into the state of fruit. At its base two leaves are produced, each of which is capable of developing buds. These are flower-buds, and constitute secondary axes a' a'', ending in single flowers f'' f''', which are thus terminal and solitary; and at the base of these axes a pair of opposite leaves is

Fig. 164.
Gentianella (*Gentiana acaulis*) *a*, axis; *b*, flower, *c*, bract.

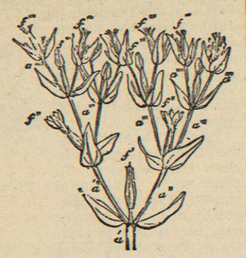

Fig. 165.
Flowering branch of *Erythræa Centaurium*.

produced, giving rise to tertiary axes a''' a''' a''', ending in single flowers f''' f''' f''', and so on. The term *dichotomous* has also been applied to this form of cyme. But these terms are not strictly correct, for here there is no dichotomous branching, although, when the terminal flower f of the generating axis has withered, an apparent dichotomy occurs; but the lateral axes on the several shoots are produced monopodially, and therefore the term is apt to lead to confusion regarding the development of the shoots. The name *dichasium* has, therefore, been substituted for the old term. In the natural order Caryophyllaceæ (Pink family) the dichasial cymose form of inflorescence is very general. In some members of the tribe, as Dianthus barbatus, D. Carthusianorum, &c., in which the peduncles are short, and the flowers closely approximated, with a centrifugal expansion, the inflorescence has the form of a contracted dichasium, and receives the name of *fascicle* (fig. 166). A

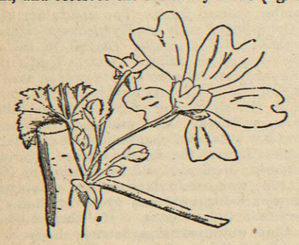

Fig. 166.
Fascicle of Mallow (*Malva sylvestris*).

similar inflorescence is seen in Xylophylla longifolia. When the axes become very much shortened, the arrangement is more complicated in appearance, and the nature of the inflorescence can only be recognized by the order of opening of the flowers. In Labiate plants, as the Dead-nettle (Lamium), the flowers are produced in the axil of each of the foliage leaves of the plant, and they appear as if arranged in a simple whorl of flowers. But on examination it is found that there is a central flower expanding first, and from its axis two secondary axes spring bearing solitary flowers; the expansion is thus centrifugal. The inflorescence is therefore a contracted dichasium, the flowers being sessile, or nearly so, and the clusters are called *verticillasters* (fig. 167).

Fig. 167.
Flowering stalk of the White Dead-nettle, (*Lamium album*) The bracts *b*, *b* are like the ordinary leaves of the plant, and produce clusters of flowers in their axil. The clusters are called verticillasters, and consist of flowers which are produced in a centrifugal manner.

Sometimes, especially towards the summit of a dichasium, owing to the exhaustion of the growing power of the plant, only one of the bracts gives origin to a new axis, the other remaining empty; thus the inflorescence becomes unilateral, and further development is arrested. In addition to the dichasial form there are others where more than two lateral axes are produced from the primary floral axis, each of which in turn produces numerous axes. To this form the terms *trichotomous* and *polytomous cyme* have been applied; but these are now usually designated *cymose umbels*. They are well seen in some species of Euphorbia. Another term, *anthela*, has been used to distinguish such forms as occur in several species of Luzula and Juncus, where numerous lateral axes arising from the primary axis grow very strongly, and develop in an irregular manner.

In the uniparous cyme a number of floral axes are successively developed one from the other, but the axis of each successive generation, instead of producing a pair of bracts, produces only a single one. The basal portion of the consecutive axes may become much thickened and arranged more or less in a straight line, and thus collectively form an apparent or false axis or *sympodium*, and the inflorescence thus simulates a raceme. In the true raceme, however, we find only a single axis, producing in succession a series of bracts, from which the floral peduncles arise as lateral shoots, and thus each flower is on the same side of the floral axis as the bract in the axil of which it is developed; but in the uniparous cyme the flower of each of these axes, the basal portions of which unite to form the false axis, is situated on the opposite side of the axis to the bract from which it apparently arises (fig. 168). This bract is not, however, the one from which the axis terminating in the flower arises, but is a bract produced upon it, and gives origin in its axil to a new axis, the basal portion of which, constituting the next part of the false axis, occupies the angle between this bract and its parent axis,—the bract from which the axis really does arise being situated lower down upon the same side of the axis with itself. The uniparous cyme presents two forms, the *scorpioid* or *cicinal* and the *helicoid* or *bostrychoid*.

In the scorpioid cyme the flowers are arranged alternately in a double row along one side of the false axis (fig. 169) the bracts when developed forming a second double

row on the opposite side, as seen in the Henbane; the whole inflorescence usually curves on itself like a scorpion's tail, hence its name. In fig. 170 is shown a diagrammatic sketch of this arrangement. The false axis, $a\ b\ c\ d$ is formed by

Fig. 168.

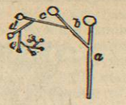

Fig. 170.

Fig. 169.

Fig. 171.

Fig. 168.—False raceme or helicoid cyme of a species of Alströmeria. a' a'' a''' a'''' are separate axes successively developed, which appear to form a simple continuous raceme, of which the axes form the internodes. It is a definite uniparous inflorescence, however, with centrifugal evolution. Each of the axes is produced in the axil of a leaf, and is terminated by a flower f' f'' f''' f'''', opposite to that leaf, and the axes have a spiral arrangement.
Fig. 169.—Scorpioidal or cicinal cyme of Forget-me-not (*Myosotis palustris*).
Fig. 170.—Diagram of definite floral axes *a*, *b*, *c*, *d*, *e*.
Fig. 171.—Flowering stalk of a kind of Ragwort (*Senecio*). The flowers are in heads (capitula), and open from the circumference inwards in an indefinite centripetal manner. The heads of flowers, on the other hand, taken collectively, expand centrifugally—the central one *a* first. Each head of flowers terminates a separate axis. They form together a corymb of capitula. The inflorescence is called mixed.

successive generations of unifloral axes, the flowers being arranged along one side alternately and in a double row; had the bracts been developed they would have formed a similar double row on the opposite side of the false axis; the whole inflorescence is represented as curved on itself. In fig. 169 the same scorpioid form of uniparous cyme is seen in the Forget-me-not, with the double row of flowers on one side of the false axis, but in this case the bracts, which should appear on the opposite side, are not developed, and hence the cyme is not complete. The inflorescences in the family Boraginaceæ are usually regarded as true scorpioid cymes. But it has been recently shown that in Myosotis (Forget-me-not) the axis is not a sympodium, but the branching takes place monopodially, therefore it should more correctly be regarded as a raceme with flowers only on one side and curving on itself. In Hyoscyamus (Henbane) and other Atropaceæ the branching is dichotomous, so that the inflorescence in this case also ought not to be regarded as a scorpioid cyme.

In the helicoid cyme there is also a false axis formed by the basal portion of the separate axes, but the flowers are not placed in a double row, but in a single row, and form a spiral or helix round the false axis. In Alströmeria, as represented in fig. 168 the axis a' ends in a flower (cut off in the figure) and bears a leaf. From the axil of this leaf, that is, between it and the primary axis a' arises a secondary axis a'', ending in a flower f'', and producing a leaf about the middle. From the axil of this leaf a tertiary floral axis a''', ending in a flower f''', takes origin. In this case the axes are not arranged in two rows along one side of the false axis, but are placed at regular intervals, so as to form an elongated spiral round it.

Compound definite inflorescences are by no means common, but in Streptocarpus polyanthus, and in several Calceolarias, we probably have examples. Here there are *scorpioid cymes of pairs of flowers*, each pair consisting of an older and a younger flower.

Forms of inflorescence occur, in which both the definite and indefinite types are represented; these, then, are *mixed* inflorescences. Thus in Composite plants, such as Hawkweeds (Hieracia) and Ragworts (Senecio, fig. 171), the *heads* of flowers, taken as a whole, are developed centrifugally, the terminal head first, while the *florets*, or small flowers on the receptacle, open centripetally, those at the circumference first. So also in Labiatæ, such as Dead-nettle (Lamium), the different whorls of inflorescence are developed centripetally, while the florets of the verticillaster are centrifugal. This mixed character presents difficulties in such cases as Labiatæ, where the leaves, in place of retaining their ordinary form, become bracts, and thus might lead to the supposition of the whole series of flowers being one inflorescence. In such cases the cymes are described as spiked, racemose, or panicled, according to circumstances. In Saxifraga umbrosa (London-pride) and in the Horse-chestnut we meet with a raceme of scorpioid cymes; in Sea-pink, a capitulum of contracted scorpioid cymes (often called a glomerulus); in Laurustinus, a compound umbel of dichasial cymes; a scorpioid cyme of capitula in Vernonia centriflora. In the catkins of the Birch we have, in reality, spikes of contracted dichasial cymes. In the Bell-flower (Campanula), there is a racemose uniparous cyme. In the Privet (Ligustrum vulgare) there are numerous racemes of dichasia arranged in a racemose manner along an axis; the whole inflorescence thus has an appearance not unlike a bunch of grapes, and has been called a *thyrsus*.

Tabular View of Inflorescence.

A. Indefinite Centripetal Inflorescence.
- I. Flowers solitary, axillary. *Vinca, Veronica hederifolia.*
- II. Flowers in groups, pedicellate.
  - 1. Elongated form (Raceme), *Hyacinth, Laburnum, Currant.*
    (Corymb), *Ornithogalum.*
  - 2. Contracted or shortened form (Umbel), *Cowslip, Astrantia*
- III. Flowers in groups, sessile.
  - 1. Elongated form (Spike), *Plantago.*
    (Spikelet), *Grasses.*
    (Amentum, Catkin), *Willow, Hazel.*
    (Spadix) *Arum*, some *Palms.*
    (Cone), *Fir, Spruce.*
    (Strobilus), *Hop.*
  - 2. Contracted or shortened form (Capitulum), *Daisy, Dandelion, Scabious.*
- IV. Compound Indefinite Inflorescence.
  - *a.* Compound Spike, *Rye-grass.*
  - *b.* Compound Spadix, *Palms.*
  - *c.* Compound Raceme, *Astilbe.*
  - *d.* Compound Umbel, *Hemlock* and most *Umbelliferæ.*
  - *e.* Raceme of Capitula, *Petasites.*
  - *f.* Raceme of Umbels, *Ivy.*

B. Definite Centrifugal Inflorescence.
- I. Flowers solitary, terminal. *Gentianella, Pæony.*
- II. Flowers in Cymes.
  - 1. Uniparous Cyme.
    - *a.* Helicoid Cyme (axes forming a spiral)
      - * Elongated form, *Alströmeria.*
      - ** Contracted form, *Witsenia corymbosa.*
    - *b.* Scorpioid Cyme (axes unilateral, two rows).
      - * Elongated form, *Forget-me-not, Symphytum. Henbane.*
      - ** Contracted form, *Erodium, Alchemilla arvensis.*

2. Biparous Cyme (Dichotomous), including 3-5-chotomous Cymes (Dichasium, Cymose Umbel, Anthela).
   a. Elongated form, *Cerastium*, *Stellaria*.
   b. Contracted form (Verticillaster), *Dead-nettle*, *Pelargonium*.
3. Compound Definite Inflorescence. *Streptocarpus polyanthus*, many *Calceolarias*.

C. Mixed Inflorescence.
1. Raceme of Scorpioid Cymes, *Horse-chestnut*.
2. Scorpioid Cyme of Capitula, *Vernonia centriflora*.
3. Compound Umbel of Dichotomous Cymes, *Laurustinus*.
4. Capitulum of contracted Scorpioid Cymes (Glomerulus), *Sea-pink*.

The flower is the *tout ensemble* of those organs which are concerned in reproduction. It is constituted by a portion of the floral axis bearing the sexual organs, usually with certain protective envelopes. The parts borne on the floral axis and composing the flower are all metamorphosed leaves, and, though usually very different in appearance from foliage leaves, their morphological resemblance is frequently shown by their developing as foliage leaves. The axis bearing the parts of the flower is usually very much contracted, no internodes being developed, and it frequently expands into a flattened or hollowed expansion termed the *thalamus* or *torus;* at other times, though rarely, the internodes are developed and it is elongated. Upon this torus the parts of the flower are arranged in a crowded manner, usually forming a series of verticils, the parts of which alternate; but they are sometimes arranged in a spiral manner, especially if the floral axis be elongated. In a typical flower, as in fig. 172, we recognize four distinct whorls of leaves:—an outer whorl of five parts, the *calyx;* within it, another whorl of five parts alternating with those of the outer whorl, the *corolla;* next comes a whorl of parts alternating with the parts of the corolla, the *androecium;* and in the centre is the *gynœcium*. Fig 173 is a diagrammatic representation of the arrangement of the parts of such a flower. The flower is supposed to be cut transversely, and the parts of each whorl are distinguished by a different symbol. Of these whorls the two internal, forming the male and female sexual organs, constitute the *essential* organs of reproduction; the two outer whorls are the protective coverings or *floral envelopes*. The calyx or outer covering (fig. 172, *c*) is formed of leaves, called *sepals*, which are generally of a greenish colour. The corolla *p*, the next covering, is composed of leaves, called *petals*, which are often showy, and normally alternate with the sepals. Sometimes, as in many Monocotyledons, the calyx and corolla both display rich colouring, and are apt to be confounded. In such cases the term *perianth*, or *perigone*, has been applied to avoid ambiguity. Thus, in the Tulip, Crocus, Lily, Hyacinth, authors speak of the parts of the perianth, in place of calyx and corolla, although in these plants an outer whorl (calyx) may be detected, of three parts, and an inner (corolla), of a similar number, alternating with them. When the parts of the calyx are in appearance like petals they are said to be *petaloid*, as in Liliaceæ. In some cases the petals have the appearance of sepals, then they are *sepaloid*, as in Juncaceæ. The term perianth is usually confined to the flowers of Monocotyledons, whatever colour they present, whether green, as in Asparagus, or coloured, as in Tulip. Some use the term perianth as a general one, and restrict the use of perigone to cases where a pistil only is present. In plants, as Nymphæa alba, where a spiral arrangement of the floral leaves occur, it is not easy to say where the calyx ends and the corolla begins, as these two whorls pass insensibly into each other. When both calyx and corolla are present, the plants are *dichlamydeous;* occasionally one becomes abortive, and then the flower is *monochlamydeous* (fig. 174), having a calyx only, or *apetalous*, having no petals. At times both are abortive, and then the flower is *achlamydeous*, or naked. It is important to remember that if only one perianth-whorl is present it is the calyx. The outermost whorl of the essential organs, collectively termed the *andrœcium*, is composed of a series of leaves

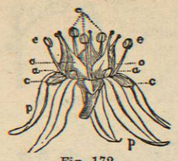

Fig. 172.


Fig. 173.


Fig. 174.

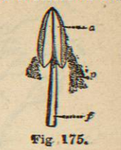

Fig. 175.

Fig. 176.

Fig. 172.—Flower of *Crassula rubens*. *c*, *c*, sepals; *p*, *p*, petals; *e*, *e*, stamens; *o*, *o*, carpels, each of them having a small scale-like appendage *a* at the base.

Fig. 173.—Diagram of a completely symmetrical flower, consisting of four whorls, each consisting of five parts. The outer row is the calyx formed of five sepals; the second is the corolla of five petals, alternating with the sepals; the third is the androecium, consisting of five stamens, alternating with the petals; the central whorl is the gynœcium, consisting of five carpels, alternating with the stamens.

Fig. 174.—Monochlamydeous (apetalous) flower of Goosefoot (*Chenopodium*), consisting of a single perianth (calyx) of five parts, enclosing five stamens, which are opposite the divisions of the perianth, owing to the absence of the petals.

Fig. 175.—Stamen, consisting of a filament (stalk) *f* and an anther *a*, containing powdery matter *p*, denominated pollen, which is discharged through slits in the two lobes of the anther.

Fig. 176.—The pistil of Tobacco (*Nicotiana Tabacum*), consisting of the ovary *o*, containing ovules, the style *s*, and the capitate stigma *g*. The pistil is placed on the receptacle *r*, at the extremity of the peduncle.

distinguished as the staminal leaves or *stamens*. These are the male sexual organs. In their most differentiated form each consists of a stalk, either filiform or foliaceous, the *filament* (fig. 175, *f*) supporting at its summit a lobed saccate mass, the *anther* (fig. 175, *a*), which contains a powdery matter, the *pollen* (fig. 175, *p*), which is discharged therefrom. In many cases, however, the staminal leaf resembles more nearly a cataphyllary leaf, bearing the pollen-sacs scattered over its surface, as in Cycadaceæ. The *gynœcium* or *pistil* is the central portion of the flower, and is the female sexual organ. It consists of one or more folded leaves, called *carpels*, either separate (fig. 172, *c*) or combined (fig. 174.) The parts distinguished in the pistil are the *ovary* (fig. 176, *o*), which is the lower portion enclosing the *ovules* destined to become seeds, and the *stigma* (fig. 176, *g*), a portion of loose cellular tissue uncovered by epidermis, which is either sessile on the apex of the ovary, as in the Poppy, or is separated from it by a prolonged portion called the *style* (fig. 176, *s*). The andrœcium and gynœcium are not present in all flowers. When both are present the flower is *hermaphrodite;* and in descriptive botany such a flower is indicated by the symbol ☿. When

only one of those organs is present the flower is *unisexual* or *diclinous*, and is either male (*staminate*), ♂, or female (*pistillate*), ♀. A flower then normally consists of the four whorls of leaves,—calyx, corolla, andrœcium, and gynœcium,—and when these are all present the flower is *complete*. These several whorls of the flower are usually densely crowded upon the thalamus, but in some instances, after apical growth has ceased in the axis, an elongation of portions of the receptacle by intercalary growth occurs, by which changes in the position of the parts may be brought about. Thus in Lychnis an elongation of the axis betwixt the calyx and the corolla takes place, and in this way they are separated by an interval. Again, in Passiflora the stamens are separated from the corolla by an elongated portion of the axis, which has consequently been termed the *androphore;* and in Passiflora, Fraxinella (fig. 177), Capparidaceæ, and some other plants, the ovary is raised upon a distinct stalk termed the *gynophore;* it is thus separated from the stamens, and is said to be *stipitate*. The apical growth of the floral axis in the flower soon ceases, and therefore the parts are arranged in whorls; but at times, as in the Ranunculaceæ, Magnoliaceæ, &c., the growth is of sufficient duration to permit a spiral arrangement of parts. Usually the successive whorls of the flower disposed from below upwards or from without inwards upon the floral axis are of the same number of parts, or are a multiple of the same number of parts, those of one whorl alternating with those of the whorls next it.


Fig. 177.

Calyx and pistil of Fraxinella (*Dictamnus Fraxinella*). The pistil consists of several carpels, which are elevated on a stalk prolonged from the receptacle. The stalk is called gynophore or thecaphore.

When a flower consists of parts arranged in whorls it is said to be *cyclic*, and if all the whorls have an equal number of parts and are alternate it is *encyclic*. In contrast to the cyclic flowers are those, as in Magnoliaceæ, where the parts are in spirals. When in such a flower the transition from one foliar structure to another, *i.e.*, from calyx to corolla, from corolla to stamens, &c., does not coincide with a definite number of turns of the spiral it is said to be *acyclic;* if it does so correspond it is termed *hemicyclic;* the latter term also includes flowers which are cyclic at one portion and spiral at another, as in many Ranunculaceæ. In spiral flowers the distinction into whorls is by no means easy, and usually there is a gradual passage from sepaloid through petaloid to staminal parts, as in Nymphæaceæ (figs. 178, 179), although in some plants

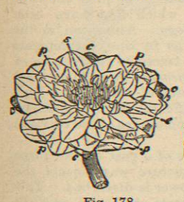

Fig. 178.

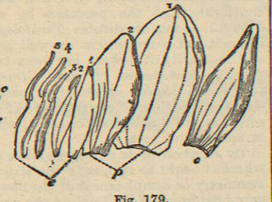

Fig. 179.

Fig. 178.—Flower of *Nymphæa alba*, White Water-lily. *c*, *c*, *c*, *c*, the four foliola of the calyx or sepals; *p*, *p*, *p*, *p*, petals; *e*, stamens; *s*, pistil.

Fig. 179.—Parts of the flower separated to show the transition from the green sepals of the calyx *c*, and the white petals of the corolla *p*, to the stamens *e*. The latter present changes from their perfect state, *5*, through intermediate forms, *4*, *3*, *2*, and *1*, which gradually resemble the petals.

there is no such distinction, the parts being all petaloid, as in Trollius. We may again note here that some regard the cone in Coniferæ and Cycadaceæ as a single flower, and in that case the whorls are much separated and arranged spirally along the floral axis. Normally, the parts of successive whorls alternate; but in some cases we find the parts of one whorl opposite or *superposed* to those of the next whorl. In some cases, as in the Ampelideæ, this seems to be the ordinary mode of development, but in Caryophyllaceæ the superposition of the stamens on the sepals in many plants seems to be due to the suppression or abortion of the whorl of petals, and this idea is borne out by the development, in some plants of the order, of the suppressed whorl. In Primulaceæ, again, where there is a superposition of stamens and petals the abnormality is due apparently to another cause. The petals are developed after the stamens, and are to be regarded as appendages from them, of the same nature as the appendages to the stamens in Asclepiadaceæ, so that morphologically in Primulaceæ, according to this view, there are no petals. As a rule, whenever we find the parts of one whorl superposed to those of another we may suspect some abnormality. Frequently, when parts are superposed they become adherent to one another; thus the stamens become adherent to the petals or are *epipetalous*, or to the sepals and are *episepalous*.

A flower is said to be *symmetrical* when each of its whorls consists of an equal number of parts, or when the parts of any one whorl are multiples of that preceding it. Thus, a symmetrical flower may have five sepals, five petals, five stamens, and five carpels, or the number of any of these parts may be ten, twenty, or some multiple of five. Fig. 173 is a diagram of a symmetrical flower, with five parts in each whorl, alternating with each other. In fig. 180 there is a section of a symmetrical flower of Stone-crop, with five sepals, five alternating petals, ten stamens, and five carpels. Here the number of parts in the staminal whorl is double that in the others, and in such a case the additional five parts form a second row alternating with the others. In the staminal whorl especially it is common to find additional rows. In fig. 181 there is a

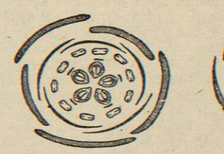
Fig. 180.

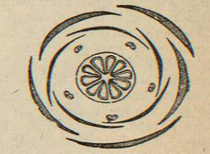
Fig. 181.

Fig. 180.—Diagrammatic section of a symmetrical pentamerous flower of Stone-crop (*Sedum*), consisting of five sepals externally, five petals alternating with the sepals, ten stamens in two rows, and five carpels containing seeds. The dark lines on the outside of the carpels are glands.

Fig. 181.—Diagram of the flower of Flax (*Linum*., consisting of five sepals; five petals, five stamens, and five carpels, each of which is partially divided into two. It is pentamerous, complete, symmetrical, and regular.

symmetrical flower, with five parts in the three outer rows, and ten divisions in the inner. In this case it is the gynœcium which has an additional number of parts. Fig. 182 shows a flower of Heath, with four divisions of the calyx and corolla, eight stamens in two rows, and four divisions of the pistil. In fig. 183 there are three parts in each whorl; and in figs. 184 there are three divisions of the calyx, corolla, and pistil, and six stamens in two rows. In all these cases the flower is symmetrical. Where, as in the Stone-crop, an extra row of parts is developed in any whorl they may be either formed in regular succession within the first row, or they may be *interposed* to them, *i.e.*, formed between them, or even external to and beneath them. We have examples of the former in many Caryophyllaceous plants, the latter being well seen in Crassulaceæ, Geraniaceæ, &c In Monocotyledons it

usual for the staminal whorl to be double, it rarely having more than two rows, whilst amongst Dicotyledons there are often very numerous rows of stamens. The floral envelopes are rarely multiplied. Flowers in which the number of parts

Fig. 182.

Fig. 183.

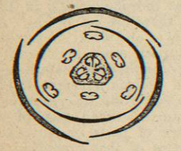

Fig. 184.

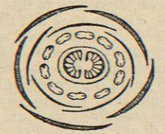

Fig. 185.

Fig. 182.—Diagram of the flower of Heath (*Erica*), having four sepals, four divisions of the corolla, eight stamens in two rows, and four divisions of the pistil. The flower is tetramerous, complete, symmetrical, and regular.

Fig. 183.—Diagram of the trimerous symmetrical flower of Iris. There are three alternating divisions of each whorl. Below is a single bract.

Fig. 184.—Diagram of the symmetrical trimerous flower of Fritillary, having three divisions of the two outer whorls, and of the pistil in the centre, and six stamens in two rows.

Fig. 185.—Diagram of the flower of Saxifrage (*Saxifraga tridactylites*). The calyx and corolla consist of five parts, the stamens are ten in two rows, while the pistil has only two parts developed. The flower is, nevertheless, called symmetrical, although the outer whorls are pentamerous, and the central one dimerous.

in each whorl is the same, are *isomerous* (of equal number); when the number in some of the whorls is different, the flower is *anisomerous* (of unequal number). The pistilline whorl is very liable to changes. It frequently happens that when it is fully formed, the number of its parts is not in conformity with that of the other whorls. In such circumstances, however, a flower has been called symmetrical, provided the parts of the other whorls are normal, —the permanent state of the pistil not being taken into account in determining symmetry. Thus, fig. 185 shows a pentamerous symmetrical flower, with dimerous pistils. Symmetry, then, in botanical language, has reference to a certain definite numerical relation of parts. A flower in which the parts are arranged in twos, is called *dimerous*, the symmetry being *binary* and the arrangement marked thus $\frac{2}{}$. This may be considered either as analogous to opposite decussating leaves, or as composed of distichous alternate leaves belonging to the one-half series. When the parts of the floral whorls are three, the flower is *trimerous*, and the symmetry being *ternary* or trigonal is marked $\frac{3}{}$. This may be looked upon as composed of verticillate leaves, or of tristichous alternate leaves with the angular divergence $\frac{1}{3}$. When floral whorls have parts in a series of four, the flower is *tetramerous*, its symmetry being *quaternary*, and marked $\frac{4}{}$. A *pentamerous* flower, marked $\frac{5}{}$, has *quinary* or *pentagonal* symmetry. The symmetry which is most commonly met with in the vegetable kingdom is trimerous and pentamerous—the former occurring generally among Monocotyledons, the latter among Dicotyledons. Dimerous or tetramerous symmetry occurs also among Dicotyledonous plants, and the numbers 2 and 4 prevail in the reproductive organs of Acotyledons. The various parts of the flower have a certain definite relation to the axis. Thus, in axillary tetramerous flowers (fig. 182), one sepal is next the axis, and is called *superior* or *posterior*; another is next the bract, and is *inferior* or *anterior*, and the other two are *lateral*; and certain terms are used to indicate that position. A plane passing through the anterior and posterior sepal and through the floral axis is termed the *median plane* of the flower; a plane cutting it at right angles, and passing through the lateral sepals, is the *lateral plane*; whilst the planes which bisect the angles formed by the lateral and median planes are the *diagonal planes*, and in these flowers the petals which alternate with the sepals are cut by the diagonal planes.

In a pentamerous flower one sepal may be superior, as in the calyx of Rosaceæ and Labiatæ; or it may be inferior, as in the calyx of Leguminosæ (fig. 186),—the reverse, by the law of alternation, being the case with the petals. Thus, in the blossom of the Pea (fig. 187), the odd petal (vexillum) *st* is superior, while the odd sepal is inferior. In the Figwort order one of the two carpels is posterior and the other anterior, whilst in Convolvulaceæ the carpels are arranged laterally. Sometimes the twisting of a part makes a change in the position of other parts, as in Orchids, where the twisting of the ovary changes the position of the labellum. When the different members of each whorl are like in size and shape, the flower is said to be *regular*; while differences in the size and shape of the parts of a whorl make the flower *irregular*, as in the Papilionaceous flower, represented in fig. 187. When a flower can be divided by a single median plane into two exactly similar parts, then it is said to be *zygomorphic*. Such flowers as Papilionaceæ, Labiatæ, are examples. In contrast with this are *polysymmetrical* flowers, which can be divided by several planes into several exactly similar portions; such are all regular, symmetrical flowers. When the parts of any whorl are not equal to or some multiple of the others, then the flower is *unsymmetrical*. This want of symmetry may be brought about in various ways. A consideration of the various unsymmetrical, irregular, and incomplete forms of the flower, and the processes by which they have been brought about, constitutes *Teratology*. Alteration in the symmetrical arrangement as well as in the completeness and regularity of flowers has been traced to *suppression* or the *non-development* of parts, *degeneration* or imperfect formation, *cohesion* or union of parts of the same whorl, *adhesion* or union of the parts of different whorls, *multiplication* of parts, and *deduplication* (sometimes called *chorisis*) or splitting of parts.

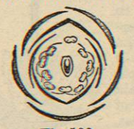

Fig. 186.

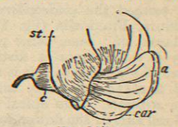

Fig. 187.

Fig. 186.—Diagram of flower of Sweet-pea (*Lathyrus*), showing five parts of the calyx, of which two are superior, one inferior, and two lateral; five parts of the corolla, of which one is superior, two inferior, and two lateral; ten stamens in two rows; one carpel, in consequence of four being undeveloped.

Fig. 187.—Flower of Pea (*Pisum sativum*), showing a papilionaceous corolla, with one petal superior, *st*, called the standard (vexillum), two inferior, *car*, called the keel (carina), and two lateral, *a*, called wings (alæ). The calyx is marked *c*.

By *suppression* or non-appearance of a part at the place where it ought to appear if the structure was normal, the symmetry or completeness of the flower is disturbed. This suppression when confined to the parts of certain verticils makes the flower unsymmetrical. Thus, in the flowers of Staphylea there are five parts of the calyx, five petals, five stamens, and only two carpels; in many Caryophyllaceæ, as Polycarpon and Holosteum, while the calyx and corolla are pentamerous, there are only three or four stamens and three carpels; in Impatiens noli-me-tangere the calyx is

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