (*Balausta*, *Officin. Rich.*)

Many-celled, many-seeded, inferior, indehiscent; the seeds with a pulpy coat, and attached distinctly to their placentae. The rind was called *Malicorium* by *Ruellius*.

*Example.* Pomegranate.

CLASS IV. Collective Fruits. ANTHOCARPI.

*Fruit of which the principal characters are derived from the thickened floral envelopes.*

XXXII. *DICLESIMUM*. (*Dyclesium*, *Desvaux*; *Scleranthum*, *Moench*; *Cataclesium*, *Desvaux*; *Sacellus*, *Mirb.*)

Pericarpium indehiscent, one-seeded, enclosed within an indurated perianthium.

*Examples.* *Mirabilis*, *Spinacia*, *Salsola*.

XXXIII. *SPHALEROCARPUM*. (*Sphalerocarpum*, *Desvaux*; *Nux baccata* of authors.)

Pericarpium indehiscent, one-seeded, enclosed within a fleshy perianthium.

*Examples.* *Hippophæe*, *Taxus*, *Blitum*, *Basella*.

XXXIV. *SYCONUS*. (*Syconus*, *Mirb.*)

A fleshy rachis, having the form of a flattened disk, or of a hollow receptacle, with distinct flowers and dry pericarpia.

*Examples.* *Ficus*, *Dorstenia*, *Ambora*.

XXXV. *STROBILUS*. *Cone*. (*Conus*, or *Strobilus*, *Rich.*, *Mirb.*; *Galbulus*, *Gartn.*; *Arcesthide*, *Desvaux*; *Cachrys*, *Fuchs*; *Pilula*, *Pliny.*) *fig.* 168.

An amentum, the carpella of which are scale-like, spread open, and bear naked seeds; sometimes the scales are thin, with little cohesion; but they often are woody, and cohere into a single tuberculated mass.

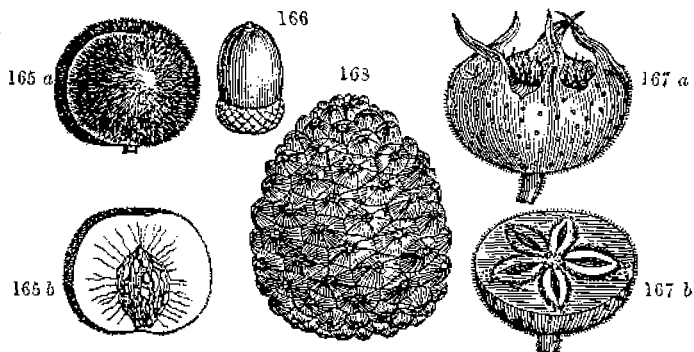
The *Galbulus* differs from the *strobilus* only in being round, and having the heads of the carpella much enlarged. The fruit of the *Juniper* is a *Galbulus* with fleshy coalescent carpella. *Desvaux* calls it *Arcesthide*.

*Example.* *Pinus*.

XXXVI. Sorosis. (Sorosis, *Mirb.*)

A spike or raceme converted into a fleshy fruit by the cohesion, in a single mass, of the ovaria and floral envelopes.

*Examples.* Ananassa, Morus, Artocarpus.



165. a, Drupa; b, vertical section.

166. Glans.

167. a, Pomum; b, horizontal section.

168. Strobilus.

## 15. Of the Seed.

The seed is a body enclosed in a pericarp, is clothed with its own integuments, and contains the rudiment of a future plant. It is the point of development at which vegetation stops, and beyond which no increase, in the same direction with itself, can take place. In a young state it has already been spoken of under the name of ovule; to which I also refer for all that relates to the insertion of seeds.

That side of a seed which is most nearly parallel with the axis of a compound fruit, or the ventral suture or sutural line of a simple fruit, is called the *face*, and the opposite side the *back*. In a compound fruit with parietal placentæ, the placenta is to be considered as the axis with respect to the seed; and that part of the seed which is most nearly parallel with the placenta, as the face. Where the raphe is visible, the face is indicated by that.

When a seed is flattened lengthwise it is said to be *compressed*, when vertically it is *depressed*; a difference which it is of importance to bear in mind, although it is not always easy to ascertain it: for this purpose it is indispensable that the true base and apex of the seed should be clearly