

fully made out, these three last may form a small group intermediate between the Sertularians and the Campanularians.

I have sent a specimen of *Reticularia* to the British Museum.

EXPLANATION OF PLATE XVI. A.

Fig. 1. *Coppinia arcta*. Two full-grown polyps and polyp-cells; another forming between them.

Fig. 2. *Reticularia immersa* investing a polyp-cell of *Sertularia abietina*.

Fig. 3. Portion of the crust still more enlarged.

XLIII.—*Observations on Relative Position; including a new Arrangement of Phanerogamous Plants.* By B. CLARKE, F.L.S. &c.

[Continued from p. 200.]

[With three Plates.]

PART III.

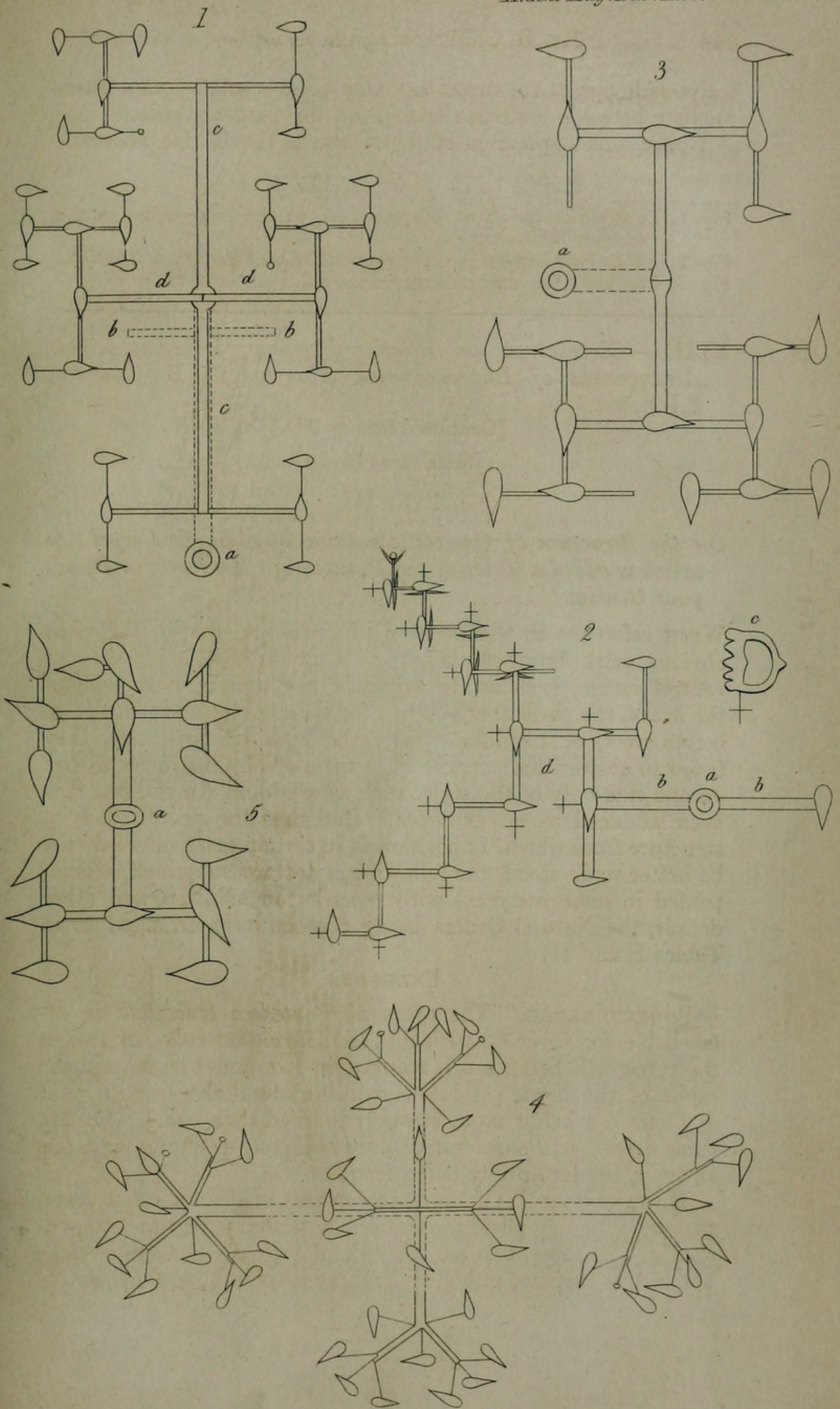
On the Structure of Ovaries consisting of a Single Carpel; to which is added a Table of the Position of the Carpels in Dicar-pous Ovaries.

WITH reference to the position of the single carpel, the most obvious mark has been taken as a guide to the placenta or ventral suture, such as the origin of the style from one side of the ovary, the parietal attachment of the ovules; and when from being erect, or pendulous from the apex of the ovary, they failed to answer this purpose, the existence of a furrow or fissure on one side only of the style, such as occurs in *Amygdaleæ*, has been adduced as an evidence. But that the peculiarities of structure from which its position is in certain cases inferred may be better understood, the following notes are subjoined, accompanied in some instances with remarks on affinities and other details, the Natural Orders being consecutively arranged as in Tables I. and II.

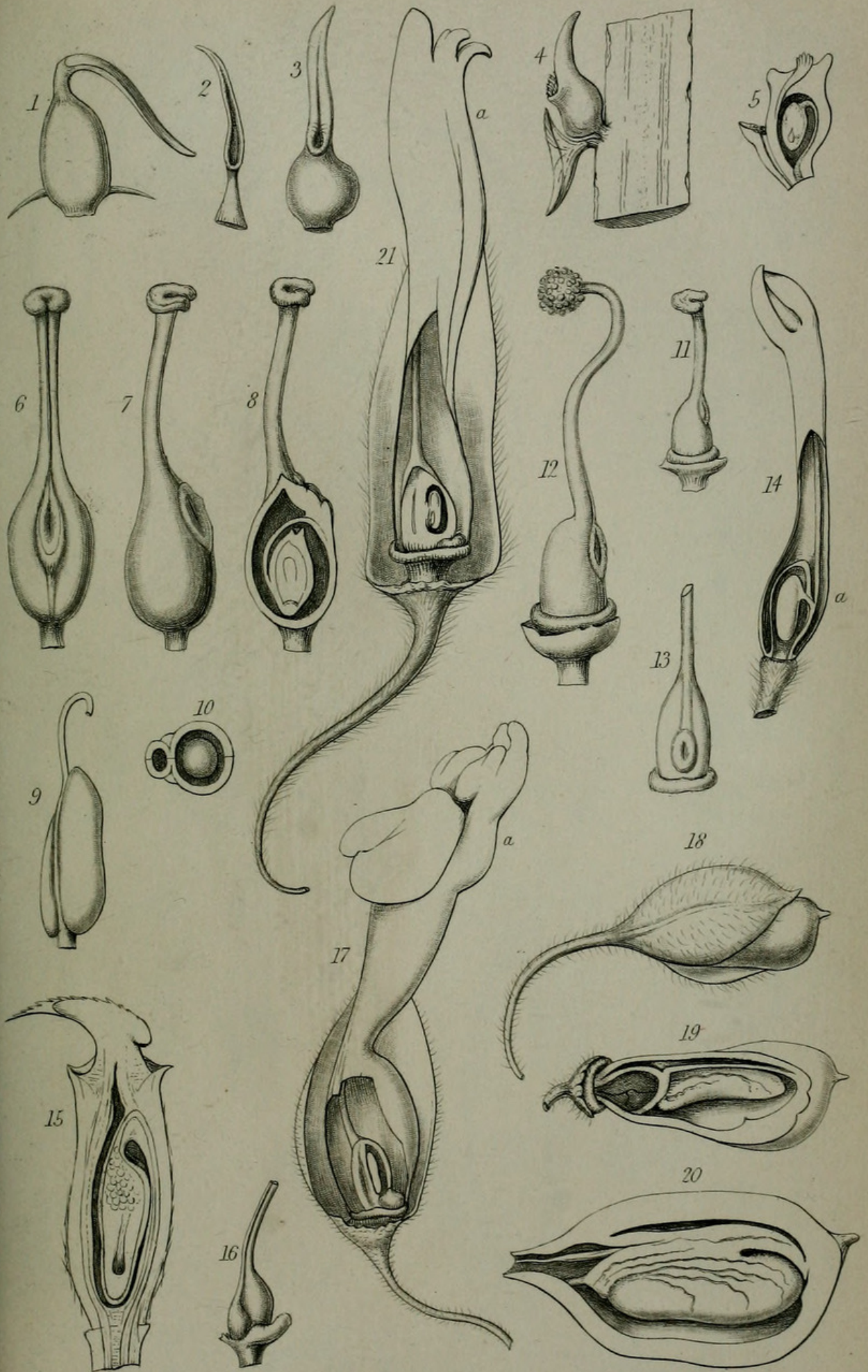
ENDOGENS.

PONTEDERACEÆ. The ovary of *Pontedera lanceolata* is remarkable for agreeing with that of *Centranthus ruber* in two of the three cells being much reduced in size and barren, and the raphe of the single pendulous ovule is lateral also in both, that of *Pontedera* being more strongly marked than usual. Of the three carpels of *Pontedera*, two are obliquely posterior and one anterior, the latter only being fertile.

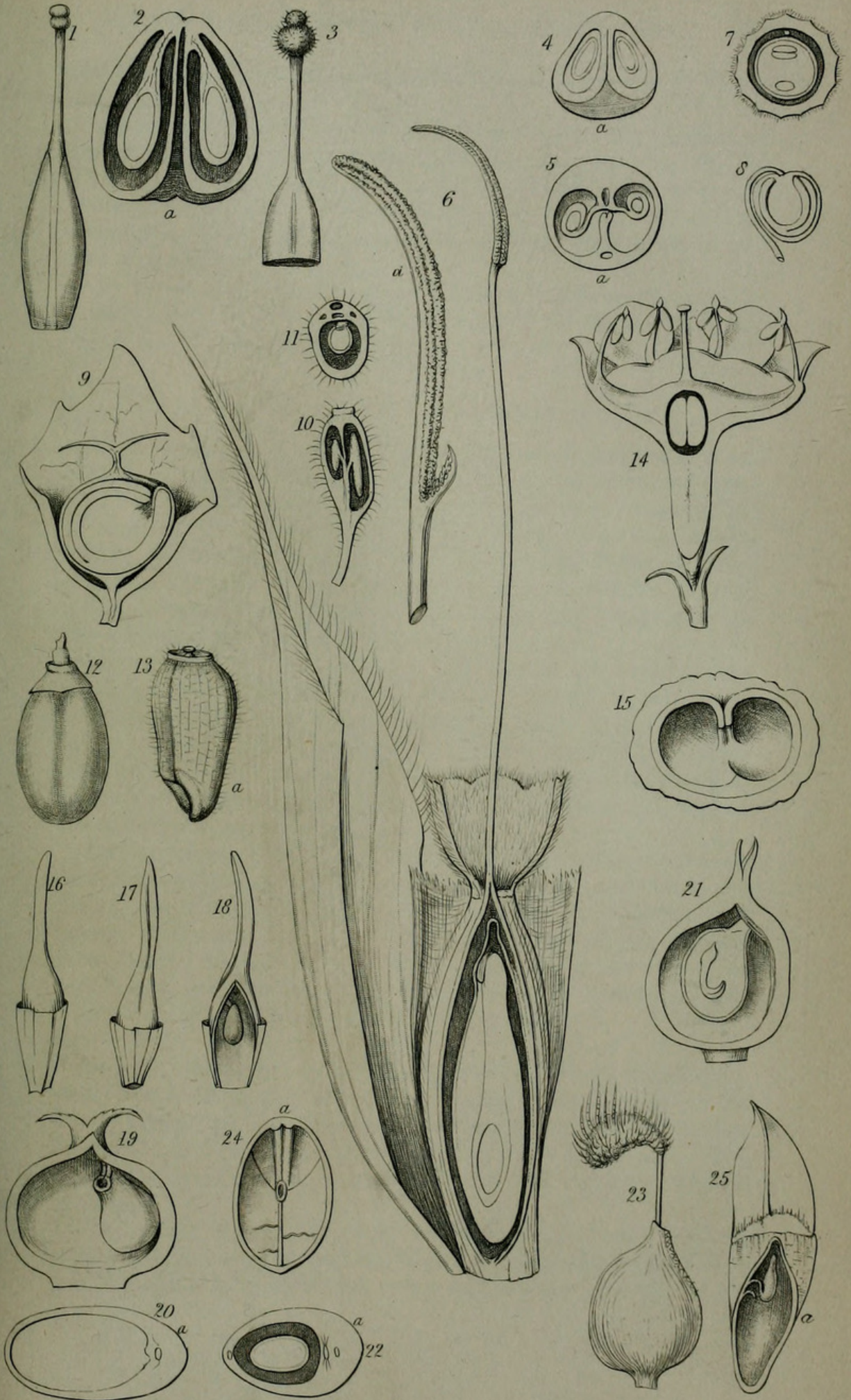
MARANTACEÆ. Of the three carpels of *Maranta dichotoma*, two are obliquely posterior and one anterior, with but little variation. Of these, two are barren and their cavities suppressed; but in this instance either of the three carpels is indifferently the











fertile one, and on this account *Maranta* is considered as Heterocarpous.

ARACEÆ. In this and in the allied families the position of the carpels when two appears variable; thus, in a species of *Pothos* all are right and left; in a *Wallichia* they are anterior and posterior, with very rare exceptions; and in dicarpous ovaries frequently occurring in *Sparganium ramosum*, they are variable and sometimes oblique.

In *Typha* and *Sparganium* the single carpel is very frequently posterior, and in *Arum* I have endeavoured to show always so. (See Part IV. *Arum maculatum*.)

HETEROCARPOUS EXOGENS.

This division, although several nearly allied families are excluded, is yet in itself a natural assemblage; the connexion however between the Gentianal and Nymphal Alliances is weak, but as some of the genera of Orobanchaceæ have the placentation dorsal, there may be a direct affinity existing between them. (See also Part IV. *Hydropeltis*.) *Villarsia nymphæoides* also corresponds with *Nymphæa alba* in the ovules being horizontal with the raphe for the most part on the upper surface.

GENTIANACEÆ. In *Leianthus* the carpels are anterior and posterior, and also in *Erythræa littoralis*, but in *E. centaurium* occasionally right and left, and *Chlora perfoliata* agrees with the latter species. *Chironia* and *Villarsia* also form partial exceptions to the lateral position of the carpels in this family in presenting an irregular arrangement, some of the carpels being anterior and posterior and others oblique.

CERATOPHYLLACEÆ. In *Ceratophyllum* a transverse section of the ovary presents no appearance by which the position of the carpel can be determined, but the stigma is unilateral and curves posteriorly with but little variation, sometimes curving down behind the ovary; in addition to this it is grooved more or less deeply, and this groove deepens towards the base in front. The posterior surface is rounded and not stigmatic. (Pl. XIV. figs. 1 & 2.)

But the attachment of the female flowers and young branches is somewhat different, each bud or young branch arising from the axil of a leaf, but the female flowers rather from the stem between two leaves: whether this should be taken into consideration in determining the position of the carpel remains a question.

CHLORANTHACEÆ. The only indication of the position of the carpel in *Chloranthus* is that the stigmatic tissue obliquely crosses the thickened summit of the ovary and always descends on its

anterior side. The ovule has obviously the appearance of being suspended from a funiculus arising in the base of the ovary and adherent to its dorsum. (Pl. XIV. fig. 5.)

PIPERACEÆ. In fully developed ovaries of *Piperomia magnoliaefolia* the stigma is always grooved on its anterior surface, but is rounded posteriorly; this furrow is also prolonged down to the ovary terminating in a small depression on its summit. (Pl. XIV. figs. 3 & 4.)

The ovary also nearly resembles that of *Houttuynia cordata* when reduced to a single carpel, which leaves no reason to doubt but that in Piperaceæ the carpel is posterior.

SAURURACEÆ. In almost all the spikes of *Houttuynia cordata* there are in the upper part dicarpous ovaries, the carpels of which are for the most part anterior and posterior, but occasionally right and left; in sixteen instances (these being all that were observed of ovaries reduced to a single carpel) it was always directly posterior, no trace of a second being present.

RANUNCULACEÆ. In *Actæa* the greater part are lateral, otherwise indifferently anterior or posterior.

DILLENIACEÆ. Variable, or more frequently posterior.

MAGNOLIACEÆ. In *Tasmannia* variable from anterior to posterior.

MENISPERMACEÆ. The ovary of *Menispermum laurifolium* consists of three carpels, one anterior and two obliquely posterior, and when reduced to a single carpel its position varies from anterior to obliquely posterior.

ANACARDIACEÆ. In three genera variable, and in *Malosma* more frequently posterior than anterior. *Spondias*, which has been regarded as the type of a distinct family, agrees with Anacardiaceæ in having the raphe averse.

LAURACEÆ. The ovary of *Sassafras officinale* closely resembles that of *Prunus* and other Amygdaleæ, the stigma being capitate, and the style furrowed on one side and rounded on the other. In *S. officinale* there is also at the base of the style a small depression in which the furrow in the style terminates; the capitate stigma is also somewhat notched by the furrow extending into its margin, and the ovule is attached to the same side of the ovary at or below the depression at the base of the style (Pl. XIV. figs. 6, 7 & 8). The carpel is variable in its position, being frequently posterior, but in *Laurus nobilis* it is for the most part lateral.

Notwithstanding this near approach in structure to Amygdaleæ, the carpels in a dicarpous ovary of *S. officinale* appeared to be united by their edges forming a one-celled ovary, the styles being also partially united. In *Tetranthera* also the ovary consists of a single carpel.

SANTALACEÆ and LORANTHACEÆ. In *Thesium* the funiculus is either anterior, posterior or lateral, and such also are its variations of position in *Mysodendron*, two of the ovules being rudimentary (or wanting?), and I believe also in *Loranthus*. So nearly do these families approach each other, that it is a question if they are really distinct; for although in *Mysodendron* the nucleus is destitute of integuments, yet it is inverted, the funiculus being attached to it on the averse side relatively to the central placenta, from which attachment a thickened rib descends to its lower extremity; the embryo also is at the upper part of the nucleus, and the funiculus curves over the embryonal sac to reach its point of attachment (vide fig. 3 in Plate II.). The apparent calyx of *Mysodendron* may be regarded as bracts originating at the base of the ovary and adhering to its sides, as an analogous structure occurs in *Abelia* and *Linnaea*, where the bracts are not adherent. And although in Santalaceæ this character is wanting, yet there is a tendency to adhesion of the bracts as in *Thesium*, where they are adherent to the peduncles in the greater part of their extent. The adhesion of bracts to peduncles is also a common occurrence in Loranthaceæ, which offers an explanation for those situated at the base of the ovary becoming adherent to its sides.

ELÆAGNACEÆ. *Hippophaë* variable and more frequently posterior; *Elæagnus* variable and more frequently anterior.

STILBACEÆ. Having expressed an opinion that in this family the female flowers are apetalous, I can now add that a more recent examination of the species of *Stilbe* leaves no reason to doubt that they are really so, and also leads to the supposition that the flowers consist principally, if not entirely, of hermaphrodites and females; it becomes a question therefore whether Empetraceæ might not be associated with them, and possibly Batideæ. In *Stilbe* the smaller cell is sometimes entirely suppressed, and the fertile cell in some species is almost uniformly posterior, being only occasionally anterior. (Pl. XIV. figs. 9 & 10.)

LYTHRACEÆ. In *Peplis* nearly all right and left; in *Lythrum* most frequently anterior and posterior; and in *Pleurophora* always so. In *P. pungens* the larger cell is always posterior, the anterior being sometimes almost suppressed.

PODOSTEMACEÆ. This Order is placed near Lythraceæ as being an apetalous form of it; the stamens are distinct or monadelphous in both; in Lythraceæ the posterior stamens are sometimes deficient, and this may prove to be an explanation of the unilateral position of the stamens occurring in Podostemaceæ; and it seems doubtful if there exists any differential character in the ovary and ovules.

NYCTAGINEÆ. In the ovary of *Mirabilis* a flattened tuberosity with a depression in its centre, situated at the base of the style, shows the ventral side of the carpel, the stigma curving down on the opposite side (Pl. XIV. figs. 11, 12 & 13). The relative position of the ovary is more evident if the flower is examined in an early stage some time before it expands, as the style at the time of expansion becomes much elongated and loses its curvature. The carpel is always lateral and internal (Pl. XIII. fig. 3), *i. e.* its dorsum is next the internal branch of the dichotomy, between the forking of which the flower is situated; and *Cuphea* may be considered as analogous to *Mirabilis* in the position of its larger cell*. From this peculiarity Nyctagineæ are placed in connection with the Silenæ instead of with the Urtical Orders.

SALVADORACEÆ. The affinities of *Salvadora* have by most writers been considered as uncertain, but supposing the raphe to be next the placenta, the position of the fertile carpel would then nearly agree with that of *Plumbago*, being however not so frequently posterior. Its foliage also agrees with that of some species of *Statice* in having a granulated appearance, and two or three species have dotted leaves resembling those occasionally occurring in Myrsinaceæ.

PLUMBAGINEÆ. In *Plumbago* and *Statice* the position of the funiculus is variable, being anterior, less frequently lateral, and rarely posterior; the mode of growth in *Statice* is however complicated, which occasions its position in that genus to be less obvious.

BRUNONIACEÆ. This genus, usually considered as belonging to the epigynous series, if not of uncertain affinity, should rather, I would suggest, be arranged with Primulaceæ and its allies for the following reasons. The position of the raphe in *Brunonia* agrees nearly with that of the funiculus in *Plumbago* in being anterior or lateral, rarely posterior, from which it may be inferred, that in both these genera the fertile carpel is variable from anterior to posterior, the latter position predominating (Pl. XIII. fig. 5). *Brunonia* may also be regarded as approaching Dipsacæ in having the same mode of growth as *Morina* and Valerianaceæ, *i. e.* regularly dichotomous, each capitulum in *Brunonia* consisting of six or eight fascicles, each of which contains a centre of growth, the ramifications of which are formed by the pedicel of each flower in succession becoming the axis of the two succeeding; the scales also surrounding the calyx may be compared to the involucre of Dipsacæ, and in the adhesion of the anthers an analogy may be traced with Calyceraceæ.

* The irregularity of the flower in *Cuphea* is considered to be from side to side, and the mode of growth irregularly dichotomous, each flower being terminal.

PLANTAGINÆÆ. In *Littorella* the axils are three-flowered, the central being axis to the two lateral; in this family the raphe is next the placenta, but it is here feebly marked, and I can only say that it is variable, being rarely, but I believe occasionally, anterior, from which it would appear that the fertile carpel is for the most anterior or lateral, thus approaching Dipsacæ in this character.

ILLECEBRACEÆ. In *Illecebrum* and *Herniaria* the stigmas are all anterior and posterior, the ovary consisting of two carpels united by their margins; and the seed is erect, having the radicle always curved down on the posterior side, thus agreeing with *Atriplex* and *Chenopodium Bonus Henricus* both in the position of the stigmas and of the cotyledons and radicle. In *Paronychia* the examination is difficult in consequence of the diminutive size of the ovary; in two or three instances however the funiculus was evidently anterior (in *P. capitata*), and in others apparently so, no variation being observed.

CHENOPODIACEÆ and AMARANTHACEÆ. In Chenopodiaceæ and Amaranthaceæ the ovary has the appearance of consisting of carpels united by their margins as in Polygonaceæ, Alsineæ, and Illecebraceæ, the ribs of the ovaries, if any are present, being opposite the stigmas, and when the stigmas are two being equally marked on both sides*. In *Beta*, &c. the funiculus adheres to the side of the ovary, and this adhesion is for the most part anterior, rarely right or left; but if the funiculus is free, as in *Rhagodia*, it still has the same position, being also in either case opposite a stigma when the ovary is digynous. As the funiculus in these instances is the remains of a central placenta, the position of the ovule shows a tendency to the production of the single carpel for the most part posterior as in Piperaceæ, and surely this is placed beyond doubt when it is recollected that in *Atriplex* and *Chenopodium* when the seed is erect the cotyledons are anterior.

In *Gomphrena* the funiculus is lateral and the stigmas right and left, which may be regarded as an approach of Amaranthaceæ to Nyctagineæ, and also to Polygonaceæ, as in *Polygonum*, when dicarpous, the carpels are all right and left.

EPACRIDÆÆ. The ovary of *Acrotriche cordata* is not unfrequently one-celled, and the position of the carpel is then variable, being frequently posterior.

COMBRETACEÆ. The style of *Combretum* is more or less oblique in its direction, as also the ovary, and the obliquity fre-

* To this it may be added, that the ovary of *Basella* evidently consists of three carpels united by their margins, three smaller ribs alternating with three larger, and the latter being continuous with the stigmas; the position of the ovule is uniform, and I believe corresponds with that of *Illecebrum*, &c.

quently differing gives the raceme a somewhat irregular appearance ; on one side of the style is a furrow sometimes marked very faintly, but often quite distinctly, and occasionally it is deepened into a fissure for some distance below the stigma ; and the opposite side is quite rounded, having the aspect of a dorsal surface. The position of the carpel, as taken from this character, is variable, and frequently posterior as in *Cratægus*.

AMYGDALÆ. Variable, and in *Cerasus Laurocerasus* more frequently posterior.

SANGUISORBACEÆ. The lateral attachment of the style readily shows the position of the carpel, which is best seen in the species of *Sanguisorba*, and can be ascertained by making a transverse section of a mass of flowers close to the axis, when the irregular position of the style will become obvious. The carpel is rather less frequently posterior than anterior, but in *Cliffortia* always lateral, as elsewhere referred to.

DAPHNACEÆ. In Daphnaceæ the lateral attachment of the style shows the position of the carpel, the ovule being pendulous from the same side ; but in *Daphne* itself the position of the raphe must be taken as a guide, which in this instance may be relied on, because in *Pimelea* the raphe is next to the placenta. In *Struthiola* and *Passerina* the carpel is almost constantly lateral, in *Struthiola* perhaps always so, thus approaching Proteaceæ. Yet the relations of the parts of the flower to each other in Daphnaceæ and Proteaceæ are different, as in Daphnaceæ the carpel is opposite a sepal, but in Proteaceæ alternate with the two anterior. In Daphnaceæ the tendency to suppression of stamens is on that side which is opposite to the carpel, as in *Lachnæa*, where the larger stamens and sepals are anterior while the carpel is posterior, but in Proteaceæ both carpel and larger stamens are anterior. In *Pimelea* the carpels are all posterior, the axils being one-flowered ; in *Daphne* the axils are two-flowered, and the ovary of each stands with its dorsum towards the axil ; and *Daias* is a mixture of these, apparently from the axils being three-flowered. (Pl. XIV. fig. 14.)

CINCHONACEÆ. In Cinchonaceæ, as also in Caprifoliaceæ, there is no regularity in the position of the carpels of dicarpous ovaries, as they are either predominantly anterior and posterior, or as frequently right and left, or neither of the two predominates, being often also oblique ; and this, taken in connection with the fact, that in the genus *Ribes* alone all these variations take place, tends to show that the position of the carpels when two is a character of comparatively inferior value, unless that such frequent contrariety and irregularity should make it probable that the position of the fertile or single carpel would be variable. The raphe being taken as an index to the placenta,

the fertile carpel in *Opercularia** fully corresponds with that of *Aucuba* in being more frequently posterior.

CAPRIFOLIACEÆ. In *Abelia* the position of the one-seeded and only fertile cell is variable, and more frequently posterior than the fertile carpel of *Viburnum*, and as in that genus the raphe is lateral. (Pl. XIII. fig. 4.)

CORNACEÆ and ALANGIACEÆ. The ovary of *Aucuba japonica* is probably not compound, as there are no remains of an abortive carpel; when fully developed the stigma is unilateral and almost horizontal, being stigmatic and somewhat grooved on its upper surface, and smooth and rounded beneath; the ovule is not attached to the apex of the cavity, but to the upper part of that side (immediately below the apex) which is away from the stigma, and the placentation consequently varies with the position of the stigma, being anterior when it is posterior and *vice versa* (Pl. XIV. fig. 15). In *Marlea* the two cells are for the most part unequal, the smaller one being often much reduced in size, and the position of the larger cell corresponds nearly with that of the single carpel of *Aucuba* in being more frequently posterior or lateral.

GARRYACEÆ. The ovary of *Garrya* has all the appearance of consisting of two carpels united by their margins, as the ovules are attached to opposite sides of the ovary near the apex, their attachment alternating with the stigmas. It may therefore be regarded as having the same structure as that of *Helwingia* with retracted dissepiments, and with that genus as being a near ally of Santalaceæ. It may further be compared with Lauraceæ and also Daphnaceæ, if in the latter family, when dicarpous, the placentation should prove to be parietal.

PROTEROCARPOUS EXOGENS.

The connexion between the Polypetalous and Monopetalous Orders is here not always so distinct as in the Heterocarpous Division, and whether Solanaceæ are a monopetalous form of Papaveraceæ is rather a question, but if arranged with Polemoniaceæ they would in Table III. be placed as before with their nearest allies.

FUMARIACEÆ. In *Fumaria officinalis* one carpel is larger than the other, and to it the seed is always attached and almost exclusively so, the hilum being oval (the junction between the two carpels is however not obvious externally, but is distinctly seen

* The axis is here compound, each capitulum consisting of several centres of growth indicated by small whorls of partially adherent ovaries. The raphe is for the most part anterior, being lateral or posterior in only two or three of six instances.

internally); and the position of the larger of the two carpels is uniform, being always on the opposite side of the flower to the spurred petal. The two carpels will be all anterior and posterior, or all right and left, according as the irregularity of the corolla, or the axis is regarded, the spurred petal being lateral, although by twisting of the peduncle becoming nearly posterior. As in *Ranunculaceæ* the spurred petal is posterior, the fertile carpel in *F. officinalis* may so far be considered always anterior.

BERBERIDEÆ. In *Epimedium* and *Berberis* the carpel is anterior, obliquely anterior or lateral, but a careful examination of several species of the latter genus failed to show any carpels posterior; in *Nandina*, however, it is occasionally but not frequently posterior.

BYTTNERIACEÆ. In *Waltheria* the anterior position predominates, the carpel being rarely, if at all, posterior, which shows further the connexion between *Malvaceæ* and *Phytolaccaceæ*, where in *Rivina* the carpel is always anterior.

TROPÆOLACEÆ. From the irregularity of the flower, the inequality of the stigmas and the oblique direction of the style in *Magallana*, it may be expected that the position of the two carpels is uniform, and also that the carpel corresponding with the elongated lobe of the stigma is the fertile one; if so, the two carpels are always anterior and posterior, as in the figure of the fruit in Cavan. Ic. iv. t. 374, the spur of the calyx is represented as being on the sutural side of the remaining cell; and this shows also that the position of the fertile cell is most probably uniform, being always anterior, as the spur of the calyx is posterior.

AMYRIDEÆ. In *Amyris toxifera* the position of the carpel is variable, being frequently anterior, but only occasionally posterior; and the same variation I believe occurs also in *Aurantaceæ*, and these two families are, more than any others that I am aware of, exceptions to the Proterocarpous character of this division.

SCROPHULARIACEÆ. In *Pedicularis palustris* the anterior carpel is always larger in diameter and considerably higher than the posterior, and the anterior column of the style is also thicker. This is also the structure of *Mendozia* as described and figured by Martius in 'Plant. Brasil,' and which has been before alluded to as having the fertile cell anterior (Pl. XIV. figs. 16, 17, 18, 19, 20 & 21). It should be observed also that in *Mendozia* the posterior cell is usually barren even at the time of flowering.

VERBENACEÆ. In *Lippia dulcis* and *Lantana crocea* and *albida* (the only species examined) the stigmas are anterior and posterior, and the ovary two-celled, but with the cells right and left, the former having also the anterior portion of the stigma much larger. The placentation is the same as in the two anterior lobes

of the ovary of Labiatae, and the relation of the unequal stigmas of *Lippia* to the cells leaves no doubt but that here the ovary consists of a single carpel always anterior. (Pl. XV. figs. 1, 2, 3, 4 & 5.)

MIMOSEÆ. Having observed carpels posterior in three species of *Acacia* in which the inflorescence was dense, it was thought possible that this might arise from the flowers growing three in an axil; this however is no longer a question, as carpels posterior occur where the axil is always one-flowered; but the posterior position does not predominate, as in *Cerasus Laurocerasus*; and in three species having a globular inflorescence the carpel is always anterior or lateral, which may be explained by the carpels posterior being confined to the upper half of the spikes or almost exclusively so.

In two instances of dicarpous ovaries occurring in *Phaseolus vulgaris* the ovary was syncarpous with parietal placentae (the carpels in their upper part being separate and diverging in a manner somewhat analogous to those of a *Reseda*, but to a greater extent), thus showing an approach in Papilionaceæ to Moringeæ and Polygalaceæ, as probably does *Ormosia* with two unequal stigmas. But in an instance of three carpels occurring in an *Acacia*, they were quite disunited.

PROTEACEÆ. In Proteaceæ with capitate flowers, such as *Mimetes* and *Leucospermum*, the carpel is always anterior, and its apparently lateral position in *Banksia* seems owing to the axils being two-flowered. And in *Grevillea*, where incomplete resupination sometimes takes place, it is always anterior if the irregularity of the flower is attended to, being alternate with the two larger and longer sepals. But in *Anadenia*, where the flower is regular, the carpel, although always anterior in the lower half of the racemes, varies in its position towards the summit, and in rare instances is perhaps posterior. The peduncles are however long and the axils two-flowered, and carpels posterior are not so frequent as in *Acacia*, being also confined to the upper part of the racemes. In *Anadenia* instances of two carpels occasionally present themselves which are quite disunited, from which it may be expected that the gland on the posterior side of the ovary in *Grevillea*, &c., is a rudimentary carpel.

Looking at the habit of Proteaceæ they might be expected to be derived from Daphnaceæ, but the flower more nearly approaches that of *Petiveria* in having the carpel alternate with the two anterior sepals, whereas in Daphnaceæ it is opposite a posterior or lateral one; and if *Anadenia* may be taken into comparison they would agree in being apocarpous, *i. e.* supposing Petiveriaceæ to be, like Phytolaccaceæ, apocarpous.

CALLITRICHACEÆ. *Callitriche* is placed near Selagineæ for

the following reasons : in Selagineæ the calyx sometimes consists of two lateral sepals which enclose the flower much like the bracts of *Callitriche* ; the embryo has short blunt cotyledons resembling those of Selagineæ (but still more reduced), and approaching *Stilbe* as described by Endlicher ; but the raphe is next the placenta in Selagineæ, and on that account the affinity of *Callitriche* is rather with the latter Order, between which and Podostemaceæ or Elatineæ it may be regarded as forming a connecting link.

VALERIANACEÆ. In *Valeriana officinalis* the mode of growth is the same as in *Scleranthus*, &c. The fertile carpel in the forking of each division of the inflorescence stands with its ventral suture towards the inner branch of the forking and the dorsal next the outer branch, the gibbosity of the corolla being anterior and coming forward between the two branches (Pl. XIII. fig. 1). The regularity of the position of the fertile cell is perhaps connected with the irregularity of the corolla, as they always have the same relation to each other, although in *Valerianella*, where the corolla is quite regular, the position of the carpel is the same. But in Valerianaceæ the fertile carpel has sometimes the appearance of being posterior ; this however arises from the mode of growth being the same as that of *Centranthus ruber* (Pl. XIII. fig. 2), viz. dichotomous with the flower sessile between the rami, one branch of the dichotomy being regularly suppressed, except near the principal axis (Pl. XIII. fig. 2 d) ; in such a case therefore the fertile cell is next the remaining ramus, and constantly so, as it is always the external ramus that remains*. In this diagram the successive branchings are represented as springing from each other at right angles (instead of obliquely as in the plant itself), that the relative position of the fertile cell may be more evident ;—the cross indicates the position of the spur of the corolla. The same mode of growth occurs in *Fedia sagittifolia*, where the barren cells are inflated.

DIPSACEÆ. In *Morina* and *Scabiosa* the placentation is lateral, and the former agrees closely with Valerianaceæ in the carpel being lateral and external ; and in *Dipsacus sylvestris* it is posterior with remarkable regularity, although, from the elongation of the style, the position of the usually unilateral stigma becomes variable. (Pl. XV. fig. 6.)

CALYCERACEÆ. The ovule is here attached to the posterior side of the ovary, but nearer its apex than in *Dipsacus sylvestris*, which occasions its placentation to be less obvious ; and the raphe is anterior, so that a partial adhesion of the anthers may prove to be the only distinction between the two Orders, as the involucrel of Dipsaceæ occurs here also.

* See also the description of the figure.

SCLERANTHACEÆ. In *Scleranthus annuus* the flower is sessile between the two branches of a forked stem, each of which again produces a flower sessile between two succeeding branches; each flower therefore stands in the relation of axis to the two succeeding flowers; but this can only be observed in large specimens growing in cultivated ground, where all the branchings become fully developed. The funiculus is uniformly posterior to the seed, in which character it differs from Chenopodiaceæ and their allies, where it is either anterior or lateral. The seed of *Scleranthus annuus* has the cotyledons next the funiculus, which may form also another differential character between Scleranthaceæ and their allies. (Pl. XV. figs. 7, 8 & 9.)

TETRAGONIACEÆ. In *Tetragonia africana* and *Trianthema micrantha* the mode of growth is, in the smaller ramifications, the same as in *Scleranthus*, and the placentation shows the single carpel anterior or (in the latter) occasionally lateral.

STYLIDIACEÆ. In *Stylidium graminifolium* the posterior cell is always less in diameter, and also less in depth than the anterior, and this, in connection with the irregularity of the corolla, forms perhaps a sufficient analogy for anticipating that in a one-celled ovary the fertile carpel would be anterior*.

GOODENIACEÆ. In *Dampiera lavandulæfolia* the ovary consists of two carpels anterior and posterior, but is one-celled from the cells communicating, or rather imperfectly two-celled; the posterior cell is much shorter (not extending below the upper half of the anterior cell), contracted and barren, being sometimes so reduced in size as to be scarcely apparent; and the single ovule is attached to the posterior surface of the anterior cell near its base, having the raphe next the placenta.

ONAGRARIÆ and HIPPURIDÆ. Of thirty-two ovaries of *Circæa alpina*† thirteen had two cells with an ovule in each; in twelve the posterior cell was empty, and in seven it was closed, leaving the ovary one-celled. When fertile it was less in diameter and also less in depth (Pl. XV. figs. 10 & 11). In the ovary of *Hippuris vulgaris* there is nothing in the structure either externally or within the cavity to show whether it consists of one or two carpels, nor yet in the style or stigma, as the latter is terete and pointed; but on the external surface of the bony nut of the mature fruit, there is found when it is denuded a

* This analogical argument has since been verified in the instance of *Stylidium adnatum*, where the ovary consists of a single carpel anterior; or if two are present the anterior only is fertile, as the ovules are always attached to the posterior angle of the cell.

† Taken from the plant in cultivation in the Botanic Gardens of Kew. When the ovary is two-celled the cells are all anterior and posterior, as also are those of *C. lutetiana*.

shallow furrow extending from its summit to its base, and this furrow is always posterior (Pl. XV. fig. 12). This may be taken as an indication of a single carpel uniform in its position, and (considering the near affinity of *Circæa*) in all probability anterior, the stamen also being anterior.

COMPOSITÆ. That a tendency exists in Compositæ to suppression of the posterior carpel is shown by the achenia of the Sunflower, and especially by those of *Centaurea*, where the anterior portion of the ovary is both larger and thicker than the posterior ; and as in both these plants the stigmas are anterior and posterior, it would be difficult to account for the inequality of the ovary on any other hypothesis. In *Centaurea nigra* there is, besides the shrinking of the posterior portion of the ovary, a line on each side like a suture ; there are also two others, one anterior and the other posterior ; and as the flower is quinary, these four lines may be relied on as marking the presence of two carpels, and the two lateral of these the juncture between them : it frequently also occurs that two-thirds of the ovary are on the anterior side of the two lateral lines and sometimes more, so that the posterior half of the ovary becomes almost rudimentary, being also much shorter than the anterior from contraction at its base (Pl. XV. fig. 13). This latter character is also well represented in Dr. Lindley's 'Vegetable Kingdom,' the figure being that of *C. Cyanus*.

The ovary of *Aster sibiricum* has nearly the same structure as that of *Centaurea*, and the anterior portion of the stigma is in the marginal florets frequently elongated like that of *Ruellia* or *Stemocanthus** (vide fig. 9 in Plate II.). But it should not here pass unnoticed that the position of the stigmas, except where the style is thickened or very short, as in *Euxenia*, cannot be relied on as an index of the position of the carpels, as the style very commonly becomes twisted half round, of which *Lasthenia* is an example.

CHAMÆLAUCIACEÆ. In *Calytrix virgata* the placenta is central, is a prolongation of the pith, and is continued uninterruptedly into the style, and as neither style nor stigma exhibit any evidences of division the carpel must be wanting, and the style only a prolongation of the axis, as suggested by Dr. Schleiden in certain cases where the flower is superior. The cavity moreover is imperfect, being occupied by cross bands of cellular tissue. The ovules are attached to the anterior side of the central column, or very rarely more or less laterally, which can scarcely be regarded as a character less than equivalent to a single carpel

* To this it may be added, that the attachment of the ovule inclines more or less to the posterior side of the ovary, and the position of the raphe being uniform tends to show that that of the fertile carpel is also.

anterior, of which an instance occurs in the nearly allied *Bækia*, as shown by the parietal placentation of the two ovules. (Pl. XV. figs. 14 & 15.)

BRUNIACEÆ. In *Brunia lanuginosa* the ovary consists of a single carpel always anterior. (Pl. XV. figs. 16, 17 & 18.)

UMBELLIFERÆ. The position of the odd carpel is perhaps in some cases variable, but in *Æthusa Cynapium* the anterior carpel is much more frequently fertile, which may arise from the posterior one being occasionally smaller; the carpels are very commonly all anterior and posterior, but this is not without exception, the anterior and posterior position however still predominating as in Araliaceæ.

CASUARINAL EXOGENS.

The families derived more immediately from Gymnosperms through Casuarina differ, as far as is at present known, from other divisions of Exogens, in having the raphe in pendulous ovules always next the placenta, a character which becomes less frequent as Endogens are approached. The connexion between the apetalous and polypetalous forms of this section is sufficiently obvious and has been frequently referred to; but the affinities between the polypetalous and monopetalous forms are not of so decided a character. It may be observed, however, that in their coronet Asclepiadææ may be compared to Passifloraceæ; that they have in some instances the habit of Euphorbiaceæ; and that *Rauwolfia* among Apocynaceæ is an approach both in structure and habit to the latter family. And Apocynaceæ may also be compared with Violaceæ in their crested anthers.

ASCLEPIADEÆ and APOCYNACEÆ. In such genera of these families as I have examined, the raphe (in cases of ovules numerous and horizontal) is always on the under surface of the ovule, which occasions the seed in *Gomphocarpus*, having become depressed in subsequent growth, to be pendulous with the raphe next the placenta, and the ovules of *Liquidambar* have I believe an equivalent character, the only other instance of the kind when numerous I have met with. In *Rauwolfia* the ovules are two, pendulous, with the raphe next the placenta, the raphe becoming rather curved as it descends, as in *Roumea*.

EUPHORBIACEÆ. When my first Dissertation on the Position of the Carpels was read to the Linnæan Society, *Eremocarpus* was considered to have its single carpel variable, although it remained a question whether it was not sometimes posterior; but having more recently examined that genus, I ascertained that in upwards of fifty instances there were no carpels posterior, and it was doubtful if any were lateral. The inflorescence here consists



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