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GARDEN.

A

NEW ARRANGEMENT

OF

PHANEROGAMOUS PLANTS,

WITH ESPECIAL REFERENCE TO RELATIVE POSITION,

INCLUDING

THEIR RELATIONS WITH THE CRYPTOGAMOUS.

By BENJAMIN CLARKE, F.L.S., & M.R.C.S.

Nam, cum *Natura* (ut dici solet) *non faciat saltus*, neque ab extremo ad extremum transeat nisi per medium, inter superiores et inferiores, rerum ordines nonnullas mediæ et ambiguæ conditionis producere solet, quæ de utroque participent, et utrosque velut connectant, ut ad utrum pertineant omnino incertum sit. *Raii Historia Plantarum, Præf.*

Methodi Naturalis Fragmenta studiose inquirenda sunt. *Primum et ultimum hoc in Botanicis desideratum est.* Natura non facit saltus. Plantæ omnes utrinque affinitatem monstrant, uti Territorium in mappa geographica. *Linnæi Philosophia Botanica*, Ed. secund. p. 27.

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ON ENTERING A CONSERVATORY OF TROPICAL PLANTS.

Lo! the stately Palm-trees rise,
Soaring to the azure skies,
Telling of the worlds on high,
Links of their sublimity.

Fern-trees there with graceful mien,
Spread around their domes of green,
Ever fresh their leaves unfold,
Pure and clear as emerald;

Emblems meet of Charity,
In age they never show decay,
Never is their foliage cast,
Young it springeth to the last.

Screw-pines there with buoyant stem,
Bearing many a cone-like gem,
As their leafy heads they raise,
Speak their mighty Maker's praise.

Banyans there with widening bound,
Arching o'er the shadowed ground,
Thickly girt with tropic flowers,
Imitate old Eden's bowers.

Pure and sacred be each thought,
By the better influence taught,
While our hearts within us glow,
Mindful whence all blessings flow.

B. C.

PREFACE.

The first idea of the present system suggested itself to the Author from a conviction that we have no great difficulty to overcome to arrive at the natural system of the monopetalous families taken separately from the polypetalous, the only defect likely to prove unaccountable being the comparative isolation of certain families, such as Ericaceæ, Ebenaceæ and their allies, which are not nearly related to any part of the monopetalous series. This being effected, could we then determine in each instance of the polypetalous families, of what monopetalous family it was the polypetalous representative, a natural arrangement of the polypetalous families would then as it were form itself; the natural system of the monopetalous families being thus made use of to explain to us what has hitherto been the greatest desideratum in systematic botany, viz., the natural system of the polypetalous. This result being obtained, the apetalous families could then without difficulty be arranged according to their nearest affinities, the polypetalous being in their turn taken as a guide to the true station of each of the apetalous. In attempting however to accomplish a task including so many inquiries he has employed also, and quite as frequently, the reverse mode of comparison, commencing with the apetalous; and as far as it has appeared to him that either of these modes of comparison has proved successful, it has been *rigidly adhered to* in the formation of the present system.

It will be found that the present arrangement is very different from that in the Ann. Nat. Hist. 2nd Ser. vol. XI. In attempting to complete and fill up the outlines of that arrangement by the addition of the results of new observations, it was soon found to be in its primary divisions impracticable, just as the discovery of new genera proved that the artificial system of Linnæus was impracticable. But of the present arrangement he is able to say, that for the last four or five years it has undergone no material alteration, all the new facts and observations which have since been made or become known, proving to be, as he views them, in harmony with the present arrangement, and in not a few instances materially improving and confirming it; and to be able to add this, after having applied to it so severe a test as the discoveries made known to us in Bentham and Hooker's '*Genera Plantarum*,' will, he trusts, remove the objection to which he has referred as applying to the arrangement in the Ann. Nat. Hist.

The main feature of the present arrangement, after having placed the apetalous, polypetalous, and monopetalous families in their mutual relations to each other, is the *complete detachment* of the Epigynous families as a distinct Division of the Class Exogens, the unisexual and many other families really belonging to that Division having hitherto been kept separate, or placed in other Divisions. His conviction is, that the Epigynous Division will prove to be as really distinct from the great mass of Exogens as the Endogens are from Exogens, and he has therefore given unremitting attention to form a correct line of division between the Epigynous and the great mass of Exogens, because it is obvious that if the existence of such a division could be demonstrated, the study of systematic botany, especially to students, would be much facilitated.

Since the appearance of the Tables, in 1853, (Ann. Nat. Hist. 2nd Ser. vol. XI.,) he has verified where there was any remaining doubt, and in many instances repeatedly, the observations as regards the position of the carpel when single, and of the raphe, and has had to correct only Brunoniaceæ among the former, (the alteration not being the consequence of error in observation, but of a different conclusion with respect to relative position,) and Nolanaceæ, Ehretiaceæ, Globulariaceæ, and Crassulaceæ and

Acanthaceæ in part, among the latter. But as those Tables were the first attempt that has been made at the formation of a series of observations of this kind, it is hoped that the few errata contained in them, (two of which were very slight, and one from a mistake in a name,) will give an increased confidence in the present work. Not only has every doubtful point been re-examined, but he has not in any instance, except the Balanophoraceæ, depended on the observations of any botanist as regards the position of either the carpel or the raphe, although those few that have been made, were made by observers in whom, and deservedly, the fullest confidence is placed. It deserves notice, however, that there are some cases in which it requires much care, good specimens and repeated examinations, to obtain conclusive evidence as to the position of the raphe; and that the difference between the lateral and dorsal positions on the one hand and the lateral and ventral positions on the other, is not unfrequently so minute that accurate observers will, he expects, differ more or less as regards the raphe lateral. In referring to the raphe in any given family as being lateral, he does not wish to be understood as being in opposition to those who describe it as dorsal or ventral, unless the genus is mentioned, but only to say that as far as his observations go it is lateral. He has very recently for the first time seen the very accurate and valuable work, '*Theoria Systematis Plantarum*,' of Prof. J. G. Agardh, whose observations will be found for the most part to agree with his own, and it is not in any instance, until after very careful examination, that he differs from so good an observer. The differences are mostly of a minor character, the lateral raphe, as it appears to him, being by Prof. Agardh sometimes described as dorsal or obliquely so, or ventral or obliquely so. In Prof. Agardh's descriptions of single erect and pendulous ovules, he admits only the existence of raphe ventral and dorsal, and the various instances of lateral raphe are consequently referred to one or other of these two positions, or are stated to be obliquely dorsal or obliquely ventral, from the form or mechanical pressure of the ovary; and as the instances of lateral raphe in these positions of the ovule are numerous, the present work will be found to contain many additions as regards this particular character. And if, as he feels well assured, the raphe lateral in erect and pendulous ovules is its only normal position in these cases, never being produced by pressure or the form of the ovary, and entirely distinct both from the ventral and dorsal raphe, these additions will be of some value. Prof. Agardh, in his observations on Erythroxyleæ, p. 296, refers to the Tables, Ann. Nat. Hist. 2nd Ser. vol. XI.*

To the late Sir William Hooker he owes a debt of gratitude for the most liberal assistance given him, having throughout the enquiry in which he has been engaged for upwards of twelve years, supplied him with rare desiderata, and the variety of specimens contained in the Kew Herbarium, and to Dr. Hooker for nearly the same term; and to his numerous botanical friends and correspondents, for the communication of valuable suggestions and observations, especially to the Rev. W. W. Newbould, Dr. Seemann, Mr. Bennett, V.P.L.S., Mr. Kippist, Libr. L.S., Mr. Miers, and Mr. J. Smith, the first Curator of Kew Gardens of that name; and he has also to acknowledge that the Royal Society, from the fund for the promotion of science, placed annually by Parliament at the disposal of the President and Council, made a grant of £10., "accorded in furtherance of the publication of his faithful and valuable observations, *On the Relative Position of the Ovule, and its parts to the Axis of the Flower*"; and that the Gardens of the Apothecaries' Society, at Chelsea, have supplied him with many living specimens not elsewhere procurable.

* He also refers especially, p. 50 and 308, to the Papers on Hydropeltideæ (Ann. Nat. Hist. 2nd Ser. vol. XII., p. 12), and Alangiaceæ (Kew Jour. Bot. vol. V., p. 129).

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A

NEW ARRANGEMENT

OF

PHANEROGAMOUS PLANTS.

ON THE NATURAL SYSTEM.

Analogies between the Animal and the Vegetable Kingdom.

In making an inquiry into a natural arrangement of any department of organic nature, whether animal or vegetable, the mind cannot well rest satisfied, unless it arrives at a conviction of what it does not consist in, as well as of what it does;—until the former negative kind of assurance is arrived at, new ideas and propositions will suggest themselves and sometimes lead to the temporary rejection of truths, which further observations finally establish. But for the purpose of arriving at a conviction of what a natural classification does not consist in, we must feel confident that we are well acquainted with the entire of the particulars of the structures which we intend to place in their natural relation to each other; and no doubt it is for the want of this, that our systematic botanists feel a degree of uncertainty as regards all the arrangements hitherto proposed. It is hoped, therefore, that the new facts brought to light by attention to relative position will supersede some part of the speculation that exists, and also in some degree tend to prevent further diversions from practical truth.

As the arrangement of the Animal Kingdom in all its principal Divisions is so well established, it becomes interesting to inquire how far divisions on the same principles can be carried out in the Vegetable Kingdom. To this inquiry the reply appears satisfactory, so far as its division into Cryptogams and Phanerogams, and of the latter in Endogens and Exogens; and these divisions being analogous in principle to those of the Animal Kingdom, *i.e.*, established on obvious characters to which there is no material exception, may so far be considered as unalterably fixed. But, if we attempt to carry this strict principle of division which serves us as a guide in the classification of the Animal Kingdom further, so as to apply it to the divisions of the Class Exogens, it entirely fails in consequence either of the limited extent of, or the numerous exceptions that occur to, any one of the structural characters that may be selected as a diagnostic sign of affinity, so that new principles of classification must be had recourse to which take several characters into consideration, instead of one only, in the same way (to some extent at least) as we recognize a countenance by the peculiar character* produced by a combination of the features. The genus *Henriquezia* for instance, described by Mr. Bentham in the Trans. Linn. Soc., Vol. XXII, Pl. 52,

* This principle accords with that of Cuvier, relative to the few genera of doubtful affinity in the Animal Kingdom, viz., that where affinities are uncertain all characters should be taken into consideration.

departs so much from the character of *Bignoniaceæ* that it could not, without setting aside one of the most fundamental principles of classification, be referred to its true station. I believe the same remark is applicable to entire families as to *Combretaceæ* and *Humiriaceæ*.

The cause of this difference I would suggest is, that the Vegetable Kingdom does not become so highly developed comparatively with the Animal, since cryptogamous plants generally cannot be regarded as analogous to any higher Orders in the Animal Kingdom than the primordial forms of the Radiata, and the highest forms of phanerogamous plants cannot well be compared to any higher developed portion of it than the Actiniadæ. Hence it would appear that with the exception of the ovule and seed of the higher departments of the Vegetable Kingdom, which may be compared to the mode of reproduction of some of the higher and perhaps the highest departments of the Animal Kingdom, all further comparisons between them must be impracticable. This being admitted, it might be expected as a consequence, that the primary differences in structure which would take place in the Vegetable Kingdom would be fewer and less strongly marked, and thus the difficulty in forming an arrangement would be accounted for.

That there is much analogy between the Actiniadæ and phanerogamous plants might I believe be admitted, if it can be proved that a leaf is a true branch, and therefore analogous to the limb of an animal, and of this I have no doubt. I have seen monstrous cabbage leaves which distinctly show that there is no difference between a leaf and a branch,* and it appears to follow as an unavoidable inference that leaves are analogous to limbs. Three of the leaves of a cabbage produced a great number of small leaves along their midribs on the upper surface, but none from their footstalks, and one of them produced a comparatively much larger leaf from about the centre, which had its dorsal glaucous surface turned towards the axil of the leaf on which it grew; and from its base on the upper side, which no doubt was its axil, grew a small branch having several rudimentary leaves, thus becoming precisely like the terminal ramifications of a *Ruscus*. The greatest difference between the Actiniadæ and phanerogamous plants probably exists in the ovule and seed which may be compared to those of the Mammalia;—if, therefore, a phanerogamous plant had the spores of a Fungus it would show a decided analogy with the Actiniadæ, each of the parts of the latter being more or less modified to suit the altered circumstances. A phanerogamous plant in this view would be analogous to an *Actinia*, producing perfectly formed individuals from its ovaries instead of rudimentary bodies scarcely differing from the simplest kind of spores.

Principles of the Arrangement.

In attempting therefore to form divisions in phanerogamous plants new principles must be sought for, and in the arrangement now brought forward the foremost is that of tracing each family to its nearest affinities, so as to demonstrate as far as possible of what family it is as it were a branch, and thus finally to form races of plants. In endeavouring to arrive at this desirable result, all characters, and especially those of relative position, have been taken into consideration, and the inferences as regards the Class Exogens are:—

1. That Epigynous Exogens form a Natural Division, and that this character is the only one by which the Class Exogens can be divided into two parts, but that several families which contain genera not epigynous must be admitted into the Epigynous Division.

2. That the Divisions Hypogynous and Perigynous do not form natural assemblages, the latter requiring to be subdivided and arranged among the former in widely different stations.

3. That the characters Apetalous, Polypetalous, and Monopetalous are also of minor value, but that the Monopetalous families are without exception monopetalous forms of the Polypetalous, and the latter are either directly or indirectly polypetalous forms of some one or other of the Apetalous; and that the foremost point in endeavouring to form a Natural System of Exogens should be to determine these relations. It is already admitted by some botanists that the Apetalous families are not a distinct Class, but only apetalous forms of the Polypetalous, or in other words, the Polypetalous are Apetalous families with the acquisition of petals;—this being conceded, the conclusion that the Monopetalous are in their turn Polypetalous families with their petals united appears unavoidable, besides which, it is well borne out by practical observation and analysis. In a limited sense the Apetalous families are dimorphous forms of the Polypetalous, and the latter dimorphous forms of the Monopetalous; and, if this is admitted, the separation of either of these three Classes from the other two would, it appears to me, render the formation of a Natural System connecting the whole impossible.

4. That the Epigynous Division is less highly developed than the great mass of the Class Exogens, and should therefore constitute the first of a series of Divisions.

* Some petioles have a perfect circle of woody fibre and a central pith, while in some foliaceous branches these are imperfectly marked, the broken circle of woody fibre exactly resembling the broken circle so common in petioles. Between the venation of leaves and foliaceous branches there is no difference which can be depended on, as the venation of some leaves agrees with that of foliaceous branches, as that of *Mercurialis annua* with the species of *Xylophylla*, although it is usually different.

Value of the Epigynous Character.

In carrying out this mode of investigation especial attention is in the first place directed to the fact that there exists among those Cryptogams which approach the Phanerogams, two forms of organisation differing from each other in that one of them, represented by the *Bryaceæ*, has its fructification contained in a seed vessel called a theca, which is surmounted by 1, 2, or 3 rows of teeth resembling rudimentary leaves* ; and the other, represented by the *Lycopodiaceæ*, has a fructification of a very different kind. Of these forms of organization we find the former, which is represented by the *Bryaceæ*, to be decidedly the lower of the two as it stands in immediate relation with the lowest forms of the vegetable system, and the latter, the vascular Cryptogams represented by the *Lycopodiaceæ*, to be as immediately connected with the Gymnosperms, besides which the higher development especially of the fossil genera place it far in advance of the *Bryaceæ*.

The first feature of the arrangement in the accompanying Tables is the division of the Class Exogens in an analogous way, placing the Epigynous Division first, as being connected with the lower of these two groups of the Cryptogams, and all the other families, whether Perigynous or Hypogynous, in advance of them, as being connected with the more highly developed group of which *Lycopodiaceæ* are the representative. We find however in systematic arrangements that the greater part of the Epigynous Division is generally placed among the higher developed sections of the Class Exogens, but there are some peculiarities in the structure of a part of the families of this Division which, according to the generally received opinions of the value of characters, require their being stationed at the commencement; besides which the fact of Hypogynous Exogens being allied exclusively to the Gymnosperms and *Lycopodiaceæ* claims for them a position in advance of the Epigynous, provided it is admitted that there exists a connection between *Bryaceæ* and the latter. The peculiarities in structure to which I refer are as follows :—

1. The ovary is often but feebly developed, as in the *Compositæ*, and, as I have endeavoured to show (Ann. Nat. Hist. 2nd Ser. Vol. XI.), in *Calytrix virgata* there is no perceptible trace of a carpel, and supposing such an ovary to have the ovule of *Balanophoraceæ*, it would then be a much lower form of organization than any which occurs in Perigynous or Hypogynous families, in which the ovary is always very distinct, even in the epigynous genera included among them. *Casuarina* on the other hand has a seed-vessel remarkable for the excess of spiral vessels.

2. The simplicity of the ovule of the *Balanophoraceæ*, and the absence of all integument in some genera of *Loranthaceæ*, are variations of structure which may be regarded as indicating a lower degree of development than any which occurs among the Perigynous or Hypogynous Exogens. On the other hand, the ovule of *Platanus* has two coats so distinct as to be scarcely if at all adherent, and the *Acanthaceæ* described by Mr. R. Kippist (Trans. Linn. Soc. Vol. XIX. p. 65), have a testa containing an unusual quantity of spiral vessels; Dr. Lindley has also observed spiral vessels on the outside of the testa very abundantly in *Collomia* (Bot. Reg. fol. 1166) and other genera of *Polemoniaceæ*, and Mr. Quekett in the testa of the almond. May not these two extremes in the structure of the seed indicate the most widely separated parts of the Class Exogens? From the observations of Mr. Miers it appears that spiral vessels occur in the testa of *Halesia* but in much less quantity.

3. The number of the cotyledons also may be regarded as in some degree showing that the Perigynous and Hypogynous families are more highly developed than the Epigynous. If we take a general survey of the Cryptogams, we find the lower families destitute of leaves, and it is only in those which approach the Dicotyledons that they are both numerous and highly developed; on this account it might be expected that families the seeds of which had the greatest number of cotyledons would occupy the highest station in an arrangement, and those which had but one, and that comparatively less developed, the lowest.

Agreeably to this suggestion we always place the Endogens at the commencement of a system of phanerogamous plants, and if this principle is adhered to, *Coniferæ*, which have many cotyledons, and *Proteaceæ*, where 5 occur,† should be regarded as the highest developed forms of Eoxgens, 4 being the highest number known to be produced in the Epigynous families, and that to a much less extent than in the Perigynous and Hypogynous. In *Proteaceæ*, however, the increase in the number of the cotyledons would perhaps scarcely deserve attention, but in the *Coniferæ* the increase is much greater, and as their affinity is exclusively with the Hypogynous families, an argument is hence afforded for placing the Hypogynous families in advance of the Epigynous, so as to be among phanerogamous plants the opposite extreme of the Endogens.

4. The raphe of the pendulous anatropal ovule in all the apetalous families of the Epigynous Division is dorsal, (with one exception and there it is not next the placenta,) which perhaps more decidedly than any other character shows that they are a lower form of organisation than the Perigynous and Hypogynous Divisions, because this is the general character of the Endogens, or at least the pendulous anatropal ovule with the raphe next the placenta must be extremely rare among them. And I think also it deserves notice that in the epigynous families and families

* For further remarks v. Table II., the accompanying explanation.

† *Persoonia* has 5 cotyledons, but as in descriptions of this genus the number is not particularly stated further than that there are several, possibly there are sometimes more.

containing epigynous genera, included among the Perigynous and Hypogynous Divisions, the raphe is never next the placenta in pendulous ovules, at least not in the epigynous genera themselves, unless part of *Dipterocarpeæ* are an exception. Such genera are numerous and widely distributed among these Divisions, and therefore if it is admitted that the raphe next the placenta in pendulous ovules is a character indicating a high degree of development, this fact would materially assist in showing that the epigynous character is one of comparatively low development.

5. And finally, when excess of development and monstrosity occurs, a superior ovary I believe never becomes inferior, but the opposite may take place, an instance of which occurred in *Cannabis sativa*, from the mode in which it was cultivated, the embryo becoming tricotyledonous, the leaves 3 in a whorl, and the female plants producing 3 or 4 male flowers (Ann. Nat. Hist. Ser. 3, Vol. 1, p. 102). The fruit has the calyx so completely adherent that no trace of it can be seen except in the variety *C. indica*, but in these plants it became in some few flowers, a nearly detached semi-transparent membranous cup, and in a somewhat monstrous flower with 3 stigmas, it was free and of a greenish colour, having three faintly marked but distinct green ribs. Three well characterized instances are described by Dr. M. T. Masters: one of *Daucus carota*, in which the ovary had become nearly superior and the calyx partially free (Trans. Linn. Soc. Vol. XXIII. Pl. 54, f. 4); one of a *Campanula*, in which the ovary was quite superior (Trans. Linn. Soc. Vol. XXIII. Pl. 34, f. 6); and the third of a *Fuchsia*, with the ovary superior (ib. f. 7). Two instances are also mentioned by Dr. Lindley, one of them a Cucurbitaceous plant, becoming hermaphrodite with a half-superior ovary, and the other an Umbelliferous plant, (Veg. Kingd. p. 774,) in which the ovary had become superior, the calyx surrounding it loosely. Prof. Oliver has also observed the calyx detached in a species of *Rudbeckia* (Trans. Linn. Soc. V. XXIII. p. 365). And agreeably to this view it will be seen that the epigynous families, which are in the Tables placed among the perigynous and hypogynous, and also the families containing epigynous genera find their natural station almost exclusively among the retrograde subdivisions, *i.e.*, those which show an inferior degree of development, as regards the position of the raphe and single carpel. Thus in Table III. the families containing epigynous genera find their place for the most part in the Scleranthal Subdivision. Table IV. may possibly be a retrograde branch of Table VI., but whether so or not, the single carpel is rarely always anterior, and the raphe very rarely in pendulous ovules next the placenta, and in this Table the inferior ovary frequently occurs. And in Table VI. it will be seen I have arranged the families of the Proteal Subdivision into Heterocarpous and Procarpous Sections, and the inferior ovary and highly perigynous stamens occur exclusively in the Heterocarpous Section.

From these peculiarities of structure it appears to me as certain that in the ovary, ovule, seed, and embryo of the apetalous families of the Class Exogens, its two extremes or most widely separated parts are indicated; and such an arrangement of phanerogamous plants would to some extent correspond in principle to that of the two highest Classes of the Vertebrata, i.e., as far as the embryo is concerned,—Endogens having but one cotyledon, imperfectly foliaceous,* might be compared to Birds, they having less perfectly developed limbs comparatively with the higher Orders of the Mammalia, and, on the other hand, *Coniferæ* and *Proteaceæ* having the highest number of cotyledons might be regarded as showing some analogy with the Quadrumana in their more perfectly developed limbs. It might be said that the Endogens show an imperfect tendency to become epigynous, and that they should, as being of a lower form of organization than Epigynous Exogens, so far correspond with them; but still it will be admitted that they show, although in a minor degree, a tendency to be epigynous or perigynous. But supposing it to remain a question as to whether the inferior ovary is a lower form of organization than the superior, yet the arguments in support of the Epigynous Exogens being a strictly natural assemblage of families are, I believe, such as cannot be well superseded; and that they are not so highly developed in the particulars of structure referred to as the Perigynous and Hypogynous Divisions, remains as an argument for the arrangement in the accompanying Tables. And it may also deserve notice, that as far as there exists a tendency to enclosed fruit among the Cryptogams, there is no doubt that it is confined exclusively to the comparatively lower forms, and among the Phanerogams the same law might be expected to obtain, however distant the affinities between them and the Cryptogams might be.

Value of the Characters Procarpous and Heterocarpous.

The value of these characters will be fully adverted to in the remaining part of the work "On Relative Position," and the meaning intended to be attached to these terms will be sufficiently understood by reference to the explanatory notes at the foot of each Table. In part of the Subdivisions these characters will appear of doubtful value, but I am able to add that they have appeared of more value within the last twelvemonth than they did three or four years since, and I do not see how the Epigynous Division could be arranged in Subdivisions by any other character. The single dagger (†) I regard as a neutral character and such families may be placed in either Procarpous or Heterocarpous Sections; on the other hand I estimate the single asterisk (*) to be

* Besides having with few exceptions imperfectly developed leaves, the number of the floral envelopes in the Endogens never rises so high as in the Exogens, the usual number of 5 sepals and 5 petals in the latter not being known among the former.

equal in value to three. I also feel confident that the position of the single carpel in families in which it is unknown may, in nearly all instances, be with moderate certainty calculated from their structure and affinities, so that outlines of Subdivisions or Sections may be thus formed which in most instances will I believe be found natural. It might be supposed for instance that the Second Section of Table IV. could not be regarded as Procarpous, but as there are included in it five families, besides *Ranunculaceæ*, in which the flowers are sometimes more or less irregular, viz., *Pyrolaceæ*, *Ericaceæ*, *Ochnaceæ*, *Pittosporaceæ*, and *Marcgravieæ* and in which consequently the single carpel would be in all probability anterior, it becomes at least theoretically probable that it is so, *Ceratophyllaceæ* and *Nelumbiaceæ* being the only exceptions as yet known.

In the Vertebrata taking the alimentary canal as the axis, the female sexual organs or their ducts are either posterior or anterior and the latter section are the more highly developed, and although this difference in the position of the male organs is less marked, yet it is already admitted as a guide to affinity as abdominal testes are acknowledged to indicate an inferior type. In Mammals the uterus and vagina are situated quite anterior, while the corresponding parts in Birds, Reptiles, Amphibians, and Fishes are posterior or show only a tendency to become lateral, so that Mammals might by the position of the uterus be separated from the other sub-classes of Vertebrata.* This rule is in a limited degree applicable to plants, the sections formed, being, as far as at Present known, smaller and less distinctly marked. Differences of the same nature occur also among the Invertebrata, but how far they would form natural sections may be a question.

Value of Other Floral Characters.

Having endeavoured to show that the epigynous is the lowest form of ovary among the Exogens, the next step naturally is to enquire which is the highest form, so as if possible to separate one or more Divisions from the Perigynous or Hypogynous families which might be regarded as the highest developed form of plants. On the principle that the Epigynous are a lower Division of plants than the Hypogynous, it might be expected that the Perigynous Division would prove to occupy an intermediate station between the two, but the families regarded as Perigynous are so intimately blended with the Hypogynous (the character itself being scarcely definite), that any separation of them appears inconsistent with a due regard to the most strongly marked affinities.

The ovary which differs most from the epigynous it will probably not be doubted, is the apocarpous, and this is one of the characters which is regarded as showing a higher degree of organization, as none of the apocarpous families are I believe near the Epigynous Division. To this rule however there are certainly such exceptions as to make it only of secondary value, but the Chloranthal Division, Table III., which I believe to be the lowest form of Perigynous and Hypogynous plants, contains no strictly apocarpous family, and in fact scarcely any apocarpous genera, while the Platano-Proteal Division Table VI. contains more than any other.

The ovule pendulous with the raphe next the placenta, especially if occurring in conjunction with the single carpel anterior, is regarded as a character always showing a comparatively higher degree of development, and such families are always placed foremost in the Subdivisions of the Tables. And where the position of the single carpel is unknown, the ovule pendulous with the raphe next placenta is still taken as a guide, so far as to place such families in the most advanced positions in the Subdivisions as far as is consistent with other affinities which very rarely interfere with such arrangements. From the very rare occurrence of this character among the Endogens as before noticed, it might be expected that it would prove applicable to a considerable extent in showing the position of many of the Exogenous families.

The occurrence of irregular flowers where they are irregular in the highest degree, especially if the ovary is reduced to one carpel and that anterior, and the raphe where the ovule is pendulous is next the placenta, is beyond doubt also a character indicating a comparatively higher degree of development even though it may not extend through the whole of the family, and it may be a question if there is any material exception to this peculiarity of structure as a guide to affinity as far as regards Subdivisions.

On these principles the *Proteaceæ* and *Leguminosæ* and their allies, in which the apocarpous ovary occurs in conjunction with the irregular flower,† and the didynamous families especially the

* In the Chamæleon, which is among the higher developed Reptiles, the two oviducts combine and form a single tube as in Fishes, but the two ducts do not form one canal at any part, and they open by separate orifices. At their lower termination they form by uniting together a double tube situated behind the large intestine. In the Tortoise and Frog the oviducts are very large and lie on the sides of the large intestine but open behind it, being separated at their termination only by a very thin septum, so that their orifices are close together, which becomes more obvious if they are distended. In both of them the urethra is in front of the intestine, so that the orifices of the oviducts, which in the form of vagina are in close relation with it in the Mammals, are widely separated from it.

† *Leguminosæ* are, in the position of the raphe in suspended ovules, more highly developed than *Ranunculaceæ*, (*V.* Table IV.)

Acanthaceæ as having the highly developed testa before referred to, will decidedly take their places as the highest developed forms of plants; and the mass of the Perigynous and Hypogynous families, according to their affinities, will then consequently find their places successively between the Epigynous Division and that Division in which these families are included. (*V.* Table VI.)

The Divisions or Races of the Hypogynous and Perigynous Families.

In the attempt to execute this part of the arrangement many difficulties it is confessed had first to be surmounted. In the first place I have endeavoured to discover, by careful analysis, of how many natural Divisions or Races the Perigynous and Hypogynous families can be regarded as consisting, and the comparatively great variety in their structure seems to make success possible if not probable.

The number of the Divisions being provisionally accredited, the next part of the analysis is to enquire, by the examination of every character showing affinity, how many of the Perigynous and Hypogynous families can be referred, without doubt, to one or other of these Divisions. There then remains I believe very few of them which are at all osculant between the Divisions, and these are arranged according to their more strongly marked affinities.

It would be difficult however in words to fully describe the mode in which I have arranged the Perigynous and Hypogynous families, or at least the attempt would imply details which do not seem at present called for, and I must refer to the Tables themselves for further explanation; but the principle is so much the same as that which has led the authors of the *Bryologia Britannica* to a natural arrangement of the genera of Mosses, (*Introduction* p. 6,) that the same words suffice as a limited explanation of it, substituting *Division* for "generic group," and *families* for "species," which would make the passage referred to read thus:—"The natural arrangement combines into one *Division* all those *families* which have a stronger mutual resemblance of structure in all parts, than to those of any other *Division;* the sum of characters, and not any single character exclusively, being taken into account." I however believe that where genera occur having what has been termed salient characters, and especially also exceptional characters, such as *Donatia* among *Saxifragaceæ*, they often show the position of a family more unequivocally than the general characters, which may leave it more or less osculant. Thus the general character of *Saxifragaceæ* places them near *Rosaceæ*, but this genus and also others appear to me to show that the resemblance, however close, is due to analogy only. In taking into account therefore "the sum of characters," such genera are frequently considered as the most certain guides to the position of a family. That the mode of the arrangement of the Epigynous Division, Table II., is throughout natural I feel quite confident, and have for some length of time past; and it also appears to me as equally certain that the Perigynous and Hypogynous families *must be subdivided on the same principles* to arrive at the natural system of Exogens; and in the Tables containing these families it will be sufficiently obvious that the same principles are throughout adhered to, both in forming the Divisions and arranging the families contained in them.

The Cryptogamous Families.

The hypothesis that the apetalous families are apetalous forms of the polypetalous may I believe in an altered form be made applicable to the vascular Cryptogams relatively with the apetalous, viz., by comparing them with the unisexual forms of the apetalous. Thus the inflorescence of each of the vascular Cryptogams consists almost exclusively either of the male or female inflorescence of some one or more of the apetalous families, as far as regards external appearance, although in reality both sexes are usually included in it. But this perhaps will not be regarded as an objection to such a comparison when it is recollected that ovaries frequently become anthers and occasionally bear anther lobes on their styles, and that anthers frequently bear ovules, while the original form both of the carpel and anther is retained. In monstrous flowers of *Cruciferæ* it is a common occurrence for disunited carpels to be antheriferous on one margin and to bear ovules on the other, and in one instance an ovule was produced from the substance of an anther lobe, springing from its rima.

Of these resemblances, the most prominent is that between *Polypodiaceæ* and *Cycadeæ*, the fronds of the former being analogous to the scales of the male flower of the latter. *Lycopodiaceæ* would be probably the male inflorescence of *Coniferæ* and *Gnetaceæ*, as their female spore-cases do not differ in any external character from the male unless it is in size, and the latter appear identical with those of *Equisetaceæ*, (Carruthers, Geol. Mag. Vol. II, No. xvi., Oct. 1865);—*Equisetaceæ* would be the male inflorescence of *Coniferæ*, i.e., of such genera as *Taxus*, but as they show so much the habit of *Ephedra* they may have more affinity with *Gnetaceæ* as the latter approach so nearly to *Coniferæ*;—and *Marsileaceæ* would be the female inflorescence of families in which the placentation is dorsal, and I believe this comparison might be made even though the capsules of that family consist only of bracts.

The approach between *Polypodiaceæ* and *Cycadeæ* is so close as to be well borne out by a minute comparison and makes it very probable that all the higher Cryptogams have a decided relation to some apetalous family. The rings or rather compressed, flattened, oval masses of spore-cases of *Marattia salicina* and *attenuata* differ from the anther cells of *Ceratozamia mexicana* only in being more numerous, (from six to ten or more instead of from three to five,) and in being adherent to each other laterally, for both the spore-cases and anther cells open internally, *i. e.* towards the

centre of the ring, by a single fissure extending from the apex to the base, and they agree also in converging as near as possible at their basis so that in *Marattia* eight or ten spore-cases are sometimes attached almost by a point. *Dion edule* has an abundance of paraphyses at the base of its anther cells which may represent the filamentous bodies occurring among spore-cases; and the interrupted character of the arrangement of the spore-cases on the fronds is fully explained by comparing it with the rings of anther cells in *Cycadeæ*. In the female *Cycas* fertile and sterile fronds are produced in alternate succession, just as in some genera of *Polypodiaceæ* e. g. *Blechnum; Stangeria paradoxa* has their forked venation and their usual mode of branching by division of the terminal bud instead of axillary budding, occurs in *Coniferæ*, a whorl of branches being given off at once. The prothallium may be regarded as a primary embryo-sac bearing minute portions of anther lobes (the antheridia;)*—the male prothallium may be a barren embryo-sac as regards archegonia? Mr. Salter's discovery of pollen in the ovules of *Passiflora* (Trans. Linn. Soc. Vol. XXIV, p. 143,) leads to this conclusion. As thus understood the contents of the anthers (spore-cases) are metamorphosed into ovules (the prothallia) and the antheridia they bear are partial reversions.† The male prothallia of *Lycopodiaceæ* and *Marsileaceæ* I regard as the same kind of development that takes place in the pollen-of *Coniferæ* and as not showing any analogy to those of the Ferns.

I have placed *Lycopodiaceæ* in relation with *Gnetaceæ* because of the singular resemblance of the short truncate stem of *Isoetes* to that of *Welwitschia*. Hofmeister compares it with *Beta* and *Cyclamen* both of which are included in Table III.‡ *Lycopodiaceæ* also approach closely in habit to *Crassulaceæ* and *Plantagineæ*, e.g. *Plantago pusilla*. If *Cycadeæ* are derived from *Marattiaceæ* becomes it most probable that *Coniferæ* are also derived from them through the former, rather than from *Lycopodiaceæ*, because it appears impossible that *Coniferæ* can be derived from both *Marattiaceæ* and *Lycopodiaceæ*. May not the 3-celled spore-case of *Bernhardia* be the prototype of the 3-celled anther of *Welwitschia?*

The affinities between the vascular Cryptogams and the hypogynous Exogens are sufficiently clear to be regarded as undoubted; but the relations between *Bryaceæ* and their allies and the epigynous Exogens are not so complete on account of the difference in their fructification; the difficulty may however I believe be superseded, see p. 13. It has been repeatedly suggested that there may be an affinity between *Gnetaceæ* and *Loranthaceæ* and if so the Epigynous Division, Table II, might be a retrograde branch of the *Gnetaceæ*, but this would require neither alteration in the arrangement of the Tables nor changes in the position of any of the families. (V. Tables II. and III.) This however appears to me impracticable and I prefer adopting the Muscal hypothesis supposing some connecting link may perhaps be wanting. As the theory of two generations or the alternation of generations does not offer any explanation of the nature of the structures composing the very variable infloresence of the higher Cryptogams, the usual rules of analogy and homology are our only guides.

If *Lycopodiaceæ* are derived from *Bryaceæ* of which they have so much the appearance, might not the near relation between them be explained on the supposition that the former are an hermaphrodite form of the latter? The capsules of the former would be the thecæ of the latter containing both male and female spores (the calyptra being absent or represented by the stipule of *Lycopodiaceæ?*), the fertilization taking place after their dispersion as in the *Algaceæ* recently observed (Nat. Hist. Rev.—1865, p. 74 et seq.); and the male spores in their development may be compared to that of the pollen of *Coniferæ* and probably also to the cell-division which takes place in the androspores of *Œdogonium* and *Bulbochæte* (l. c. p. 74). Assuming that *Bryaceæ* are, through *Jungermanniaceæ*, derived from *Algaceæ*, *Lycopodiaceæ* would be *Bryaceæ* returning to their original character as far as regards fertilization taking place after the dispersion of the spores.

The term *polyembrynous* refers to the number of embryos or germinating bodies produced by a single archegonium; in the vascular Cryptogams it produces but one, but in *Bryaceæ* and their allies it produces many, and from the mode in which this is effected they may be regarded as one degree lower in their organization.

Miscellanea.

Some of the families now regarded by some botanists as distinct will doubtless be finally included in others, but I am obliged for the present to place them as distinct or as sections of others for the purpose of showing the position which from my own analysis I infer they should occupy.

* The long vitality and continued growth of the prothallium has nearly its parallel in the embryo-sac of *Nuphar lutea*, which I have seen thickened, completely enclosing the cotyledons, and still in vigourous growth, six weeks after the germination of the embryo when it had produced two or three leaves. The albumen was dead, as it was quite softened like pulp. The cells of the cellular tissue of the embryo-sac were large, and had the glistening appearance of the surface of a young leaf. How long these sacs would have continued living I do not know, as the plants were destroyed.

† Consistently with this view it appears from very recent observations made by M. Duval-Jouve since the above was written (Nat. Hist. Rev.—1864, p. 562,) that archegonia usually one or more occur on the male prothallia of *Equisetum*, but they are not fertile.

‡ Currey's Translation of Hofmeister on the Higher Cryptogamia, p. 372.

The families included in the Apetalous and Monopetalous Divisions will be found true to their appellations, the former being all apetalous and the latter all monopetalous, but in the Polypetalous Division are included some of the apetalous families because their nearest affinities are with one or more of the polypetalous families, and so decidedly so, that they would be out of place in the Apetalous Division, as for instance *Tetragoniaceæ* and *Callitrichaceæ*. This appeared unavoidable consistently with the principal object in the present arrangement, which is to place each family with its nearest allies, and then to show how far characters structural and physiological can be made, consistently with the principles of scientific botany, to support such an arrangement.

The expression "next the placenta," made use of in the Tables in reference to the position of the raphe, is equivalent to "raphe ventral," an expression referring to the same character, both in erect and pendulous ovules, in the 'Genera Plantarum' of Bentham and Hooker;—"next the placenta" will perhaps be more readily understood by those who have not given especial attention to the subject.

ENDOGENS.

Table I.

I am aware that there is no evidence to show that any near affinity exists between *Lemnaceæ* and *Ricciaceæ*, further than that the habit of some species of *Riccia* is so much like that of *Lemna*, that they are stated to have been mistaken for species of that genus by some authors, while species of the latter genus have in fact been described as belonging to the former; and although habit is often of little value as a character among phanerogamous plants, it is acknowledged to be of more importance among the cryptogamous. But as the present arrangement includes the placing of all the cryptogamous families in relation with the phanerogamous, the Endogens should in all probability be compared to one at least of their lowest forms; and as the *Ricciaceæ* have no affinity with the apetalous forms of the Exogens, a negative evidence is afforded of their being the cryptogamous form of the *Lemnaceæ*.

An affinity between *Marchantiaceæ* (which are scarcely distinct from *Ricciaceæ*) and *Zosteraceæ* is suggested by Dr. Lindley, who remarks that the pollen of *Zosteraceæ* is "in a condition that may be well compared to the elaters of *Marchantia* and its allies, and totally different from all that is known in other flowering plants." (Veg. Kingd. p. 145). But whether this should now be regarded as more than an analogy may with some botanists perhaps be a question. A decided resemblance however between *Lemnaceæ* and *Marchantiaceæ* as regards mode of growth has been pointed out by Hofmeister. In *Lemna* the young shoots proceed from the median line on the under surface of the frond, or at least they are connected with it by distinct bundles of tissue like ribs, which may be seen on its under surface; and in *Marchantia* "a process of cell-multiplication commences in individual cells (usually near the median line) of the under side of perfect shoots, by means of which slender, delicate shoots are produced, which soon throw out rootlets, and which, by the decay of their posterior parts, separate from the mother plant and become independent individuals."*

It also deserves notice that the translucent involucre of *Marchantiaceæ* occurs in *Naideæ* and in *Monochoria* enclosing two flowers;—that in *Riella*† the archegonium is enclosed in a veil much like the membranous spathe of *Lemna*, so that supposing the seed of a *Lemna* when single to have several embryos (as sometimes occurs in the onion,) and that they were acotyledonous, the approach would be very close, especially if the testa were adherent to the carpel;—and that in *Marchantia* and *Rebouillia*‡ the conical head of flowers, the upper half of which is barren, is a miniature representative of the spadix of an *Arum*. And possibly some analogy may be traced between the Endogens and Lichenales in the physiological character of the *Bromeliaceæ* growing freely without any source of nutrition, except the surrounding atmosphere, and their habit also is not unlike that of *Parmeliaceæ*, e. g. *Tillandsia usneoides*, if it is admitted that leaves may be compared to foliaceous branches. (V. Obs. On the Natural System, p. 2.) I however regard the Fungales and Lichenales as having no representatives among phanerogamous plants like the higher Cryptogams and even the Algales remotely, and have therefore placed them separately at the commencement of the Sections of Cryptogams.

The habit of *Tacca* is so much like that of *Aristolochiaceæ* as to have led to repeated comparisons (Lindl. Veg. Kingd. p. 149,) and it may also deserve notice that in one species of *Maranta* the same peculiarity occurs as in *Valeriana*, viz. the fertile carpel and stamen are always lateral in relation to the flower but anterior in relation to the axis of the inflorescence§; and also that

* Currey's Translation of Hofmeister on the Higher Cryptogamia, p. 108.

† L. c. Pl. XIV. f. 16.

‡ L. c. Pl. XV. f. 12; and Pl. XVI. f. 17.

§ For further explanation of this singular character, V. Ann. Nat Hist. 2nd Ser. Vol. XI.

the adhesion of the stamens to the style in *Orchideæ* has its parallel in *Stylidiaceæ*, all which coincidences may tend to bear out the idea that the Endogens and Epigynous Exogens are branches of nearly allied subdivisions of the cryptogamous families. (V. Tab. II.)

With regard to the division of the Class Endogens, proposed in Trans. Linn. Soc. Vol. XXII. p. 409, further observations have given me an increased confidence in its practicability, as there does not appear to be any close connection between the Endorhizal and Exorhizal families as now separated, except that of *Juncaceæ* and their allies on the one hand, with *Liliaceæ* and their allies on the other, and these may by further analysis prove to be sufficiently distinct. The position of *Palmaceæ*, and also of *Taccaceæ*, then appeared to me to be doubtful, but the subjoined notes will I hope leave their affinities no longer a question.

With the Endorhizal families, however, are included several in which the germination as far as the primary radicle is concerned is exorhizal, as I then particularly noticed; but as the endorhizal character is probably one of much importance, it should occupy a prominent position notwithstanding the exceptions.* It deserves notice also, that with the Endorhizal families are naturally included all those in which the bulk of the embryo consists of an enlarged radicle, as unnatural combinations must follow their separation. The Endorhizal Section is therefore to be understood as having reference only to alliances, those alliances containing families the germination of which is endorhizal, or the embryo macropodal being placed together under this head. Should, however, these characters prove insufficient for the purpose of effecting a division of the Endogens, yet I believe they may be naturally arranged in two Races, springing respectively from *Zosteraceæ* and their allies and *Araceæ* and their allies, the former of which may be termed as now Endorhizal, on account of its containing all the families known as being Endorhizal, or as at all likely to prove to be so.

Desvauxiaceæ.

This family presents the remarkable character of having the single carpel always posterior, the only instance I have met with in the Endogens. It may be regarded as decidedly indicating the lowest developed, or at least the most retrogade form of the Endorhizal Section. The single stamen is also posterior, a very rare character, as in all other instances (except in *Callitriche*) in which it has appeared to be posterior, it alternates with the posterior petal, and is therefore not directly posterior.

Taccaceæ.

I have now no doubt that this family is nearly allied to the *Orchideæ*, having very recently had an opportunity of observing that *Tacca* has precisely the embryo of *Burmanniaceæ*, it being attached by a suspensor like a thread-like funiculus to the thin layer of albumen which intervenes between the cavity in which it lies and the hilum (fig. 1). It therefore agrees with the embryo of *Dictyostega*, as described by Mr. Miers,† and with that of *Thismia*, although the suspensor in the latter instance is often indistinct. In *Tacca* the funiculus is firm, it being difficult to detach it without injury to the embryo itself. The embryo is a simple ovoid body without any trace of a plumule. These well-marked characters appear to me to remove *Taccaceæ* far from *Araceæ*, to which they have been compared, and to associate them exclusively with *Orchideæ* and their allies.

* As far as my observations have extended, the endorhizal germination is peculiar to the Class Endogens, as in those instances referred to as occurring in the *Nymphæaceæ* it seems probable that secondary radicles only are intended to be described as endorhizal; and in the *Cruciferæ* as in the Radish, the exfoliation of the cuticle does not take place till a long time after germination, and is more distinct on the upper half of the cauliculus, but whether extends, or whether it sometimes extends, on to the radicle is a question somewhat difficult to decide, but I believe the answer would be in the affirmative.

† *I. e.* supposing the origin and place of attachment of the funiculus in the latter genus to be the same, and it is not at all likely to differ.

Hydrocharideæ.

In *Hydrocharis Morsus-ranæ* the greater part of the ovules are attached to the dissepiments, none however to their inner edges; but a considerable part arise from the midribs and wall of the ovary, over the surface of which they are irregularly scattered, so that this family as regards placentation suits well as being the epigynous form of *Butomaceæ*. In *Stratiotes aloides* there are no ovules on the dissepiments as they arise only at the junction of the wall of the ovary with the dissepiment, so that the placentation may be regarded as really dorsal, as it is in *Hydrocharis*. The ovule is, as described by Prof. Agardh (Theor. Syst. Plant. p. 39), anatropal, ascending with the raphe dorsal, with some few exceptions in which it is more or less lateral, thus corresponding very nearly with *Butomus*.

Palmaceæ.

This family agrees either in structure or habit with so many others, that it has given rise to the suggestion of very different comparisons, and until very recently I felt an uncertainty as to their nearest affinity. While engaged in the inquiry, Mr. Bennett favoured me with an opportunity of examining the specimens of Thrinax in the British Museum, and I now am satisfied that they are very near the *Araceæ*, the ovule of *Thrinax* being very much like that of *Dieffenbachia* among the latter. It is erect from the base of the ovary and incompletely anatropal, so that the foramen appears like a small aperture on its side close to the base. I find also on a further examination of the germination of *Arum*, that they approach very nearly in the mode of the growth of the cotyledon, the opening for the emission of the plumule being very small and terminating above in a furrow precisely as in *Phœnix*; I have no hesitation in regarding the latter as exorhizal. The position of the carpel in *Thrinax*, and also of the fertile carpel in *Phœnix* and *Calamus*, is variable, very nearly in the same manner as in *Sparganium*, nor have I met with any other genera among the Endogens which correspond so nearly with *Sparganium* in this character, and I should therefore regard *Palmaceæ* as connecting *Typhaceæ* with *Liliaceæ* and *Araceæ*.

Melanthaceæ.

In *Veratrum album* the primary radicle is exorhizal, and in all probability it will prove to be so in the few remaining families included in the Exorhizal Section, the germination of which is at present unknown. (V. Trans. Linn. Soc. Vol. XXII, p. 402.)

THE DIVISIONS OF EXOGENS.

Table II.

The Balanophoral, or Epigynous Division.

That the Epigynous Exogens, or as I have termed them the Balanophoral Division, are really related to the *Bryaceæ*, may I believe be assumed, because the involucre (perianth) of *Jungermanniaceæ* may be regarded as analogous to the involucre so remarkable in the Epigynous families, especially in *Chamælauciaceæ*, *Calyceraceæ*, and *Dipsaceæ*;—the dense inflorescence of some *Bryaceæ* (50 archegonia on one stem) may be a near approach to the densely crowded spikes of *Balanophoraceæ;* a further comparison is offered in the close resemblance in appearance between the paraphyses of the former and the paraphysiform filaments occurring in the inflorescence of *Helosideæ* and other sections of the latter;—and it may also be confidently anticipated that *Bryaceæ* will agree with *Balanophoraceæ* in the physiological character of parasitism. (V. Linn. Proc. vol. V. p. 50.) It appears to me not improbable that the calyptra is a carpel, and, if so, may not the theca be a polyembrynous seed, its operculum an embryotega, and its inversion a tendency to become anatropous, as in the *Coniferæ?* And although the theca as thus understood represents an ovule, yet as it has internally the structure of an anther as far as regards the production of spores (like the ovules of *Passiflora* when producing pollen, Trans. Linn. Soc. Vol. XXIV., p. 143), the occurrence of a columella in the anther of *Mysodendron punctulatum* (Flor. Antarct. Vol. II., pl. 104, fig. 5 & 6), may be a very singular coincidence in structure between *Loranthaceæ* and *Bryaceæ* (v. p. 7,) and offer an unexpected explanation of the origin and nature of the columella, in the latter hitherto obscure or unknown. The seta may be analogous to the jointed filament of *Melastomaceæ*, the articulation in the former being generally at its base but not always *(Sphagnum)*, instead of towards the apex; and the peristome to a tuft of scales on the apex of the half-superior ovary of *Centradenia*.

As far as my observation has extended, the line of separation as it may be termed, between the Epigynous and the other Divisions of the Class Exogens, is quite distinct, so far as that every family belongs decidedly to one or other of them. Between their apetalous and monopetalous forms there is no approach which can be regarded as showing a decided affinity, from which it may be expected that the approaches between them in their polypetalous departments, although so close, are only analogies. The nearest approaches appear to be in the families *Humiriaceæ* and *Saxifragaceæ;* but the first may without doubt be regarded as *Styraceæ* with a superior ovary, having no near affinity with any of the Perigynous or Hypogynous families; and the latter have parietal placentæ in those genera which most nearly approach *Rosaceæ* as *Tiarella*, although the upper part of the ovary is deeply bifid, and indeed it still appears to me a question whether the approach between *Saxifragaceæ* and *Rosaceæ* is more than an analogy, because, otherwise, *Hydrangeaceæ* would be very near *Leguminosæ*.*

I have already noticed that in the apetalous families of the Epigynous Division the raphe is always dorsal in pendulous anatropal ovules, with the exception of *Garryaceæ* where it is lateral; and it is also remarkable that in this Division the raphe next the placenta in pendulous ovules occurs only in highly developed families, and (with the exception of *Umbelliferæ* and *Araliaceæ*) only where they approach the Perigynous and Hypogynous.

* It is difficult to suppose that *Saxifragaceæ* are in closer affinity with *Rosaceæ* than *Hydrangeaceæ* are, or even *Cunoniaceæ* and *Philadelphaceæ*, because the genus *Vahlia* has a 1-celled ovary consisting of 2 carpels with 2 pendulous placentæ attached to the apex directly beneath the styles, the placentæ being covered with small very numerous ovules, the placentation resembling that of *Garrya* (v. Appendix) and *Hydnora*. The apetalous forms of the Cornal and Rosal Alliances have no affinity with each other.

Diclidantheræ.

In the Kew Herbarium I find *Diclidanthera* placed with *Styraceæ* to which it is doubtless nearly allied, and it may almost be regarded as a genus of that family with a completely superior ovary, there being no other difference except in the dehiscence of its anthers and the cells of the ovary containing 1 ovule each, in the latter of which characters it agrees with *Humiriaceæ* when the ovule is single. In the dehiscence of its anthers it is perhaps nearest to *Aptandra*, and the ovary (the cells of which communicate above) and ovules agree very closely with those of *Humiria*. It is also very near *Lonchostoma*.

Humiriaceæ.

I have no doubt but that *Diclidanthera* forms a connecting link between *Humiriaceæ* and *Styraceæ*, as they may be regarded as scarcely differing, except in the petals and stamens of the former being hypogynous; and this comparison is further supported by its being generally admitted that they are very nearly allied to *Olacaceæ* which are a polypetalous form of *Styraceæ*. In one of the species of *Saccoglottis* the anther opens by valves laterally, bringing to mind the *Hamamelideæ* and approaching also *Diclidanthera*. The cells of the ovary are opposite the lobes of the calyx, in which I find they agree with *Diclidanthera*, so that possibly this genus may be regarded as a section of *Humiriaceæ*. Their barren stamens are remarkable for being either external or internal to the fertile, their narrow terminations in the former case being not unlike those of the external row of barren stamens of *Napoleona*, which has been compared to *Symplocaceæ*. The station of this family is therefore decidedly in the Epigynous Division, especially as they do not appear to approach any of the hypogynous families except *Olacaceæ*, in which however the ovary is in some instances inferior or partly so, and which from their very near affinity with *Santalaceæ* are unavoidably placed in the Epigynous Division. The transverse partition, which separates the ovules in *Humiria*, is most probably the same which takes place imperfectly in *Halesia* and allied genera, and I believe the ovule is erect in the upper cell and pendulous in the lower as in *Halesia*.

Umbelliferæ.

I suggested in the Trans. Linn. Soc. v. XXII., p. 412, that the single carpel posterior is a character not likely to occur in the Epigynous Division, and on that account regarded *Vochysiaceæ* as having no affinity with them. But the single carpel in *Didiscus cæruleus* being always posterior, leaves no doubt that it is a character common to this Division In this plant the ovaries of the central flowers of the umbel are dicarpous, but the greater part of those of the intermediate flowers, and all those of the circumference, are reduced to a single carpel without exception posterior.

Gunneraceæ.

In the flower of *Gunnera* there seems to be no evidence to decide whether the ovary consists of one or two carpels, the stigmas being two and the ovule pendulous from the apex of the cell, but on separating the hardened endocarp, which is quite distinct from the external substance of the pericarp, it is found that it is unequal-sided, and that one side is always more convex, protuberant and ridged than the other. In other similar cases, as in *Cannabis*, this would be the dorsal suture, and if so the raphe is next the placenta; and I also believe that I have seen the ovule attached to the opposite, i.e., the contracted side of the ovary. The remains of the withered stigmas show that they are opposite these two ridges on the opposite sides of the ovary, so that of the two carpels, one is abortive being represented only by a stigma.

Balanophoraceæ.

The affinities of this family have been so satisfactorily explained by Dr. J. D. Hooker (Trans. Linn. Soc. vol. XXII.), that I have only to add that I believe that the compound inflorescence of *Calyceraceæ*, in those instances where the involucre contains several flowers, may be compared to the compound inflorescence of *Balanophoraceæ* (the female inflorescence only) such as that of

Balanophora fungosa (loc. cit.) and that of *B. alveolata* (Trans. Linn. Soc. vol. XX. tab. 5, figs. 9 & 10), and I have on that account placed them as an apetalous form of that family with which they agree in their syngenesious anthers and albuminous seed. The position of the carpel is inserted on the authority of Dr. J. D. Hooker (loc. cit.), and I should have expected from the analogy between *Cynomorium coccineum* and the *Onagraceæ* where the stamen is single, that the carpel would in that genus be anterior. An examination of the ovule of *Lophophytum** confirmed Dr. J. D. Hooker's inference as to the position of the raphe (loc. cit.), as it has all the appearance of being dorsal in that the funiculus is attached to the upper part of the dorsum of the ovule, which has a three-ribbed triangular appearance, one of the ribs being dorsal and two lateral, it being simply flat and rib-less on that side which is next the placenta, and in these characters it agrees precisely with the ovule of *Mysodendron*.

Brunoniaceæ.

The structure of the genus *Brunonia* has attracted much attention, but as its affinities remain up to the present time entirely a question, the following notes, which are the result of repeated examinations, will I trust, not prove unacceptable:—

The habit of the species is perhaps most like that of *Dipsaceæ* with which they particularly correspond in their dichotomous inflorescence, which may be regarded as a capitate form of that occurring in *Morina*; and in the venation of their corolla, in which they differ from *Compositæ*, they approach *Dipsaceæ* very nearly, as in the latter family the segments of the corolla have a midrib, a part of the branches of which are inflected inwards so as to rejoin it; and in all probability also their affinity with *Dipsaceæ* offers the most satisfactory explanation of their superior ovary, for in that family we have the ovary quite free from the calyx, except at its apex giving rise to the "flos superus" with "ovarium liberum."

In all other parts of their structure, except the involucral leaves of their flower, in which they may further be compared with *Dipsaceæ*, and the indusiate stigma in which they approach so closely to *Goodeniaceæ* that the structures may be regarded as identical, they agree with *Compositæ* being more nearly allied to the Tubulifloral than to the other subdivisions.

1. The involucre and calyx. Surrounding the calyx are 4 imbricated involucral leaves, to which occasionally a fifth is added, and it may then be analogous to the involucre with five flowers, occurring in *Valerianaceæ* in genera connecting that family with *Dipsaceæ*, *i.e.*, supposing the central flower to become rudimentary and each involucral leaf to contain a flower in its axil. The calyx although it is not exactly like the pappus of *Compositæ*, yet differs from it only in the simplicity of its segments, for each of them from base to apex is only a slender hairy fibre, scarcely varying in its diameter.

2. The corolla agrees entirely with that of *Compositæ* except in the venation of its segments, each of which has a central rib from which proceed 1 or 2 branches which form a secondary rib or vein on each side close to the margin, and unite again with the central rib at the apex. In *Compositæ* the central rib is not perceptible, though traces of it may be supposed to exist, and the vessels of each segment consist of only 2 marginal veins which proceed upwards from the veins alternate with the segments and unite at its apex. I would not however in the present instance attach any importance to the venation of the corolla further than that it may serve to show to which of the allies of *Compositæ*, *Brunoniaceæ* may be regarded as most nearly approaching in this character, because the venation of the corolla in *Calyceraceæ*,† although its segments have midribs, is very nearly the same as that of *Compositæ*, so that *Brunoniaceæ* and the latter may be regarded as differing in this character in the same way as *Dipsaceæ* (the venation of the corolla of which is before noticed) and *Calyceraceæ*.

3. The anthers are so identical with those of the *Compositæ*, especially in their remarkable jointed filament, which is otherwise peculiar to that family and *Melastomaceæ*, and to which I have given careful attention, that from their structure alone a very near affinity would be suggested.

4. The ovary. The ovary of the *Compositæ* I believe is now generally regarded as compound, and is proved to be so by the peculiarly marked characters of the ovary of *Centaurea Cyanus* and other species (Ann. Nat. Hist. 2nd Ser. vol. 11, Pl. XV. fig. 13). The ovary in several of the genera has 4 well-marked lines on its parietes, 1 anterior and 1 posterior, and 2 lateral, (the anterior being the more strongly marked,) so that a question might arise as to whether it consisted of 2 or 4 carpels, but as the stigmas are only 2 it cannot consist of more than 2. In *Centaurea* the anterior and posterior lines always correspond with the 2 lobes of the stigma, and I find on tracing up the 2 lines in the parietes of the ovary of *Brunonia australis* through the style (in unopened flowers where it is short) that they distinctly terminate in the centres of the 2 lobes of the indusium; and the ovary may be further compared with that of *Centaurea* in showing traces of 2 more lines

* V. fig. *L. Weddellii* Ann. Nat. Hist. 3rd Ser. vol. 1, Pl. VI. fig. 23.

† The segments of the corolla in *Calyceraceæ* have both the midrib and the lateral veins, but the lateral veins do not spring from the midrib, as in *Brunoniaceæ* and *Dipsaceæ*, but pass up the corolla at the commissures of the petals as in *Compositæ*.

in its parietes* alternate with the other 2. *Brunonia* however differs from *Centaurea* in the 2 larger and much more strongly marked lines being sometimes right and left of the axis instead of always anterior and posterior, but this variation is also common in the *Compositæ* and is therefore of no importance; it is always accompanied by a corresponding change in the position of the stigmas, and is consequently owing to a change in the position of the carpels.

5. The indusium and stigmas. The only difference between the germen of *Brunonia* and that of the *Compositæ* apart from the non-adhesion of the calyx is in the indusiate stigma and in the different relation of the lobes of the stigma to the 2 more obvious lines in the parietes of the ovary. I have described the 2 more obvious lines in the opposite sides of the parietes of the ovary (which as in *Compositæ* are, I have no doubt, the midribs of the two carpels) as terminating each in the centres of the corresponding lobes of the indusium, whereas the 2 lobes of the stigma are alternate with those of the indusium, and consequently alternate these lines instead of opposite as in *Compositæ*, which would be an anomaly with difficulty accounted for were it not that in *Goodeniaceæ* the stigmas are also alternate with the 2 lobes of the indusium. The 2 lobes of the indusium are in *Goodeniaceæ* anterior and posterior, corresponding with the 2 carpels which are as regularly anterior and posterior, and the lobes of the stigma are consequently alternate with the carpels, *i.e.*, in relation with the placentæ instead of with the dorsal ribs, and the inference therefore is that such is also the structure of *Brunonia*.

6. The ovule and the position of the fertile carpel. The ovule in its relation with the ovary agrees so constantly with the *Compositæ* that in connection with other characters it places beyond donbt that the nearest affinity of *Brunonia* is with that family. I have noticed that the raphe in *Compositæ* (loc. cit.) is always next to the anterior rib of the ovary and in relation with the anterior lobe of the stigma, *i.e.*, when the carpels are anterior and posterior, and I find in *Brunonia australis* that the raphe is almost always in relation with the anterior of the 2 more strongly marked lines in the parietes of the ovary, the exception being as far as calculation has extended only 1 in 28. The conclusion consequently is, that in *Brunonia* as in *Compositæ*, the raphe of the ovule is next the dorsal rib of the anterior carpel. Sometimes however the carpels of *Brunonia* are right and left of the axis or oblique, and then I find the raphe removed so as to correspond as before in its relation with 1 of the 2 larger lines. In fact *Brunonia* agrees so decidedly with the *Compositæ* in the structure of its ovary and in the position of the raphe, that I believe it has but a comparatively distant affinity with *Goodeniaceæ*, as in the latter family the raphe is either lateral, or (when the ovule is single and erect,) next the placenta.

In its appearance also the ovule closely resembles that of *Compositæ* in having a larger foramen than usual in monopetalous plants, and the raphe soon becomes lost in consequence of its fibres spreading as they ascend as in some *Compositæ*, so that in the upper third of the ovule it is not discernible as a single cord.

It now only remains to endeavour to show what would be the position of the carpel supposing the ovary to be reduced to only one, and this can be satisfactorily accomplished provided it is taken for granted that the structure of the ovary and the position of the raphe are the same as in *Compositæ*, to which I believe no objection whatever exists. The position of the raphe then being taken as a guide to that af the fertile carpel, it proves to be either anterior or lateral, occasionally having an oblique direction between these two positions. Of 28 ovaries of *Brunonia australis* in one capitulum of flowers, the fertile carpel was anterior in 12, lateral or obliquely lateral in 15, and posterior in only 1.† It may therefore in this character differ from *Compositæ* in the carpel being occasionally though very rarely posterior, and agree with *Dipsaceæ* where in *Morina* ‡ it is occasionally so, but as rarely as in *Brunonia*.

As the ovary superior and the filament having a joint near its apex occur in *Melastomaceæ*, that family well represents the polypetalous form of *Brunoniaceæ*, having the same relation to *Myrtaceæ* as the latter to *Compositæ*. The jointed filament of *Melastomaceæ* appears to me identical with that of *Compositæ*, and in the inner row of stamens in *Heterocentron* it is quite as near the base of the anther.

Lythraceæ.

The affinities of this well-known family have hitherto remained doubtful, but the newly discovered genus *Axinandra*, Thwaites, I believe, shows that it is very near *Melastomaceæ*, of which it may possibly prove to be a section. Looking at the flower only, this genus might I believe be referred to the section *Memecyleæ*, as it has the peculiar anthers of *Memecylon* and so much so

* In the smaller ovaries these 2 lines are not perceptible, and sometimes one is larger than the other so as to give the ovary at first sight a 3-ribbed appearance.

† In the *Ann. Nat. Hist. 2nd Ser.* Vol. XI. the position of the carpel in *Brunonia* was described as variable, being often posterior, but that inference was deduced supposing the raphe to be next the placenta, *i.e.* axial, the carpels being two;—the signs in the diagram therefore which is there inserted require only reversing to show the true position. The diagram gives a correct view of the dichotomous mode of the branching of the inflorescence.

‡ *Morina* is the only genus in *Dipsaceæ* in which I have observed any carpels posterior, or rather lateral and internal, which I regard as equivalent to posterior, (V. Ann. Nat. Hist. 2nd Ser. Vol. XI.) and this occurs so rarely, perhaps in 1 of 40 or 50 flowers, that it does not seem to require that *Dipsaceæ* should be on that account removed from their natural station, even if the carpel were not always anterior in other genera.

that they could with difficulty be distinguished except that those of the latter have a small gland near the apex;—the very short filaments of *Axinandra* depressed so as to be horizontal, and the singular thickened connective with small anther lobes on its under surface, are very nearly identical with those of *Memecylon*, if indeed they are distinguishable;—and the calyx and corolla are very nearly alike, except that the lobes of the calyx in *Memecylon* are slightly imbricated, while those of *Axinandra* are valvate, those of the former however being thickened and closing over the petals in æstivation much like those of the latter.

But the winged seed of *Axinandra* is so precisely that of a *Duabanga* that I believe it is correctly referred to *Lythraceæ*. The embryo is straight, and the cotyledons have their edges in apposition with the raphe, but in *Memecylon* the flat surfaces of the cotyledons are in apposition with the raphe,* which is probably a difference of the same kind as the cotyledons accumbent and incumbent in the *Cruciferæ*, as the raphe is always in the same line as the curvature of an embryo. This difference in the position of the cotyledons I believe to be the only distinction which deserves notice as separating *Lythraceæ* from *Melastomaceæ*.

There are also some other approaches between *Lythraceæ* and *Melastomaceæ* which are very close, as that of *Chætogastra divaricata*, which has the dichotomous inflorescence of *Cuphea* with a sessile flower in each fork;—that of *Microlicia cuspidifolia* in which the ovary, which is of an elongated oval form, is quite superior, being attached to the calyx only by its flat base;—and on the other hand that of *Physocalymna* among *Lythraceæ* has a free central placenta with numerous ovules, the ovary consisting of three carpels, traces of the dissepiments being seen on the inner surface, showing an analogy with *Spathandra* and some species of *Memecylon* as far as a 1-celled compound ovary is concerned.

Lythraceæ also approach *Myrtaceæ*, the genus *Sonneratia* having been referred to the latter family, but I find it is so near *Duabanga* among the former that unless it is in the embryo, which in all probability is the same, they differ only in the fruit of *Sonneratia* being in some degree succulent, the ovary of *Duabanga molluccana* being more inferior than that of any species of *Sonneratia* I have seen. The valvate calyx and other parts of the flower are stikingly alike, as also the remarkably vascular wood. The calyx in *Myrtaceæ* when fully developed is much imbricated.

The ovary of *Pleurophora* has the appearance of being 1-celled, and if so the carpel would be always posterior, *i.e.*, supposing it to consist of a single carpel, but having repeatedly examined it I have no doubt it consists of 2 carpels and is always 2-celled, the 2 cells communicating above so much as sometimes to make it appear 1-celled. The anterior cell I have never found to contain more than 1 ovule, but the posterior cell usually contains from 3 or 4 to 8. The anterior cell is much shorter, and the single ovule arising immediately below the edge of the dissepiment where the 2 cells communicate, it is uncertain to which it belongs, but the raphe next the placenta always shows that the anterior cell contains 1 ovule. Although I have never found the anterior cell empty, I have occasionally found the ovary with the two cells much less unequal than usual, and only 1 ovule in each.

Vochysiaceæ.

The irregularity of the flower of *Erisma* is the same as that of *Cuphea*, and the only distinction between this family and *Lythraceæ* is that the calyx is imbricate, the presence of stipules not being without exception, as in *Salvertia* they are wanting. A tendency to an irregular flower occurs also in *Melastomaceæ*, so that it is probable that *Lythraceæ* and this family are two sections of *Melastomaceæ*, but they should be kept distinct if they can, as in all other cases where the genera are numerous and for the most part different in appearance. Among other agreements between this family and *Lythraceæ* are the large wooded fruits, occasionally verticillate leaves, quadrangular stems and a close resemblance in the wood, that of *Qualea grandiflora* agreeing with that of *Sonneratia*, *Duabanga* and other genera of *Lythraceæ* in having a rather large but dense pith, very numerous distinct medullary rays, and vessels rather large (much larger than in *Myrtaceæ*) and often in pairs.

Cucurbitaceæ.

The structure and affinities of this family are so well known that I have only to add that in *Sicyos angulata* the raphe is dorsal, or possibly lateral, but not next the placenta, which may be regarded as an approach to *Onagraceæ* and *Myrtaceæ*, and as in some degree removing them from the hypogynous families with which they have been compared.†

* For a further notice of the embryo of *Memecylon* see remarks on *Combretaceæ*, Table IV.

† For a comparison between the anthers and those of *Columelliaceæ* see *Ann. Nat. Hist.* 3*rd Ser.* Vol. I. p. 109.

Homaliaceæ.

This family has been considered as osculant between *Loasaceæ* and *Passifloraceæ*, but to me they appear scarcely distinct from *Loasaceæ*, agreeing with them in habit and in all the parts of the flower, the same similarity between the sepals and the petals occurring in both families. In *Loasaceæ* the stamens, when the same in number with the petals, are alternate with them, occupying the same position as the glands in *Homaliaceæ;*—these stamens are sometimes developed as an inner and smaller row of petals which are truncate at the apex, which may be regarded as intermediate between a stamen and the flattened sometimes slightly pedicellate gland of *Homaliaceæ*, as the latter represents in all probability but one stamen, because in pentandous species, having 5 sepals and 5 petals, these glands are as large as usual.* *Loasaceæ* are undoubtedly in very near affinity with *Cucurbitaceæ* for even the anther cells become elongated as if approaching the long sinuous anthers of that family, and they may perhaps differ more in the position of the raphe than in any other character. The half anther of *Cucurbitaceæ* may be regarded as the first of a series of changes terminating in the formation of the glands of *Homaliaceæ*. If then *Homaliaceæ* differ from *Loasaceæ* only in their more completely abortive stamens, they cannot well be regarded as very near *Passifloraceæ*, but are the nearest analogue of that family in the Epigynous Division, near which they take their place in Table VII.

Cactaceæ & Aristolochiaceæ.

The position of the genus *Ribes* I believe to be between *Escallonieæ* with which it agrees in habit and *Cactaceæ*, and although it is nearer the former, yet it very closely resembles the latter in the fruit, that of an *Opuntia*, e.g. the Palermo Prickly Pear having a seed with a succulent testa like that of *R. Grossularia*†, from which it is evident that *Cactaceæ* are very nearly allied to the Epigynous Division, which is doubted by some botanists who compare them with *Mesembryanthemeæ*. The seed of this *Opuntia* has a small quantity of albumen, so that it differs only in the curved embryo, which however is in other genera of *Cactaceæ* straight. *R. Grossularia* has a singular thick fungous lobulated raphe much like that of *Asarum Europæum*, which may lend some support to the position of *Aristolochiaceæ* as an apetalous form of the Epigynous Division.

* I met with an instance in which one of the glands had on its surface the appearance of two imperfect anther cells, from which I should suppose that the gland itself is the thickened connective occurring in *Homaliaceæ*.

† The only other instance in which I have observed this character in a remarkable degree is in *Punica*.

Table III.

The Chloranthal, or Corolline Scale Division.

The very close affinity of all the families here associated will not I believe be doubted, with the exception of the *Labiatæ* and their allies, but these appear so distinctly to have the *Crassulaceæ*, *Callitrichaceæ*, and *Batideæ*, as their polypetalous forms, that the evidence of their true station being in this Division seems to be conclusive, and in fact I do not at present doubt it. The affinity between the *Gnetaceæ* and *Chloranthaceæ* is stated by Mr. Bennett to be undoubted, and that between the latter and *Polygonaceæ* is even more marked, (Ann. Nat. Hist. 3rd Ser. vol. 1. p. 106,) and *Piperaceæ* also show a close approximation to *Chenopodiaceæ*, which may be regarded as substantiating the affinity of *Chloranthaceæ* to *Polygonaceæ*. *See also* p. 6 & 7.

As physiological characters are of some weight, where doubt exists it may deserve notice that *Crassulaceæ* well represent *Welwitschia*, by growing in the most arid deserts; and an undescribed Selaginaceous plant from South Africa, collected by Dr. Wallich, has very closely the habit of *Crassulaceæ*.* The monadelphous stamens of *Welwitschia* may be compared to those of *Polygonaceæ*, especially to the monadelphous cup of *Coccoloba*, and also to those of *Chloranthus*, and it also agrees with the latter in the larger stamens being anterior.

So large a family as *Polygonaceæ* might be expected to have their representatives in the Polypetalous Division, and although they have not been compared with *Tamaricaceæ*, yet I believe that family to be their more immediate polypetalous form. They agree in habit, in their partially monadelphous stamens, and in their tricarpous ovary, the carpels being united by their margins, not otherwise materially differing except in their ovules. Their wood also is much alike, having strongly marked medullary rays.

It is remarkable that in this Division are included nearly all the instances of wood in which there are no medullary rays, and also those in which they are so imperfect as to be reduced to minute vertical cords of cellular tissue scattered irregularly through the wood, viz. *Piperaceæ*, *Chenopodiaceæ*, *Amaranthaceæ*, and *Nyctagineæ*, described by Dr. Schleiden; *Crassulaceæ*, by M. Brogniart; and more recently *Caryophyllaceæ* and *Plumbagineæ*, by Prof. Oliver (Trans. Linn. Soc. vol. XXII., p. 289). To these may now be added *Frankeniaceæ*,† *Mesembryanthemeæ*,‡ *Scleranthaceæ*,§ and perhaps *Illecebraceæ*, ‖ but in the latter instance a part of the genera will probably have them distinctly marked, except in the first two or three annual rings forming the centre of the stem.

On this account this Division might be not inappropriately named from its *variable wood*, as *Myrsinaceæ*, *Primulaceæ*, and *Portulaceæ* (the two latter in some instances only), are the only families included in the Scleranthal Subdivision I have examined, which have wood marked in an ordinary degree with medullary rays; but, for the sake of uniformity, it appeared preferable to name it in allusion to one of the most obvious characters of the flowers.

This Division is very remarkable for the presence of barren stamens in the form of scales adhering to the petals, as in *Caryophyllaceæ*, *Frankeniaceæ*, *Primulaceæ*, *Myrsinaceæ*, *Reaumuriaceæ*, *Borragineæ*, and *Hydrophyllaceæ*, to which may, perhaps, be added *Crassulaceæ*, as the stamens of some genera alternately adhere to the petals in precisely the same way as the scales in *Caryophyllaceæ* and *Frankeniaceæ*. Apart from the peculiarities of the wood, these corolline scales are perhaps its most remarkable general character, as they extend into the monopetalous department, *Borragineæ*, and *Hydrophyllaceæ* closely corresponding in their scales with *Caryophyllaceæ*, and being as far as I have observed the only monopetalous families that do so.

* I should not suppose it is a distinct genus, as it is very near *Selago*.

† I have examined the stems of several species of *Frankenia* having wood with from 3 to 7 rings, and in all the wood is uninterrupted, except by vessels and perhaps traces of cellular tissue between the rings;——also one of *Beatsonia portulacæfolia* $\frac{1}{8}$ of an inch in diameter, having 3 or 4 or perhaps more rays as they are very indistinct.

‡ In the stem of a *Mesembryanthemum* having 7 or 8 rings of wood, the most external are as deficient of medullary rays as the most internal; the wood has very rarely slight traces of cellular tissue which are probably detached portions as it were of medullary rays;—in two other stems one having 2 rings of wood and the other 3, nothing like a medullary ray was perceptible.

§ *Scleranthus marginatus*, Guss. the stem having 3 or 4 rings of wood.

‖ The stem of *Paronychia Jamesii*, Torr. et Gr. having 3 rings of wood, is much like that of a *Frankenia*.

Frankeniaceæ.

With those botanists who regard this family as in nearest affinity with *Caryophyllaceæ* I entirely concur. The leaves are opposite in pairs; each flower has 2 bracts at its base, not more, the others being only pairs of opposite leaves; their calyx, corolla with scales, and stamens agree very closely with *Caryophyllaceæ;* and their marginal placentation occurs in monstrous specimens of *Saponaria officinalis* (Linn. Proc. vol. 1. p. 159). The embryo of *Caryophyllaceæ* although generally, is not always curved, so that the seeds nearly agree, the tubercle at the chalazal end being perhaps analogous to that of *Reaumuriaceæ*.

Reaumuriaceæ.

The affinities of this family are it is generally admitted with *Tamaricaceæ* and *Ficoideæ* on the one hand, and *Hypericaceæ* on the other, but it being desirable to decide if possible to which of these widely different families they approach the nearest, I have minutely examined the genera for that purpose, and to me it appears that they are so near *Tamaricaceæ* that they must be stationed as conterminous with them.* Except in the presence of albumen they scarcely differ from them, having the same placentation and also dehiscence, i.e. through the midribs of the carpels.

And I also believe that they approach very nearly to *Caryophyllaceæ* and their allies, of which they have the remarkable and singular scales adhering in pairs to each petal; and the ovules of *Eichwaldia* have long funiculi (nearly as long as the ovule itself), bringing to mind those of *Mesembryanthemum* and *Batis*.

The characters in which they correspond with *Hypericaceæ* are:—1, dotted leaves; 2, unequal-sided petals; and 3, polyadelphous stamens. 1. The glandular dots (or rather appearances, for they are not well defined,) on the petals and leaves are not resinous, as they entirely disappear from petals and almost from the leaves, by being placed in boiling water, which is not the case with those of *Hypericaceæ;* but supposing they did resemble those of that family, it would still be a character of doubtful value, because in *Ægiceras*, among *Myrsinaceæ*, the leaves and sepals have dark-coloured dots like those of an *Hypericum*, and they are not destroyed by infusion. I have also observed in *Crassulaceæ* dots of a very dark colour and irregular form, (but more numerous and better defined than those of *Reaumuria*,) imbedded in the tissues of the leaf.† 2. The unequal-sided petals are doubtless the same or nearly so as those of *Hypericaceæ*, but this character is indeterminate in the same way as the glandular dots, because the sepals of *Ægiceras* are quite as unequal-sided as the petals of any of the genera of that family.§ I have also observed this character very well marked in the hypogynous scales occurring in *Crassulaceæ*, besides which it is common to *Apocynaceæ*, a family having no affinity with either of these. As the families in Tables III. & IV. are now arranged, *Reaumuriaceæ* show the same kind of analogy to *Hypericaceæ* as *Myrsinaceæ* to *Sapotaceæ*. 3. The polyadelphous stamens of *Reaumuria* are to some extent like those of *Hypericum;* the greater part of them are, however, entirely distinct, and the bundles are 5, being equal in number and opposite to the petals, each consisting of 4 or 5, or occasionally 6 stamens united below but distinct above.

The wood of the *Reaumuriaceæ* has remarkable peculiarities, which I believe assist in explaining their affinities. In the wood of *Reaumuria hypericoides* there are no medullary rays in the first two rings, so that so far it is like that of *Frankeniaceæ*, and it also agrees with that of *Frankenia lævis*, in having a reddish-coloured tissue between the rings of wood, which are otherwise of a pale lemon colour;—but in the external rings of its wood the medullary rays are distinctly marked, and in this difference between the central and external rings of wood it agrees with *Polycarpæa Teneriffæ*, Lam. among *Illecebraceæ*. *Eichwaldia* and *Hololachna* differ from *Reaumuria* in all the rings of their wood, having well-marked medullary rays, in which they agree with *Tamaricaceæ*. The structure of the wood is therefore intermediate between *Frankeniaceæ* and *Illecebraceæ* on the one hand and *Tamaricaceæ* on the other. The wood of *Hypericum* is of a very different character, being very compact, with numerous small medullary rays like many ordinary dense woods.

* This notice of Reaumuriaceæ was written before the appearance of the 'Genera Plantarum' of Bentham and Hooker, but is allowed to remain because I am not aware that the structure of the wood and the character of the polyadelphous stamens have hitherto been described.

† The glandular appearances in the petals and in the leaves of *Reaumuriaceæ* are very minute and irregular in form, and are only opacities in the tissues, and appear to me decidedly more like those of *Crassulaceæ* than those of *Hypericaceæ*.

§ Whether this character is common to all the species of *Ægiceras* I do not know, but I never saw petals so unequal-sided as the sepals of the species I examined.

Crassulaceæ.

It appears not improbable that the broad scales opposite the lobes of the corolla in *Borragineæ* are barren stamens, the filaments of which, if they were fertile, would be broader than those of the fertile which are alternate with the lobes of the corolla;—this really does occur in *Echeveria* among *Crassulaceæ*, where the stamens, which are alternate with the petals, have the usual narrow filaments, and those opposite them have their filaments in the lower half as broad as the petals to which they are adherent nearly as high as the lower half of the petals.* This dilated filament has a lateral process on each side near the middle, and may therefore be regarded as the prototype of the scale, sometimes bifid, of the corolla in *Borragineæ*. I regard *Tetradiclis* as near *Crassulaceæ*, because it is an annual like some species of the British genera, is described as succulent, has a somewhat gyrate inflorescence, and a seed very closely resembling that of *Penthorum*, which has also a flattened ovary and projecting placentæ. Are not the long arms of the placenta a tendency to the same kind of displacement which Payer has shown to take place in *Mesembryanthemum*? See also Callitrichaceæ. *Tillæa*, a part of the species of which are aquatic, forms a very close approach to *Elatine* except in its apocarpous ovary, but in other genera the ovary is partially syncarpous.

Callitrichaceæ & Batideæ.

The species of *Callitriche* are small herbaceous plants, which are perhaps terrestrial rather than aquatic, as they grow more luxuriantly and produce much more seed out of the water on the margins of rivers and ponds, than when they grow immersed, and they will grow with their usual vigour and fruit abundantly in a flower-pot. In habit they resemble *Portulaceæ* and *Caryophyllaceæ*, *C. verna* when growing out of water, being much like *Montia fontana*, and *C. pedunculata* when growing on banks becomes tufted, much like a *Sagina* or *Stellaria*, and in the venation of their leaves they also agree with *Caryophyllaceæ* (fig. 6).

They further agree with *Caryophyllaceæ*, and with the nearly allied *Tetragoniaceæ* in the surface of their stems (especially when the plant grows out of the water), having a crystalline appearance, which is owing to its being covered with crystalline glands (fig. 8). These have been very accurately described by Dr. E. Lankester (Linn. Proc., Vol. II., p. 94), and require no further notice, and are in all probability as he suggests, analogous to hairs. In *Tetragoniaceæ*, as in *Callitriche*, they occur thickly on the young branches, and more sparingly or scarcely at all on the leaves, and I have no doubt about their identity, those of *Tetragoniaceæ* differing in being globular, so that they have not the stellate appearance of those of *Callitriche*.

In *C. verna* there is a decided tendency in the flowers to become polygamous, as the stamen and ovary in the hermaphrodite flowers are neither of them smaller than usual. The stamen in the hermaphrodite flower is remarkable for being posterior without any inclination to either side, a very rare occurrence; and it is precisely hypogynous, the filament being attached partly to the receptacle, and in a slight degree to the base of the short stalk which supports the ovary (figs. 6 & 7). It might be supposed that these hermaphrodite flowers were only apparently so and in reality consisted of male and female flowers produced in the same axil; but if this were the case there would in every probability be in some instances more than two bracts, but I have never seen any trace of a third bract, and there appears no difference in the bracts as seen in the figure. When axils are 2-flowered they stand side by side, never as far as I have seen one directly before the other and in every instance precisely so without variation. In *Hippuris* the stamen is anterior. The anther has been described as having but 1 cell, but in *C. pedunculata* it is 2-celled nearly up to the period of maturity, so that the pollen can be removed from one of the cells and the firm intervening membrane distinctly seen (fig. 9). In its dehiscence, the anther of *C. verna* closely resembles that of *Campylostachys abbreviata* presenting a semilunar 1-celled appearance, as if the cells had become confluent, and this is equally remarkable in one species of *Stilbe*.

The ovary is, as described by Mr. Babington, dicarpous, the dorsal suture of each carpel projecting inwards and uniting with the placenta, so as to make it 2-celled. The ovule is amphitropal, the raphe not being more than half its length, and what is remarkable it scarcely increases in length as the seed ripens, so that in the matured seed it is scarcely more than a fourth of the length of the seed itself; and another peculiarity is, that the nucleus incompletely distends the tunic of the ovule on the inner side next the placenta, and in the ripened seed a membranous portion of the tunic is left in that situation, like a portion of a wing (figs. 10, 11, 12 & 13). The radicle is distant from the hilum by nearly half the length of the seed and not pointed directly to the micropyle (fig. 14), so that together with the shortness of the raphe, the seed differs considerably from that of the *Euphorbiaceæ* with which *Callitriche* has been compared. The embryo is nearly as long as the albumen and almost half its diameter, and the cotyledons are about one-third of the length of the embryo itself (fig. 14), so that in these characters it does not differ much from *Elatinaceæ* and *Crassulaceæ*, *Tetradiclis* having a small quantity of albumen. And, another circumstance in which *Callitriche* agrees with *Elatinaceæ* is, that the achenium or half carpel

* Described from a species in flower at Kew Gardens.

when growing separately, so that it can take its natural form, becomes curved in the same manner as the seeds of *Elatine*. This curvature, as in other similar cases, is owing, there appears no reason to doubt, to the curvature of the seed, not of its carpellary covering.

From the habits of the species when they become terrestrial, it might be anticipated that the affinities of the genus would be those already suggested, especially if amongst such affinities genera occurred with 2-celled carpels, and this division of the cell takes place in *Batideæ* (Trans. Linn. Soc. vol. XXII. p. 412), and also in *Tetradiclis** among *Crassulaceæ*, of which perhaps *Elatinaceæ* and *Callitrichaceæ* may be regarded as reduced forms. *Tetradiclis* differs, however, in the raphe being lateral, at least it is so in the lateral enclosed ovules in which I believe its position can be better relied on than in the intermediate ovules. In *Callitriche* there is a tendency in the half of each cell to adhere more firmly to the half cell of the other carpel than to that of its own, and this also takes place in *Tetradiclis*, the halves of opposite carpels remaining firmly adherent after dehiscence.

It is therefore near the *Elatinaceæ* that I would station this genus, and it does not appear to nearly approach any other family, except the *Boragineæ*, with which it agrees in the structure of its ovary, ovule, and seed, as noticed in the *Trans. Linn. Soc.* vol. XXII. p. 412. In this point of view it connects *Elatinaceæ* with *Boragineæ*, which are also allied to each other through *Crassulaceæ*, which I have endeavoured to explain elsewhere.

Batis is so near *Verbenaceæ* that the spikes of fruit and seed are identical except in the position of the two carpels (l. c. p. 412).

Podostemoneæ.

Castelnavia may be compared to *Callitriche* in its two stamens being posterior (v. Callitrichaceæ), and also shows a close resemblance to that genus and *Tetragonia*, in the surface of the stem being covered with glands, which in the dried plant have a flattened appearance, and if examined in the fresh plant they would, it might be expected, prove identical with them. In the number of their sepals, from three to eight, and of their stamens; in the carpels being, in some genera, united by their margins; and in the hardened texture of the capsules of some genera I believe they approach *Polygonaceæ*. The numerous ovules occurring in Saurureæ compared with the single one of Chloranthaceæ, may assist in accounting for the difference in these characters between *Podostemoneæ* and *Polygonaceæ*.

Dr. Lindley's suggestion that they are near *Plantagineæ* is I believe quite correct, and it appears beyond doubt that the true station of this remarkable family is in this Division. One of their differences consists in the compound foliage, but as in *Plantago Coronopus* the leaves are sometimes doubly pinnatifid, this character may to some extent be accounted for.

Phytolaccaceæ.

This family is generally considered either as a part of, or a near ally of the apetalous families allied to *Caryophyllaceæ*, especially of *Nyctagineæ*, which they approach in habit, but to this alliance there appears to me to be two objections, viz., the ovary of these families is syncarpous, with a free central placenta where any is formed, except in *Molluginеæ*, but that of *Phytolaccaceæ* is always apocarpous; and the embryo of *Seguiera* is large and foliaceous with the cotyledons contorted laterally, much like that of *Petiveria*.† The wood of *Seguiera* has medullary rays showing a resemblance to *Polygonaceæ*, between which and *Crassulaceæ* appears to me to be their position.

Chloranthaceæ.

The near affinity that exists between this family and Polygonaceæ on the one hand and Gnetaceæ on the other, I have endeavoured to explain in the Ann. Nat. Hist. Ser. 3, Vol. 1, p. 106; and more recently the genus *Welwitschia* has been added to *Gnetaceæ*, the monadelphous stamens of which may be regarded as a further approach between *Gnetaceæ* and these families; they are also somewhat unilateral, the anterior stamens being longer, in which they agree with *Chloranthus*.

* I have no doubt that the division of the cell into compartments in *Tetradiclis* is of the same nature as that of *Boragineæ* and *Callitriche*. In a very early stage the ovary of *Callitriche* is round or very obscurely quadrangular, having no appearance of division. In *Tetradiclis* a few ovules intervene between the inflected dissepiments, by protruding as it were between them.

† In *Gallesia Gorazema* the cotyledons do not fold over each other, in *Petiveria alliacea* very slightly so; the former has a small quantity of albumen the cotyledons curving round it.

Table IV.

The Ceratophyllinal or Dorsal Placentation Division.

That the families here brought together are all very naturally conterminous with each other will probably not be doubted (with the exception of *Gentianaceæ*), but whether taken as a whole, they constitute a distinct Division of the Exogens, or are a retrograde branch of the Platano-Proteal Division, Table VI., may perhaps admit of further arguments;—to combine them, however, with Table VI. or with Table V., to which they are also closely allied, would bring together a mass of families much too large to form one Division.

The most remarkable character in this Division is, that the placentation is in a part of the families, dorsal, viz. in *Ceratophyllaceæ*, *Hydropeltideæ*, *Nymphæaceæ*, *Gentianaceæ*, *Lardizabaleæ*, *Anonaceæ*, and *Combretaceæ*; and in it are probably included all the exogenous families where the placentation is really dorsal, as in *Mesembryanthemum* Payer has shown that the branches of the placenta are displaced and adhere to the dorsal ribs of the ovary, and this may be the case in *Orobanchaceæ*, v. Appendix. This being admitted, these families so far may be regarded as having a peculiar relation to each other, and it may be deserving of notice, that the five exogenous families having ruminated albumen, *Myristicaceæ*, *Anonaceæ*, *Menispermaceæ*, *Ebenaceæ*, and *Dipterocarpeæ*, also have their natural stations in this Division. And I would further suggest, that the contortuplicated condition of the cotyledons of *Dryobalanops*, *Dipterocarpus*, and *Doona*, may be analogous to ruminated albumen, especially if the testa is induplicate, and if so it would assist in proving the true station of *Ancistrocladus* to be with *Dipterocarpeæ*. From the descriptions of the seeds of these genera, the contortuplicated character of the cotyledons would appear to be almost, if not quite, identical in the mode of its formation with that of the ruminated albumen of the common nutmeg. The albumen of the nutmeg consists of 8 or 10 rather irregular longitudinal plates extending from the base to the apex of the seed, which are again repeatedly subdivided near the surface, and it is these smaller fissures which give the transverse section a perforated appearance. The plates form one continuous mass in the centre in the same way as the convolutions of the embryo of the walnut all unite in the cauliculus, so that no portion of it can be separated without a fracture. Its testa consists of two coats, or at least of two quite distinct layers, which are readily separable, and of these the external completely envelopes the albumen, sending down no processes between its plates, but the internal does so, and the infolded portions extend almost to the base of the laminæ of the albumen, *i.e.*, nearly to the centre of the seed, although they do not extend into the smaller fissures. This suggests that contortuplicated, cerebriform, or laminated, would be a better term for such an albumen than ruminated, which probably refers to the specks seen in a transverse section, but these are only the terminations of the more superficial fissures.

If the attachment of the spore cases in the globular involucre of *Pilularia* can be compared to dorsal placentation, which may be admissable, because it shows an unusual tendency to growth from the mid-rib, there may prove to be a very close approach between it and *Ceratophyllum*, and on this account I have placed *Marsileaceæ* as the cryptogamous form of this Division.* An analogy may also exist between *Marsileaceæ* and a part of the families here included, in the circinate vernation of the leaves, as in *Nepenthaceæ* and *Droseraceæ*. *Ophioglossum pedunculatum* and *Pyrola uniflora* die when they flower, and are reproduced by root-buds of adventitious roots (Currey's Transl. Hofm. p. 315), which perhaps may lend some support to the opinion that *Ophioglossaceæ* are the basis of this Division.

In *Ceratophyllum* the carpel is always posterior,† from which it would appear that it is a retrograde form of some genus or a family, perhaps now extinct, in which the carpel is always anterior—; in the position of the carpel it is an exception as regards the primitive forms of the Divisions.

The Erical and Ternstrœmial Subdivisions may not be sufficiently distinct, M. Planchon having pointed out an approach of *Ternstræmiaceæ* to *Ericaceæ*.

* May there not be a connection between the compound anthers of *Lauraceæ* (the anther with four or six valves) and the compound male inflorescence of *Marsileaceæ?* In monstrous flowers of *Matthiola incana* I have met with ovaries in which the carpels were not united, and had become antheriferous on their margins (or one margin was antheriferous and the other bore ovules), but instead of bearing one anther lobe the polleniferous mass was divided into several distinct portions of various sizes. Is not this in some degree analogous to the male inflorescence of *Salvinia?*

† Those families in which the carpel is always posterior are, I believe, always retrograde forms of others in which it is always anterior.

Combretaceæ.

This family differs so much from *Myrtaceæ* and their allies, that if retained in the Epigynous Division they would show anomalies in structure which, I believe, could not be accounted for. On the other hand they are very distinctly connected with *Lauraceæ* through *Illigeraceæ*, by the genus *Hernandia* afterwards noticed; and the wood of some species of *Combretaceæ* is referred to by Prof. Oliver as presenting that kind of irregular structure which occurs in *Malpighiaceæ* and *Bauhiniæ*, viz., of being partitioned into numerous vascular masses by intruded plates of cellular tissue. (Trans. Linn. Soc. vol. XXII. p. 290.) They differ from *Myrtaceæ* in their winged fruit, the wings being produced by the tube of the calyx in the same way as those of *Margyricarpus* among *Sanguisorbaceæ*, not by the ovary, as in *Begoniaceæ* and *Umbelliferæ*;—in their style, which is furrowed like that of *Amygdaleæ*, and in some instances of *Lauraceæ*, which does not occur in *Myrtaceæ*, although the ovary may be reduced to a single carpel;—in their fruit, which is occasionally umbilicate, a character which occurs in *Lauraceæ*;—and in the position of the carpel which is irregular, as in *Illigeraceæ*. In their placentation, also, they differ from the epigynous families. In *Combretum* (R. Spruce, No. 1523*), the ovules are 10 or 12, in part pendulous from the apex of the ovary, but the greater part of them are attached to the sides, suspended in a ring round the apex. Supposing the ovules attached round the orifice of an inverted funnel would give a correct idea of their placentation. The style is quite pervious in its lower half, and the canal opens into the centre of the ring in which the ovules are attached, so that the placentation of nearly all of them must consequently be regarded as dorsal. The uppermost ovules are attached so close to the stigmatic canal, that their funiculi extend into it. Where the ovules are two, they are attached to opposite sides (or nearly so) of the apex of the ovary and stigmatic canal, and the raphe in most instances is dorsal, so that the raphes of the two ovules are sometimes in apposition with each other, but the funiculi being long it is sometimes possibly from twisting lateral, or more rarely next the wall of the ovary; but whether the placentation in these instances is dorsal remains a question, as the ovary may be dicarpous. In the *Combretum* above referred to, the raphe in most of the ovules is also dorsal. The position of the carpel is inferred from the furrow in the style, which is occasionally deepened into a fissure, not from the placentation.

In their spirally convolute cotyledons they have been referred to as agreeing with the § *Memecyleæ* in *Melastomaceæ*, but the convolution of the cotyledons of *Memecylon* is of a very different character. In *Memecylon* the embryo is curved in the direction of the flat surfaces of the cotyledons from apex to base, like those of *Lepidium* and *Heliophila*, and the cotyledons are curved probably to a less extent than those of the latter genus, being simply incumbent in their relation to the radicle, and not in any degree spirally convolute. The embryo is curved in the same way in other genera of *Melastomaceæ*, but to a less extent, the curvature in the cotyledons being from apex to base, whereas in *Combretaceæ* and *Calycanthaceæ* it is from side to side;—in *Granateæ* and *Vochysiaceæ*, however, it is also from side to side, so that this character throws no light on affinities in the present instance. The peculiarity of the adhesion of the style to the long tube of the calyx, with which it is confluent for more than three-fourths of its extent, occurring in the genus *Quisqualis*, I regard asanalogous to the adhesion of the ovary to one side of the tubular calyx in *Chrysobalaneæ*, and in *Bauhinia* and *Jonesia*, among *Leguminosæ*, and as therefore tending to show that *Combretaceæ* do not belong to the Epigynous Division. In *Jonesia* the tube of the calyx is much elongated, the stamens arise from its orifice and the stipes of the ovary adheres to the tube up to the orifice.†

The 6-furrowed embryo of *Sparattanthelium* and the 3-furrowed cotyledons of *Hernandia* may show an analogy to the 8 or 10 plates of the albumen of the nutmeg (v. p. 23), and admitting the very near affinity of *Illigeraceæ* to *Combretaceæ*, this would supply another argument for placing the latter with the perigynous and hypogynous families.

Illigeraceæ.

This family, originally described by Dr. Blume, was subsequently admitted into systematic arrangements as distinct from *Lauraceæ*, but the genera have more recently become regarded as only apetalous forms of *Combretaceæ*. The genus *Hernandia* agrees in all important characters with *Illigera* and *Gyrocarpus*, and I would refer it, and without doubt, to the *Illegereæ* of Blume, as constituting with them and *Sparattanthelium* Mart.‡ a very distinct section of *Combretaceæ* or a distinct family intermediate between them and *Lauraceæ*. It is the generally received opinion that

* Coll. R. Spruce, Maio, 1851. Ad oram meridionalem Rio Negro, &c.

† In *Chrysobalaneæ* and *Bauhinia* the adhesion is to the anterior side of the tube, but in *Jonesia* I believe it to be posterior.

‡ This genus is very near *Gyrocarpus*, but besides the stamens being alternate the lobes of the calyx, it differs in the embryo being deeply plaited in addition to being convolute, which gives it the appearance of being 6-lobed like that of *Hernandia*; and, as far as I have seen the species, it differs also in the fruit being wingless, the segments of the calyx not enlarging. A part of the species are described in the *Botanische Zeitung*, 1841, vol. II., p. 40.

Hernandia belongs to the apetalous series of families, and *Sparattanthelium* has the stamens alternate with the sepals (which are not biseriate when only four,) being of the same number, and is therefore, when the sepals are only four, in the strictest sense apetalous; this however may serve to indicate that when two whorls are present as in the former genus the inner may be petals.

In the descriptions of *Hernandia* the ovary is either obscurely referred to, or said to be superior, or to contract a partial adhesion with the calyx at the base of the style; but on examining specimens from different localities, both of *H. sonora* and *ovigera*, (the flowers being in various stages of growth,) the ovary proved to be uniformly inferior and completely so (fig. 2); from which it might be supposed that its fruit only had been examined, in which apparently an almost complete separation of the calyx or superficial integument of the pericarp takes place. There is, however, a tendency to this separation in the fruit of *Gyrocarpus*, and in that of *Sparattanthelium* it takes place (except perhaps at the apex) quite as much as in *Hernandia*. Gœrtner describes the fruit of *Hernandia* as clothed with the inflated calyx; I believe, however, that the neck of the calyx still continues adherent to the apex of the ovary, as in *Sparattanthelium*, unless accidentally broken away; but this description may possibly refer to the involucre which enlarges and almost covers the fruit.

Some time afterwards I examined some imperfectly hermaphrodite flowers, and in two of them I found a cavity on one side only of the ovary, scarcely extending to half its circumference, the neck of the calyx being completely adherent with the base of the style and upper part of the ovary. This cavity appeared to me to be only an irregular separation of the calyx from the ovary, which might be owing to the imperfect development of the ovary in consequence of the flowers becoming hermaphrodite; but even supposing this to be the constant structure in one or more species, it would be only another instance of "flos superus" with "ovarium liberum," which occurs in a much more marked degree in the *Dipsaceæ*.*

The anthers of *Hernandia* may perhaps be, in some degree, analogous to those of *Illigera* and *Gyrocarpus*, the dehiscence consisting in the valves being cut out of the integument of the anther lobes, leaving a thick connective, the difference being that they are turned laterally instead of directly upwards (figs. 4 & 5). This mode of dehiscence however as far as the valves being turned laterally, occurs in families of very remote affinity, as *Sabiaceæ (S. parviflora)* but the connective is wanting.

In all other characters, except the involucre, which may be compared to that of *Myristicaceæ* and *Chlœnaceæ*, *Hernandia* differs but little from *Gyrocarpus*, having nearly the same habit as one of the species of *Gyrocarpus* has undivided leaves.

1. The calyx is biseriate, consisting usually of three external and three internal sepals, or of four within four, the highest number occurring in the imperfectly hermaphrodite flowers, which sometimes have five external and four internal.† When in *Sparattanthelium* the calyx consists of eight or nine sepals,‡ it so closely resembles that of *Hernandia*, that they could be with difficulty distinguished, except by their size and by that of the latter being biseriate.

2. The stamens are three in flowers with six sepals, being opposite the outer three (thus agreeing with *Illigera* in their position), and the anthers open inwardly. In such flowers the barren stamens are six, in pairs, opposite the three inner sepals, so that each stamen appears as if it had one on each side of it, and in the hermaphrodite flowers this proved to be the case, each of them having a pair of glands attached to the filament close to its base, as in some genera of *Lauraceæ*. These barren stamens or glands are either solid, or consist of sacs on short stalks opening outwardly, or are small scale-like leaves, which can be unfolded so as to resemble the small petaloid barren stamens internal to the fertile occurring in *Anonaceæ*. They may in all probability be regarded as analogous to the glands of *Illigera*, and in being turned outwards while the anthers open inwards they resemble the barren stamens of *Sassafras*, and so nearly as to show I believe a very close and undoubted affinity between *Illigeraceæ* and *Lauraceæ*.

3. The tissues of the ovary of *H. ovigera* contain very numerous glandular dots like those of *Gyrocarpus*, and so much so, as with the other characters, to suggest a very near affinity. The expanded stigma is deeply divided on one side, the fissure extending to the centre, and being continued down the style on the same side distinctly shows the position of the carpel (fig. 2).

4. The ovule has a strongly marked dorsal raphe,§ as in *Illigera*, and a comparatively large foramen, through which the secundine sometimes projects (fig. 3), and, as in *Illigera*, a canal

* I have observed this separation of the calyx very distinctly in *Epacrideæ*,—the cavity passed all round the ovary.

† Since the above was written, I have examined imperfectly hermaphrodite flowers of two species, which fully agreed with those of *Illigera*, the sepals being ten, biseriate, and the stamens five, opposite the external sepals. On this account and from the close resemblance of the flower to *Lauraceæ*, I regard the inner series as petals. The ovaries were very small and mostly empty. It seems also very probable that *Sparattanthelium* has petals when the perigonium is 7-9 parted.

‡ It may appear questionable whether these flowers belonged to a distinct species or were only those of *S. Tupiniquinorum* become monstrous;—the ordinary number of sepals in this species is four or five, when increased to eight or nine the stamens are, I believe, not equally increased, seven being the highest number I have seen. I believe, however, there are two very distinct species included under this name, the sepals being much longer in the 6-9 sepaled specimens; their anthers like those of *Gyrocarpus* and *Lauraceæ* have the valves turned directly upwards.

§ In every flower I have examined I found the ovule attached to that side of the ovary (although very near the apex) which corresponded with the fissured side of the style and stigma, so that the attachment of the ovule, together with the stigmatic canal always entering the ovary towards the opposite side, proved beyond doubt that the raphe is dorsal.

extends from the base of the style to the ovary, passing over the dorsal side of the funiculus of the ovule into its cavity. In the position of the carpel, as indicated by the position of the raphe, it does not materially differ from its allies, as it is always lateral, as it is in *Laurus nobilis*.

5. The embryo of *Hernandia* may be regarded as imperfectly plaited, being crumpled all over the surface, and in addition to this longitudinally 6-furrowed on its lower half, but it is not at all convolute. I have already noticed that the embryo of *Sparattanthelium* is 6-furrowed in consequence of being longitudinally plaited, so that in this character it forms a connecting link between *Hernandia* and *Gyrocarpus*.

The genera may be naturally and conveniently distinguished by their fruit and embryos, although *Sparattanthelium* further differs in having the stamens alternate with the sepals, and *Hernandia* in its anthers.

Cotyledons convolute .	Fruit winged laterally	Illigera.
	Fruit winged only at the apex . . .	Gyrocarpus.
Cotyledons plicato-convolute, making the embryo 6-furrowed . .		Sparattanthelium.
Cotyledons crumpled, each of them 3-furrowed at the base . .		Hernandia.

Lauraceæ

The flower of *Laurus* is described as tetramerous with the stamens alternate the sepals, but a careful examination has convinced me that it is trimerous like the generality of the genera, and it serves to show that the 3 inner sepals of this family are sepaloid petals. The sepals are 4, but 1 is smaller and internal to the others, and is, I doubt not, 1 of 3, the other two of which have become stamens, and this circumstance has occasioned this genus to be described as having the stamens alternate the sepals. This appears to me to be clearly proved by the occurrence of flowers with 6 sepals, 3 inclosing 3 (the petals) much more than in most of the genera, and by the stamens in these cases being opposite the sepals ;—one good instance I met with had 6 stamens opposite 6 sepals, 3 (the petals) entirely within 3, and 1 of the internal still retained its antheriferous character so far as to bear half an anther on one side. It is common to find flowers with five sepals, and it was sufficiently evident in all the instances examined that 1 of the stamens was missing having become the additional sepal, *i.e.*, a sepaloid petal.

Litsæa is dimerous, the 2 sepals in æstivation inclosing the 2 petals, from which however they cannot well be distinguished after expansion. The stamens are 6, the outer 4, which are usually glandless, being opposite and adherent to the sepals and petals ; and the remaining 2 which have glands at their base, are opposite the sepals, being within the first 2 and like them adherent to the middle of the sepal near its base. The female flower has 6 barren stamens and their position is more obvious.

Calycanthaceæ.

This family is so near both to *Rosaceæ* and *Magnoliaceæ*, that they have been regarded as osculant between them, but still they may not improbably prove to be decidedly nearer to one of them than to the other. It appears preferable to place them here, as having opposite leaves and a calyx composed of more than the usual number of sepals, in which they agree with *Monimiaceæ ;* and anthers turned outwards, in which they agree with some genera of *Anonaceæ*, but decidedly differ both from *Rosaceæ* and their allies ; and should the remarkable character of the wood, exhibiting discoid markings on its tissue prove to be identical with that which occurs in *Illicieæ*, the approach to the Anonal Alliance will become the more evident. As a near ally of *Magnoliaceæ* they also, in common with that family, approach *Nymphæaceæ* and even *Nelumbiaceæ*, agreeing with the former in the gradual transition from petals to stamens, which occurs in *Calycanthus occidentalis*, where the inner row of petals are tipped with precisely the same kind of gland that forms the crest of the anthers, and in the margins of the smaller ones becoming more or less antheriferous ; and with the latter in the gradual transition of the sepals to petals, the glandular crest of the stamens being also the same, that of *Nelumbium* being rather more elongated. These affinities being admitted, *Calycanthaceæ* would be far removed from *Rosaceæ*, and their convolute cotyledons, opposite leaves, and other characters, would find a parallel in *Combretaceæ* near which they are placed in the Laurinal Subdivision.

Gentianaceæ.

It is well known that *Villarsia nymphæoides* agrees remarkably with the *Nymphæaceæ* in habit, and it has also to some extent their sessile spreading stigma; *Frasera* is scarcely monopetalous while *Barclaya* is decidedly so; and although *Gentianaceæ* are widely separated from a part of their nearest affinities in this Table, yet in Table VII. this distance nearly disappears as they take their place close to *Apocynaceæ*. When it first occurred to me that Gentianaceæ might be a monopetalous form of Nymphæaceæ and their allies, the proposition appeared to be very theoretical, but further comparisons now give it to some extent a practical form, as the 5-spurred corolla of *Aquilegium* occurs in *Halenia** (Sir W. Hooker's Fl. Bor. Amer. Pl. 155 & 156), the only two genera in which this character is known to occur.

Nelumbiaceæ.

Nelumbium agrees with *Ceratophyllum* in its whorled leaves, those of the former being three in a whorl, two of which are only scales;† in the ovule being pendulous from the apex of a funiculus adherent to the wall of the ovary; and in the embryo having a large plumule and a very short radicle. Since my notice of the ovary of *Nelumbium* (Ann. Nat. Hist. Ser. 2, vol. XII., p. 11), I have never met with any explanation that removed the difficulty as regards the position of the umbilicus and canal which are external to the style and stigma, *i.e.*, on the wall of the outer side of the ovary directed towards the stamens, and are also distinctly visible in the fruit, and up to the present time it has appeared to me an anomaly which could not well be accounted for. M. Baillon's recent discovery of small flowers and single naked carpels bearing ovules occupying the place of ovules in the ovaries of *Sinapis arvensis* (Adansonia, 1862—63, Pl. XII, figs. 8 & 9), offers however a satisfactory explanation and the only probable one, and I now therefore regard the disk as a mass of barren carpels, each producing one female flower at its base having its back turned towards the axis of the fruit. As thus understood *Nelumbium* agrees with *Ceratophyllum* in the carpel being posterior and the ovule pendulous from a funiculus adhering to its dorsal rib, v. Ann. Nat. Hist. Ser. 2, vol. XII., Pl. III., figs. 1, 2, 3, 4, & 5. In all the *Nymphæaceæ* and *Hydropeltideæ* the placentation is dorsal, so that in this character *Nelumbium* would differ from its nearest allies, unless this proposition is correct, because the funiculus is attached to the inner or axial side of the ovary.

Nepenthaceæ.

The position of *Nepenthes* I regard as being between *Cephaloteæ* and *Sarraceniaceæ* on the one hand and *Francoaceæ* on the other. Dr. Seemann, who is so very correct as regards affinities, is convinced that it is near *Droseraceæ*, to which he states it is allied in the greater part of its characters, among which he particularly notices the circinate vernation of the leaves, and he consequently would admit its relation to *Francoaceæ* as the latter are conterminous with that family.

This position will, I believe, satisfactorily account for all the peculiarities of its structure. In its numerous spiral vessels it may be compared to *Nelumbium*, being connected with that genus through *Ranunculaceæ*. Its pitchers may be compared to those of *Sarracenia* and *Cephalotus*, and there may be also a tendency to assume the singular leaf of *Nepenthes* in *Caltha dionæafolia*, (Fl. Antarctic. Part II., Pl. LXXXIV.,) the two serrated plates on the upper side of the leaf, at the base of the lamina, being perhaps analogous to the two serrated wings on the pitcher of *Nepenthes*. In its calyx, consisting of four sepals, its agrees with *Francoaceæ*, and the large glands almost covering its base are, I believe, a reduced form of the fleshy disk covered with stalked glands occurring in *Cephalotus*. In its monadelphous stamens it may perhaps be compared to *Lardizabaleæ*, *Schizandraceæ* and *Myristicaceæ*, being connected with them through *Ranunculaceæ*, but this character is so general as scarcely to call for an explanation. Its ovary agrees with that of *Francoaceæ* in being 4-celled, and although the stigmas are not alternate with the cells as in that family, yet they are deeply bifid, and so far combined together (in at least one species) as to make the stigma appear 8-lobed, so that if the stigmas were rather more deeply divided they would consist of four bifid lobes alternate with the cells; and in this character it may also be compared to *Drosera*, which has deeply bifid stigmas. It occasionally shows a tendency to become polycarpous, by the production of

* *Halenia* has a 4-parted corolla with four large spurs.

† These are quite distinct from the fully developed leaf which has intra-axillary connate stipules; they show a tendency to be alternate by the margin of one overlapping the other. The internodes are quite smooth, and of considerable length.

from three to eight imperfect carpels (some of which have cavities but contain no ovules), in which it may be regarded as approaching *Ranunculaceæ;* these surround the original ovary and are adherent to it, some of them being as high as the ovary itself and others not half its height. The ovules are obliquely ascending, with the raphe lateral, as in *Francoa;* and in its long loose testa the seed closely approaches that of *Pyrolaceæ*; and *Droseraceæ* and even *Ericaceæ,* to some extent, also agree in this character, the seed having in some species of *Drosera* a loose membranous testa prolonged at the base and apex into acute membranous processes.

Ceratophyllaceæ.

The affinities of *Ceratophyllum* appear to me, as originally suggested by Dr. Asa Gray, to be entirely with the Nymphal Alliance, except in the conical male flowers, which have in some degree the appearance of those of *Schizandraceæ* (V. Ann. Nat. Hist., ser. 2, vol. xii., p. 12). *Salvinia* differs from other vascular Cryptogams in being almost rootless, thus approaching *Ceratophyllum.*

Ericaceæ.

The genus *Diapensia* is so near *Azalea* agreeing with *A. procumbens* in habit, in the number of stamens and cells of the ovary, that it appears to me that *Diapensiaceæ* are not distinct from *Ericaceæ,* differing from them only in a more complete adhesion between the stamens and petals. The flower is pedunculate, with no bracts near the calyx, except two immediately under it, which are so much like the sepals that they appear as if they formed a part of the calyx, but they are distinctly external to it. In this character it agrees well with *Erica* and *Calluna, E. cinerea* having only two bracts which are equally close to the calyx and look like sepals. It is probable that the monopetalous corolla is formed for the most part by the adhesion of the flat filaments to the petals as in one instance the margins of a petal could be distinctly traced down to the base outside though usually they form only ribs. The flat filament narrows at the apex like the broad filament of *Cyrillaceæ,* the anther projects inwards bringing to mind *Epacrideæ,* and has appendages not unlike those of *Ericaceæ.* The ovules are as numerous as in *Erica,* attached to a shield-like placenta occupying the upper half of the cell, and the raphe is lateral with some variations especially in the upper and lower portions of the placenta, which may be regarded as the normal position where the ovules are numerous and horizontal.

Sapotaceæ.

Among species arranged as undetermined *Sapotaceæ,* which are probably not distinct from the genera at present known, is a Brazilian plant collected by Mr. Spruce, having a calyx consisting of four sepals, the external two being valvate or very nearly so, and completely enclosing the two inner, which are much thinner and imbricated, and a monopetalous corolla with four segments.* This so closely agrees in the calyx with *Clusiaceæ,* that *Sapotaceæ* may perhaps be as near *Clusiaceæ* as *Ebenaceæ* are to *Ternströmiaceæ.* (V. Linn. Proc. vol. V., p. 54.)

Brexiaceæ.

The more remarkable variations in the structure of this family are, that in *Ixerba* the stamens are distinctly perigynous, although it is in a low degree;—that in *Argophyllum* the ovary is not less than half inferior;—that the flower of *Ixerba* has no barren stamens, while in *Argophyllum* they are more numerous than in *Brexia,* and adhere in parcels, which terminate in a fringe;—and that the seed of *Ixerba brexioides* has a fungoid aril adherent to the raphe and covering about a fourth part of the surface of the seed. The last character I believe to be a more certain indication of their affinity than any other, bringing them near *Clusiaceæ;* and the minute embryo of *Argophyllum* and its small cotyledons may be compared to those of *Marcgraviæ.* The flattened peduncle of *Brexia* brings to mind the 2-edged and compressed stems of *Hypericaceæ.* The seed both of *Ixerba* and *Argophyllum* contain a small quantity of albumen in which the embryo is enclosed.

* The number and disposition of the parts of the calyx and corolla are the same as those of *Imbricaria* reduced to half; the segments of the corolla are, however, not subdivided as in that genus.

The question as to whether the placentation in *Parnassia* is dorsal, is one which bears with some weight on the affinities of the genus. Some time since, while examining some flowers of *Hypericum elodes*, I was so struck with the close resemblance of the bundles of stamens to the fringed scales of *Parnassia*, that I felt confident that if I could meet with the flower of a *Parnassia* with five carpels, I could then, by comparing it with *H. elodes*, come to a conclusion (although not perhaps to an unquestionable demonstration), as to whether the placentation was sutural or dorsal. The difference between the structure of *Parnassia* and *H. elodes* (the placentation being equally parietal or very nearly so in both) is, that the latter has three carpels, instead of four or five; that the 5 fringed scales, which in *Parnassia* are barren, are three bundles of monadelphous stamens; and that the five single stamens of *Parnassia*, which alternate with the fringed scales and petals, are large pale glands, which being reduced to three are thrown out of their normal positions relatively to the petals. The cause of this difference is, that in *Parnassia* the flower is pentamerous, the corolla, stamens, and fringed scales alternating with each other, but when the carpels are reduced to four, which is so generally the case, the stamens and fringed scales, instead of becoming four each, continue to be five, by which their normal relation to the carpels is destroyed. But it is not so with *H. elodes*, for the five monadelphous bundles (each of which consists of three stamens) become reduced to three alternating with the three carpels;—but to obtain this two bundles are not suppressed, but unite with two others forming two double bundles, so that one of the bundles (which is always opposite a petal) consists of only three stamens, while the other two consist of six, or by a deficiency of one of only five. By this junction two of the glands which are between them are suppressed, and the remaining three are *always opposite the three carpels*.* Supposing then these glands to represent the stamens of *Parnassia*, it would follow that, if in a flower of the latter, with five carpels, the five stamens were opposite the placentas and stigmas, the placentation (the structure of the flower being the same) would be dorsal.

Having recently examined a flower of *Parnassia* with five carpels, for which I am indebted to the liberality of the Rev. W. W. Newbould, I do not find from this comparison that the placentation can be regarded as dorsal; the carpels were rather unequal in size, but one of the placentas, which was the smallest and less likely to be displaced, was exactly opposite one of the fringed scales, thus agreeing with *H. elodes* in being opposite the bundles of stamens; and the stamens I concluded to be alternate with the placentas, as are the glands of *H. elodes*. In most of the instances of dorsal placentation the walls of the ovary are thickened, but in *Parnassia* they are very thin. *P. nubicola* is one of the more remarkable instances of stigmas opposite placentas, as the style is slender and elongated, being nearly as long as the ovary and the stigmas are linear and spreading.

Parnassia may be compared with *Argophyllum*, in which the ovary is half inferior, and the barren stamens numerous and filamentous, and it agrees with *Ixerba* in its loculicidal dehiscence. It differs however from *Brexiaceæ* in the absence of albumen, (but the quantity in the latter is very small), and in the stamens being turned outwards, but otherwise they nearly resemble them. *Droseraceæ* have been referred to as one of the nearest affinities of *Parnassia*, and doubtless the fimbriated stipules of *P. tenella* (Linn. Proc. vol. II., p. 80,) show a near approach to *Drosera;* and the placentas opposite the stigmas in *Parnassia* is a coincidence in structure with *Francoaceæ*, a near ally of that family. *Parnassia* may be further compared with *Hypericaceæ*, in the leaves of the creeping stem being opposite in pairs, which when young are connate at their bases, and in dyeing a strong clear yellow, and, if it were not for the loculicidal dehiscence, it might serve to connect *Brexiaceæ* with that family.

Ochnaceæ.

Sauvagesia and the genera associated with it are so closely allied to *Ochnaceæ*, through *Luxemburgia* and allied genera, agreeing with them in their septicidal dehiscence, remarkable fimbriated stipules and habit, that they may be stationed as a section of that family. They also nearly approach *Hypericaceæ* and *Droseraceæ*, *Sauvagesia* (at least in one species) agreeing with *Hypericum* in the younger stems being flattened, perhaps more so than in the two-edged species of that genus, and in the septicidal dehiscence of the fruit; and with *Drosera* in its intra-axillary fimbriated stipules and small embryo, which is I believe less than half the length of the albumen. In *Sauvagesia* the stipules extend in a reduced form into the axil, so as to join together, and *Drosera* has this character more obviously, so that it seems not improbable that the fimbriated leaves of the latter may be accounted for by a comparison with this kind of stipules. The placentæ, although parietal, project considerably inwards, as much or more so than in *Hypericum elodes*, so that the walls of the ovary may be cut away without breaking them through. In their sensible and medical properties they agree with *Ochnaceæ*, being mucilaginous and somewhat astringent.

* That this is the mode of formation of the flower of *H. elodes* I have no doubt, because in two instances I have met with four carpels, and then there were four bundles of stamens, three of them consisting of only three stamens each, and although there were only three glands, this appeared sufficiently accounted for by two of the bundles being scarcely separated, so that the space between them was insufficient to admit of the production of a gland.

Linaceæ.

The affinities of this family are so fully explained in Bentham and Hooker's 'Genera Plantarum,' that any further comment at present is scarcely required, but it may be interesting to notice that the genus *Radiola*, which is the farthest removed from *Ternströmiaceæ*, shows an agreement with *Pentaphylax* in its filament dilated in the lower half. The stamens of *Pentaphylax* are figured in the Trans. Linn. Soc. vol. XXI., Pl. 12, and those I have seen are more like those of *Radiola* than there represented. The stamens of *Radiola* are not monadelphous, but interpetalous, and with the claws of the petals form a very short tube.* *Erythroxyleæ* have been placed with families having a dorsal raphe, and Prof. Agardh (Theor. Syst. Plant. p. 296), thinks it probable that the raphe is dorsal; it is however so indistinct externally that no very decided opinion could perhaps be given, but the foramen which is external to the funiculus curves slightly inwards so as to be above it, and in one species it is directly on the outside of the funiculus (i.e., not inclining to either side) covered by a small process of the placenta or funiculus to which it is partially adherent, so that the raphe must be next the placenta, and in fact a transverse section of the ovule, apart from the position of the foramen, leaves scarcely a doubt of it.

Dipterocarpeæ.

The ovary of *Ancistrocladus* I believe to consist of two or three carpels united by their margins, their number being shown by the styles. The parts which Mr. Thwaites regards as stigmas, I believe to be styles, and the apex only of each to be the stigmas; and the part he describes as the subglobose persistent style I believe to be the apex of the ovary incompletely covered by the calyx. The flower of *Lophira* agrees well with *Clusiaceæ*, scarcely differing from *Calophyllum*, as the ovary of that genus may, I believe, be safely regarded as compound with the carpels united by their margins, having one ovule erect from the base, that of *Lophira* consisting of two carpels, and having eight or ten, which are in both cases anatropal, and it thus assists in bringing to light the nearest affinities of *Dipterocarpeæ*.

In *Ancistrocladus*, as in *Calophyllum*, the raphe is variable in its relation to the axis or rachis from which the flower springs, and therefore, whether the ovary consists of two or three carpels, the fertile carpel will be variable in its position in accordance with the raphe.

Chlænaceæ.

In the sepals being fewer than the petals, this family may perhaps be compared with *Clusiaceæ* and *Papaveraceæ;* the leaves of *Sarcolæna grandiflora* are oval, with veins like those of Endogens, agreeing with some genera of *Menispermaceæ*.

* There are no intermediate barren stamens, from which it might be supposed that the barren stamens in *Linum* might be the consequence of the junction of the angles of the broad filaments; this, however, is certainly not the case.

Table V.

The Casuarinal, or Amentaceous Division.

That the families here associated are a branch of the Gymnosperms, I believe there is no reason to doubt, *Casuarina* having been compared to *Ephedra* by Dr. Lindley, but as *Chloranthaceæ* are decidedly in nearer affinity with *Gnetaceæ* than *Casuarina*, I prefer regarding this Division as branching from the *Coniferæ* and place *Gnetaceæ* in Table III. *See also* p. 6 & 7.

There is however a yet nearer approach taking place between *Taxaceæ* and *Myricaceæ*, as they do not materially differ either in habit or inflorescence, and perhaps another decided evidence of affinity may exist between *Taxaceæ* and this Division in the foliaceous branches of *Xylophylla**, which are almost identical with those of *Phyllocladus;* and, if foliaceous branches may be compared with leaves, which is perhaps admissible, some Euphorbiaceous plants at first sight very much resemble *Cycadeæ*, showing a further analogy with the Gymnosperms. And it may also deserve notice that a species of *Podocarpus*, the *Myrica Nagi* of Thunberg, has, under the name of *Nageia*, a supposed distinct genus consisting only of that species, been referred successively to *Myricaceæ*, *Taxaceæ*, and *Euphorbiaceæ*.

Subdivisions are here scarcely practicable, but the two forms, Urtical and Casuarinal, are so far distinct among the Apetalous families as to deserve notice.

The genus *Wormskioldia* appears to me to be very near *Turnera*, differing perhaps more in the form of the fruit than in any other character; the reticulated seeds, with the almost peculiar aril, so closely resemble those of *Turnera*, that I doubt if they could in some instances be readily distinguished, and there is a tendency in the foliage of *Turnera*, where the leaves are narrow and bluntly serrated, to assume the Cruciferous habit of *Wormskioldia*.

Apocynaceæ.

This family, from the agreement of its structure with the *Asclepiadeæ*, may be compared in almost the same manner as that family with *Violaceæ*, with which they agree in their crested anthers; and to *Euphorbiaceæ* they perhaps have some affinity, as *Rauwolfia* agrees with them in habit, and they have nearly the same acrid and poisonous qualities, *Vahea madagascariensis* agreeing with them also in the production of caoutchouc. Where the ovules are two and suspended, I have seen the same peculiar twist in the raphe which occurs in *Scolopia* among *Flacourtiaceæ*, and the anther of this genus has a remarkably elongated crest. By placing them here they are in Table VII. brought into their natural position close to the *Loganiaceæ*.

Euphorbiaceæ.

The affinities of this family are more than usually complicated, but as it is generally admitted that they are very near *Stilagineæ*, *Scepaceæ*, *Urticaceæ*, and their allies; their remaining affinities, which are widely different, may be regarded as scarcely more than analogies. Of these the approach between them and the *Malvaceæ* and *Byttneriaceæ* is the nearest, but, besides other differences, the involucre of *Euphorbiaceæ* is like those of *Moreæ* and *Urticaceæ*, consisting of the leaves of the stem reduced in size, whereas in *Malvaceæ* it is like such an involucre as that of *Hernandia*, consisting only of bracts on the pedicels at the base of the flower, and consequently rarely contains more than one flower. To *Stilagineæ* and *Scepaceæ* they approach so nearly, that they are more distinguished by their habit than by any positive difference in structure, and it does not appear certain that the limits between them and *Stilagineæ* are as yet clearly defined. As a

* The apparent leaves of the genus *Xylophylla* are true branches, because in one of the species all the branches are in the first stages of their growth foliaceous like the apparent leaves of other species, but they subsequently contract so as to form the permanent rounded woody stems.

further argument for placing *Euphorbiaceæ* as the polypetalous form of *Artocarpeæ, Moreæ, Urticaceæ,* and their allies, I would suggest that it is certain that all the larger apetalous families have, and very distinctly, their polypetalous forms, and if *Euphorbiaceæ* are not the polypetalous form of these families they would be without any adequate representatives, which would be a deficiency that could not be accounted for; or, if this should be doubted, it may at least be said that a greater degree of affinity exists between them and *Euphorbiaceæ* than between them and any other polypetalous family, as they agree in being always unisexual. *Cecropia* among *Artocarpeæ* scarcely differs, either in structure or habit, from *Euphorbiaceæ.*

In *Buxus* the raphe is dorsal, as Prof. Agardh has observed (Theor. Syst. Plant p. 292, & Pl. XXII., fig. 1 & 2), which is an anomaly the more remarkable because in all the nearest allies of *Euphorbiaceæ* the raphe in pendulous ovules is next the placenta. *Corema* and *Ceratiola* are, however, so near *Buxus* that *Empetraceæ* might be regarded as a section of *Euphorbiaceæ,* which may be sufficient to explain this unexpected exception; or, possibly *Buxus* with *Simmondsia* and probably *Pachysandra* may, with *Empetraceæ,* form a distinct family.

Empetraceæ.

A minute and extended examination of this family leads to the conclusion that their nearest affinity is with *Euphorbiaceæ* and that their resemblances to *Ericaceæ,* such as the cohesion of the pollen grains in *Oakesia Conradii,* which are combined in fours (Mem. Americ. Acad. New Ser. vol. III., Tab. I., fig. 5),* consist of analogies common to families which are widely separated.

In all the genera there are bracts surrounding the base of the flower, besides that which subtends the flower itself, out of the axil of which it springs, and unless this is taken into account it would be impossible to arrive at any satisfactory conclusion with regard to the nature of the floral envelopes. These bracts are 1, 2 or 3, and the flowers of each genus are otherwise so different as to require a separate notice before any inference as to the nature of the floral envelopes can be safely made.

In *Empetrum nigrum* the male flower has, besides the axillary bract subtending it, two lateral bracts, one on each side of it; these are strictly foliaceous, having occasionally leafy buds in their axils, but I am satisfied they exist only in *Empetrum* itself, the inflorescence in the other genera (where two whorls of floral envelopes at most are present) being too crowded to allow them to develope. The succeeding whorl consists of three bracts which look like an external row of sepals, but as one of them is often wanting, and when present is only a rudiment, it is much more probable that they are bracts;—and when it is recollected that the three sepals above them (which are alternate with them) are closely approximated at their bases and slightly imbricated, I believe there can be no doubt that they are only bracts. It being admitted that the three sepals above these bracts are the true calyx, which I believe is the prevalent opinion, it appears to follow that the remaining whorl, which consists of three small petaloid bodies alternate with the sepals, would be true petals, but a comparison with *Ceratiola* and *Corema* makes it much more probable that they are a second row of sepals like those which occur in *Euphorbiaceæ.* The three internal sepals are so far separated at their bases, that the stamens appear at first sight as if inserted between them, but they are slightly internal to them as in *Ceratiola ericoides.* As thus understood the male flower agrees with that of *Phyllanthus* and other genera of *Euphorbiaceæ,* where the sepals are six and the stamens three. The female flower differs from the male only in the absence of stamens. The stigmas are spreading and 2-ridged on the upper surface from being furrowed and are sometimes more or less bifid.

In the Kew Herbarium a note is added by a donor, stating that the flowers sometimes become hermaphrodite.

Ceratiola may be regarded as a reduced form of *Empetrum,* the external and internal sepals although only two each, being much like those of *Empetrum* in that the external pair are imbricated while the internal pair are only closely approximated; and although the ovary is only 2-celled, the stigmas are almost as numerous, the two belonging to the fertile carpels being much larger. The axils are 2-flowered from the suppression of the central bud, a rudiment of which remains, and the first two lateral bracts, which in *Empetrum* sometimes have buds in their axils, are entirely wanting. In *C. ericoides* the male flower has only one bract (besides the secondary axillary bract) which is directly posterior, and it is larger than the succeeding sepals to which it is external, at its insertion quite enclosing them. The external pair of sepals are placed anterior and posterior, and the posterior of the two is consequently directly opposite the bract, and therefore the bract (as I regard it) cannot be a part of the calyx; they are, although the anterior one almost encloses the posterior, much narrower than the bract, and are quite opposite each other.†

* In *Epacrideæ* the pollen sometimes consists of three connate grains.

† Dr. Klotzsch's description of *Ceratiola* agrees with mine so far, as that he states that the inner whorl of floral envelopes consists of two scales which he regards as petals, but as he does not take into consideration the relative position of the external floral envelopes, it is perhaps partly different on that account.

The second pair are alternate with the first pair, from which they do not differ much in appearance, except that they are smaller and are separated at their bases by the stamens, which appear as if inserted between them, but on a close inspection they prove to be slightly internal. The stamens are two, alternate with the second pair of sepals and consequently are anterior and posterior. The female flower differs from the male only in the absence of stamens. The style and stigmas resemble those of some genera of *Euphorbiaceæ*, e. g. *Caturus*, in being much larger than usual compared with the size of the ovary. The two stigmas are sometimes more or less bifid, and between them are four or five rudiments in which it agrees with *Buxus sempervirens*.

Corema is very different from *Empetrum*, besides the ovary being only 3-celled with only three stigmas, but may be compared with *Ceratiola*, if it is admitted that the inner pair of floral envelopes are sepals, which appears to be sufficiently obvious, as it consists of two opposite scales placed right and left of the axis as in that genus. In *C. alba* the male flower has three pairs of scales resembling sepals. The external pair I believe must be bracts, because being lateral they are opposite the innermost pair, which are, by a comparison with *Ceratiola*, sepals; and they are moreover inserted by a comparatively broad basis around a minute peduncle, which the succeeding pairs form by the contraction of their bases. The intermediate pair are doubtless sepals, being anterior and posterior, but are not distinguishable from the internal pair except by their distinctly external position and inequality, the posterior being frequently much larger than the anterior. The innermost pair which are the sepals before noticed as being lateral, are alternate with the intermediate pair. The stamens are four opposite the sepals, the posterior being most commonly the larger and the anterior the smaller, so that they correspond in their inequality with the sepals, and the anterior is sometimes deficient, which occasions the two lateral to appear as if alternate with the anterior and two lateral sepals. The anthers in æstivation appear as if opening inwards, but may perhaps be versatile. *Corema* is the only genus in which the male flower has no rudiment of an ovary. The female flower differs from the male only in the absence of stamens.

Dr. Asa Gray's character for this genus agrees with the foregoing so far, as that he describes the floral envelopes taken together as consisting not uncommonly of six scales. (Mem. Americ. Acad. New Ser. vol. III.)

Oakesia may be regarded as a reduced form of *Corema*, but differs so much that it may be a distinct genus, there being in the male flower neither bract nor sepal posterior, whereas in *Corema* the posterior sepal is the larger of the two. In *O. Conradii* the male flower consists of three scales having the appearance of sepals, (but not forming a symmetrical whorl like the sepals of *Empetrum nigrum,)* two of them being lateral and one anterior, within which are three stamens, occasionally four, and a rudimentary ovary having three stigmas. The two lateral scales are evidently an opposite pair, like the two lateral bracts of *Corema alba*, and they also curve slightly backwards in the same manner, so as to leave scarcely a doubt of their identity. The anterior scale is inserted distinctly within the two lateral, which are on the same plane, and is consequently a sepal; and this inference is further supported by *Corema alba*, in which the anterior scale is a sepal; and also by its being more deciduous than the two lateral, which remain attached after it has fallen off. Of the three stamens, two are lateral and one posterior, to which occasionally a fourth is added anteriorly, when it agrees precisely with *Corema alba* in its stamens,* but it, however, differs from it further in the presence of a rudimentary trigynous ovary. The female flower differs from that of *Corema alba* only in the absence of the anterior sepal, which in *C. alba* is the smaller, but this is sometimes present when the identity becomes complete; so that, if it were not for the well-known accuracy of the observers who have described this genus, it might be supposed that the female flowers of *C. alba* had been mistaken for those of *O. Conradii*, as yet unknown.

That such is the structure of the male flower is certain, as it is the same in unopened flowers, and it is also sufficiently evident from Dr. Asa Gray's figures (Mem. Americ. Acad. New Ser. vol. III., Tab. I., figs. 3 & 4), that the floral envelopes consist only of three scales; and as the anterior scale is a sepal both in *Ceratiola* and *Corema*, it is not in any probability otherwise in a genus so closely approaching *Corema*. The margins of the bracts approach each other more closely on the posterior side, where they overlap each other, and have been regarded as adherent and compared to a monopetalous corolla, but in 10 or 12 flowers examined, they were in each quite distinct to their bases. Dr. Gray's description of the female flower also agrees with mine as far as the number of the scales is concerned (v. loc. cit. figs. 10 and 11), for he figures two as external, which I regard as lateral bracts and three as internal (loc. cit. fig. 10).

May not this genus be a dimorphous form of *Corema*, occasioned by a tendency in the male flower (which has no rudiment of an ovary) to become hermaphrodite? Dr. Gray (loc. cit.) describes and figures hermaphrodite flowers with 1-celled anthers. May not the 1-celled anthers and the disappearance of three of the sepals in the male flower, be analogous phenomena?†

In this view of their structure the main distinctions of the genera are as follows:—

Sepals 6		Empetrum.
Sepals 4	Bracts 2	Corema.
	Bract 1	Ceratiola.
Sepal 1		Oakesia.

* When only three stamens are present they appear as if alternate with the bracts and sepals, but when the fourth is present they are of course opposite them as in *Corema alba*.

† In *Corema alba* I met with two instances of an anther reduced to one cell, the other side of the stamen having become membranous.

Asclepiadeæ.

There is such a well-marked coincidence in structure between *Violaceæ* and this family in the stamens, that although perhaps it has never been suggested that any near affinity exists between them (unless between the coronet of *Stapelia* and *Passifloraceæ*), yet as they are more nearly related to *Violaceæ* than to any other polypetalous family, they would by inference be their monopetalous form. This similarity is especially remarkable between the stamens of *Hoya pulchella* and *Ionidium commune* and the spurs of the latter are distinctly the same in their mode of formation, the difference being that in the former the filament is longer and the anther cells much shorter, while the connective continues elongated (which is frequent in *Asclepiadeæ*), which occasions the spur in *Ionidium* to come off from the filament much lower down. Although in *Ionidium* only 2 of the stamens have appendages, yet in *Hymenanthera* all equally have them, and the anthers are connate as in *Asclepiadeæ*. In *Asclepiadeæ* the appendages, when erect, are sometimes much elongated and even meet over the centre of the flower, and their being erect in *Hymenanthera* (which are the same as those of *Ionidium* become erect,) is together with the connate anthers a singular coincidence in structure, because in *Viola* they are directed downwards.

Although they differ from *Violaceæ* in having an axial placentation, yet in the very nearly allied *Apocynaceæ* the placentation is in part of the genera parietal. They also agree remarkably with *Violaceæ* (i. e., when the ovules are suspended,) in the position of the raphe, and by placing them here as a monopetalous form of that family they are brought into their natural position in Table VII., which I venture to believe is an admissible argument, with reference to true station, where affinities are doubtful. Mr. Griffith, I believe, first noticed the position of the foramen of the ovule, where they are numerous and horizontal, (Trans. Linn Soc. vol. XX. p. 391,) which is on its upper margin, and *Viola tricolor* corresponds very remarkably in having this character, *Apocynaceæ* being the only other family in which I have observed it. With other families of this Division they agree in the production of caoutchouc, of medicines called Ipecacuanha, and very strong fibre, that of *Marsdenia tenacissima* being amongst the strongest known.

Juglandeæ.

This family is generally compared with *Anacardiaceæ* by systematic botanists, but in all the amentaceous families the ovule when pendulous has the raphe next the placenta or ventral, from which it is at least very probable that it would be so in *Juglandeæ* if the ovule were pendulous, and this would be an anomaly among the allies of *Anacardiaceæ*. In their compound leaves and bifid stigma they agree with *Euphorbiaceæ*, that family, although so often deleterious, being also remarkable for edible nuts as *Conceveiba Guianensis*.

Table VI.

The Platano-Proteal, or Labiatifloral Division.

That the extensive range of families here regarded as forming one Division are a strictly natural assemblage will probably be admitted by whatever name it may be called; and that they take their origin from the *Coniferæ* through *Platanaceæ* and *Proteaceæ*, can scarcely be doubted, if it is admitted that there are no other families, either Gymnospermous or Cryptogamous, of which they could be considered as branches. The approach between the *Coniferæ* and *Proteaceæ* is not very near except in habit, but *Platanus* agrees with *Pinus* in its male flowers, the apex of the anther being broad and flattened, unlike those of any other families, and in the ovule having an inferior foramen and the seed containing albumen.*

If any part of this Division could be separated, it would be the Geranial Subdivision, which is a very natural assemblage of families, the polypetalous forms being I believe, distinctly connected with *Nolanaceæ* through *Kitaibelia* among *Malvaceæ*, which with several rows of carpels on the same plane has but one style, and *Limnanthes* may also be an approach to the same kind of structure. But it seems not advisable to separate it, because *Geraniaceæ* and their allies scarcely differ from *Rutaceæ* and their allies.

Forestiera agrees with the *Oleaceæ*, an affinity suggested by Mr. Bentham, in having suspended ovules with the raphe obviously lateral, occasionally inclining to dorsal, in which it differs from other families with which it has been compared.

Phytocreneæ.

This family is very close to *Aquifoliaceæ*, agreeing with them in the number of ovules and the position of the raphe, and the porous stem of *Phytocrene* like that of *Vitis*, produces a large quantity of watery fluid; and these with other characters seem to indicate an approach to *Anacardiaceæ* and their allies.

Salvadoraceæ.

The families with which *Salvadora* has been associated have compound ovaries, with the carpels united by their margins, but its ovary consists of a single carpel (there being in the unopened flower a furrow on one side, relatively with which the raphe is lateral which shows that it is not accidental), which alone would make it very improbable that its affinities had been correctly understood. I have no doubt but that M. Planchon is right in regarding it as allied to *Oleaceæ*, and he informs me that he believes it to be near *Loganiaceæ*, and this agrees with a suggestion of

* I regard the scale of the female cone of *Pinus* as two bracts analogous to those of *Welwitschia*.

Dr. Lindley, that it may be compared with *Jasminaceæ*. With the *Oleaceæ* it agrees in its racemous inflorescence, the branches of which are flattened immediately beneath each pair of flowers; but, however nearly it may approach the monopetalous families, I think it must belong to the polypetalous series, because in *S. persica* there are four glands alternate the stamens, which most probably are barren stamens, and the stigma is sessile; besides which in *S. Wightiana* the leaves are strongly marked with very numerous pellucid dots, as in *Rutaceæ* and their allies.*

Icacinaceæ.

The ovary of *Pennantia* consists of only three carpels, as is shown by the three very distinct stigmas, one of which is the fertile, and is in nearly all the flowers I have examined somewhat depressed;—the ovary is one-celled, two of the carpels being abortive, and the ovule single and pendulous, having a more than usually well-marked dorsal raphe. This is precisely the structure of *Smodingium* which has three stigmas, the depressed one always indicating the dorsum of the carpel, and in which the raphe is at once obvious. As *Smodingium* has a small quantity of albumen, I would suggest that the only difference between *Icacinaceæ* and *Anacardiaceæ* consists in the quantity of albumen, as the ovary of the latter consists of from one to five carpels, in common with that of the former.† May not the stigma of *Cardiopteris* be an analogous structure? The fibrils that surround the anther in *Lasianthera* appear much like the cup-like connective of *Sabia* (which occurs in one or more of the species but not in all) and the branched filament of *Meliosma*, and *Cassinopsis* in its inflorescence has the peculiar habit of *Hypelate*.

Sapindaceæ.

Having had an opportunity of seeing a *Stackhousia* in flower, the corolla proved on careful examination to be irregular, the anterior petal being obviously not so long as the two posterior, nor yet so long as the two lateral, so that in a longitudinal or perpendicular section the mouth of the corolla is very oblique. The two posterior petals being erect have something of the appearance of an upper lip, and the two lateral, slightly turning up at their ends, leaves the lower one separated. The stamens correspond in their irregularity with the corolla, one of the two shorter of the five (and which is probably the shortest) being posterior, and the other short one being one of the two anterior. As the corolla in *S. pubescens* and *juncea* is polypetalous at the base, and the petals are so separated that the filaments of the stamens are inserted in vacant spaces between them, this genus might be referred to *Melianthea*, were it not for the stamens attached to the edge of the disk and its very different habit. It agrees, however, in the flowers being in dense spikes, and its anthers are much like those of *Melianthus*, and the attachment of the filaments to the edge of the disk I believe to be no objection to this comparison, because the filaments may be without difficulty torn up, so as to make them artificially hypogynous and internal to the disk; in a flower of *S. pubescens*, I have succeeded in raising all the five filaments. This may explain why the filaments remain permanent and require to be torn off to remove them, while the corolla, being articulated at the edge of the disk, readily falls off.‡

Platanaceæ.

I regard *Platanus* as differing from *Proteaceæ* only in the stamens being alternate the sepals, the ovule orthotropal and the seed containing a small quantity of albumen. The ovary of *Platanus* consists of from two to six or eight distinct carpels, and in *Proteaceæ* when two are present they are distinct, and the radicle in both cases is inferior. Broad-leaved *Proteaceæ* are not unlike *Platanus* in habit. *Platanus* is also very near *Aceraceæ*. (V. Ann. Nat. Hist. Ser. 3, vol. I., p. 102.)

* In *S. Wightiana* these stand out both from the upper and under surface of the leaves;—*S. Kœnigii* has also dotted leaves but not so strongly marked.

† In *Apodytes* the ovary has all the appearance of consisting of a single carpel, the stigma being quite simple, contracted at the apex and unilateral.

‡ *S. juncea* is remarkable for having a singular kind of defective flower, irregularly mixed with the fertile, the petals are wanting, the filaments are anantherous, the ovary has no cavity, and the style is wanting. It is a very close approach to the dimorphous flowers of *Malpighiaceæ*.

Polygalaceæ & Moringaceæ.

The foliage, fruit, and seed of *Moringa* are so much like those of *Papilionaceæ*, as to make a near affinity to that family very probable, and one of the species shows a more decided approach in the stamens being ten, five of them fertile and five barren, the posterior one being barren, very short, and looking separate from the rest, so that a vacuity is left on the posterior side of the otherwise closely packed stamens, like the fissure in the posterior side of the staminal tube of that family. This condition of the stamens, however, occurs equally well marked in *Polygalaceæ*, with which I find they agree in having the odd sepal posterior, it being exactly opposite the vacuity on the posterior or upper side of the declinate stamens, and therefore exactly opposite the shortest barren filament, the non-development of which produces the vacuity. The odd petal is therefore anterior, and the two posterior petals are evidently alternate with the vacuity on the posterior side of the stamens, as in *Polygalaceæ*. The two posterior petals, in a part of the species, are of a different form from the other three, and are tufted with hairs on their lower half, while the other three are smooth, so that the former are obviously a pair, as in *Geraniaceæ* and other families.

The stamens of *Moringa* are in most, if not all the species, more or less declinate, being very unequal in two or three of them, the two posterior, when there are nine, being scarcely more than half the length of the anterior one, which is the longest.* The anther is one-celled from consisting of only half an anther, as it is in a part of the species unequal-sided, one side being larger; and on the larger side is a furrow, having the appearance as if it were produced by an attempt to extend, in an oblique direction, the fissure which takes place in its dehiscence.

In the absence, perhaps, of any proof that the one-celled anthers of *Polygalaceæ* are only half-anthers, the simplicity of their appearance and the single fissure, as in *Polygala vulgaris*, makes it most probable that they are so; and if so, *Moringa* might take its place as a section of *Polygalaceæ*. *Phaseolus vulgaris* when dicarpous has all the appearance of having parietal placentæ.†

Krameriaceæ.

In *Krameria* the sepals are much and unequally imbricated, besides which they are unequal in size, which makes it difficult to decide their position, so that I believe it would be scarcely possible to say whether the odd sepal is next the axis or the contrary. But, if the irregularity of the flower is taken as a guide, we find three of the petals separated as it were from the other parts of the flower, and, as regards the irregularity of the flower, they are distinctly and certainly posterior. Of these three petals one, i.e., the intermediate one, is consequently directly posterior, which shows the irregularity of the flower to be the same as in *Leguminosæ*. *Krameria* further agrees with *Leguminosæ* in the ovary consisting of a single carpel (the cavity at least belongs to one carpel), and the raphe also in the two ovules is obviously quite lateral, which is not known to occur in *Polygalaceæ*. As the position of the odd petal, (known by its different form,) directly anterior, may be the only separating character between *Polygalaceæ* and *Leguminosæ*, I prefer placing *Krameriaceæ* near the latter. If the flower is inverted, then the carpel would be always posterior.

Trigoniaceæ.

The same remarks with regard to the position of the sepals, and especially of the petals which apply to *Krameria*, may be made with equal certainty with reference to *Trigonia*; it differs however, in having numerous horizontal ovules, and in this character especially it agrees with some of the genera of *Leguminosæ*, to which it may possibly belong, notwithstanding the considerable quantity of albumen its seed contains, as the embryo is large, having thin flat cotyledons, which are as broad as the seed.

Chailletiaceæ.

The affinities of this family are perhaps more obscure than those of any other in this Division, but there are three of the more remarkable characters which bring them near either to

* I should suppose there are 4 or 5 species, unless they are liable to much variation. † I have met with 3 or 4 instances all exactly alike and also produced it by cultivation; below the last ovules the ventral sutures are scarcely apparent.

Aquilariaceæ, Leguminosæ, or *Polygalaceæ,* which in the accompanying Table are nearly approximated to each other. 1. The corolla in *Tapura Guianensis* and *ciliata* is unilateral, two of the petals which are anterior being perfect, two which are lateral being ligulate, and the remaining one which is posterior being filamentous, so as to appear like a barren stamen, and this gives rise to an irregular flower, in which the odd sepal is anterior, i.e., between the two perfect petals ;—the position of the petals and sepals is therefore the same as in *Leguminosæ,* and as I find those of *Krameria* and *Trigonia** to have the same position, this family may have a near relation to them. The stamens also of *Tapura* have the same kind of irregularity, only two or three on the anterior side being fertile, the posterior filament being shorter than the others. 2. The singular deeply bifid petal of *Chailletia* and most of the genera, may perhaps be accounted for by comparing it with the barren stamens of *Aquilaria,* of which two belong to one stamen, so that supposing it to become a petal, and to retain its bifid character, the petal of *Chailletia* would be formed.† 3. The seed of *Moacurra gelonioides* very closely resembles that of *Aquilaria Agallocha,* as described and figured by Dr. Roxburgh, (Trans. Linn. Soc. vol. XXI., p. 199,) both in its singular testa and embryo ; for the inner integument of the seed in the former adheres so slightly (if in fact at all) to the external, that on dividing the seed the embryo covered with the internal integument can be readily taken out, and it also agrees with the second integument of the latter, in being of a chocolate brown colour ; and the embryo of the former has, comparatively with the size of the cotyledons, the same minute radicle (l. c. p. 199), which although attached to their bases is scarcely perceptible till they are separated.

With *Rhamnaceæ, Chailletiaceæ* agree in habit, and with *Celastraceæ* in their inflorescence, but the irregular corolla of *Tapura,* and their two pendulous ovules with the raphe next the placenta, prevent a close approximation to either of these families, but such coincidences may serve to show that the true station of this family is in this Division.

And finally, they may perhaps be compared with *Polygalaceæ,* especially with the § *Moutabeæ,* but like *Polygalaceæ, Moutabeæ* have the odd sepal next the axis, and their petals are not bifid but quite entire, and although their stamens are more perigynous than those of *Chailletiaceæ* the approach between them is comparatively distant.

Penæaceæ.

The genus *Geissoloma* differs so much from the other genera of this family, that I believe it should be kept separated as a distinct section of it, for besides other differences the two pendulous ovules have the raphe dorsal. In Ad. de Jussieu's, and other figures which have appeared, the position of the foramen of the ovule is either doubtful or it might be supposed that it was external, and the raphe consequently next the placenta, but having re-examined the ovules I am satisfied the raphe is dorsal, and that the appearances in the figures are due to a projection of cellular tissue upwards and outwards from the raphe in the form of a wing-like process.

Proteaceæ.

This family scarcely differs from *Chrysobalaneæ* except in the absence of petals and fewer stamens, and they seem very naturally to take their station as the apetalous form of that family and *Leguminosæ,* especially as the carpels when two are quite distinct (Ann. Nat. Hist. Ser. 2, vol. XI, p. 453), the gland also at the back of the carpel in *Grevillea* being, I believe, a second in a rudimentary condition. With *Rosaceæ* they agree in the position of the raphe, but it may sometimes be lateral, as in some instances it is not distinct. The want of adhesion between the coats of the seed in *Persoonia* may be regarded as showing a close approach to *Chailletiaceæ v.* supra.

* *Trigonia* may also approach *Chailletiaceæ* in the 2 abrupt or irregularly emarginate anterior petals, and in the glands representing barren stamens which have much the same appearance as those of *Chailletia.*

† *Aquilaria* agrees with *Daphnaceæ* in the scales representing barren stamens being double the number of the lobes of the calyx, but in *Aquilaria* as in *Daphnaceæ* they are not alternately opposite and alternate with them, but each lobe has 2 of them opposite to it. *Struthiola* however among the latter has deeply bifid glands alternate the sepals and these terminate in 2 apiculate processes which widely separate from each other which serves to explain the true nature of the barren stamens in the other genera and in *Aquilaria.*

Table VII.

SHOWING THE LATERAL RELATIONS OF THE DIVISIONS OF THE EXOGENS.

The intention of this Table is to bring the entire of the families of the Exogens, into their mutual relations with each other, so as to show at one view, both their vertical and lateral relations, and completely so, their lateral relations being but partially indicated, as the Divisions stand separately in the Tables. I believe this to be the only mode of arrangement which can possibly be made to accord with the well-known maxim of Ray, "*Methodum intelligo naturæ convenientem quæ nec alienas species conjungit, nec cognatas separat,*" (families in the present comparison being understood instead of species), and it so far fulfils it, as to show that the Divisions in the foregoing Tables must be at least to some extent natural.

I believe Ray's idea to be strictly correct, and that it might be extended not only to families but to Divisions, and that its truth might be clearly demonstrated in such a Table as this, by using curved instead of straight lines, so that the forms of the Divisions might be varied to suit affinities. The relative spaces the Divisions occupy might also be varied, and promontories might be made as in maps, but this being the first attempt of the kind, (except the sketch in the Ann. Nat. Hist. 2nd Ser. vol. XI., Tab. III.,) I thought it would be better not to complicate the arrangement more than was absolutely necessary to show the relative positions of some of the most extensive and remarkable families.

This I believe is for the most part effected, even in the Polypetalous families where affinities are the most complicated; as for instance, *Combretaceæ* find their place very near *Myrtaceæ*, *Vacciniaceæ* near *Cinchonaceæ*, and *Passifloraceæ* near *Homaliaceæ;* among the perigynous and hypogynous families, *Euphorbiaceæ* fall very naturally into their nearest affinities being in immediate contact with *Menispermaceæ* and *Rhamnaceæ*, and are contiguous to the Division containing *Malvaceæ;* and *Ochnaceæ* are contiguous to *Violaceæ*, so that whether the former are placed in Table IV. or in Table V. their station in Table VII. would not be materially altered. *Saxifragaceæ* and *Rosaceæ* are however widely separated, and also *Olacaceæ* and *Icacinaceæ*, but I believe there is no certain evidence to show that these families are nearly related, and their approaches although so near may be only those of analogy; but these are questions requiring further attention whatever the decision may be.* Among the Apetalous and Monopetalous families equally natural approaches between the families are evident, and I think it deserves notice that all the didynamous families with the labiate corolla are brought into close contact with each other, because at first sight it might appear that in Tables III. and VI. they are widely separated.

Till these Divisions however have been thoroughly examined, and admitted by competent botanists to be well established, it would be premature to carry out this plan of showing what may be termed lateral affinity, any further; but I think it will be obvious that a Table of this kind is really a *sine qua non* as regards the accomplishment of the Natural System of Exogens.

If it were wished to place Table VI. in relation with Table II., so as to bring *Icacinaceæ* and *Phytocreneæ* into relation with *Olacaceæ*, and what would perhaps be equally natural *Rosaceæ* into relation with *Saxifragaceæ*, it might be effected without any further alteration than by placing Table VI. between Tables II. & IV., leaving *Homaliaceæ* in relation with *Passifloraceæ*. This would require Table VI. to be regarded as a branch of Table II., and it could not then be considered as having any relation to the Gymnosperms, but it appears to me that *Platanaceæ* are much too near *Cupuliferæ* and *Artocarpeæ* to allow such an alteration. Possibly from the position of the radicle in *Platanaceæ* and *Proteaceæ*, Table V. should be placed before Table VI., or what would be preferable, placed with it in the most advanced position.

* V. p. 13; Phytocreneæ p. 35, and Icacinaceæ p. 36.

TABLE I.

PHANEROGAMS.

ENDOGENS;

OR RACE OF THE RICCIACEÆ.

§ 1. ENDORHIZAL,

(COLEORHIZA OF THE PRIMARY RADICLE, AND ENLARGEMENT OF THE CAULICULUS AND RADICLE, FREQUENT;)

OR RACE OF THE ZOSTERACEÆ.

§ 2. EXORHIZAL,

(COLEORHIZA OF THE PRIMARY RADICLE ALWAYS WANTING, CAULICULUS AND RADICLE NOT ENLARGED;)

OR RACE OF THE ARACEÆ.

SUB-DIVS.			HETEROCARPOUS.	PROCARPOUS.				HETEROCARPOUS.	PROCARPOUS.	
			GRAMINAL.	ORCHIDAL.	ZOSTERAL.	MARANTAL.			ARAL.	DIOSCOREAL.
EPIGYNOUS.				ALL. 1. ORCHIDEÆ (***?) APOSTACIACEÆ. ALL. 2. TACCACEÆ. Numerous, horizontal, or in part suspended, r. lateral or variable. BURMANNIACEÆ.	ALL. 3. HYDROCHARIDEÆ. Stratiotes, *ascending, r. most frequently dorsal.*	ALL. 4. MUSACEÆ. AMOMACEÆ. MARANTACEÆ***. 1, ascending, cotyledon next pl. BROMELIACEÆ.			ALL. 1. HYPOXIDEÆ. Numerous, horizontal, r. lateral. IRIDEÆ. AMARYLLIDEÆ. Numerous, horizontal, r. lateral. HÆMODORACEÆ.	ALL. 2. DIOSCOREACEÆ (* ?) *Suspended, r. next pl.*
HYPOGYNOUS & PERIGYNOUS.			ALL. 5. MAYACEÆ. XYRIDEÆ. ALL. 6. ERIOCAULONEÆ. RESTIACEÆ. DESVAUXIACEÆ†††. ALL. 7. CYPERACEÆ. Erect, r. next pl. ? GRAMINACEÆ. Ascending, r. next pl.	ALL. 8. PHILYDRACEÆ. PONTEDERIACEÆ***. When single and pendulous, r. turning obliquely towards pl. but the foramen lateral in its relation to the funiculus. COMMELYNACEÆ***. JUNCACEÆ. Juncus, ascending or horizontal, in several rows, r. lateral; a very few of the uppermost sometimes ascending, r. dorsal; the lowermost sometimes depressed, r. dorsal. Luzula, 3 erect, r. axile.	ALL. 9. TRIURIDEÆ. Erect, r. next pl. ALISMACEÆ. Erect, cotyledon next pl. BUTOMACEÆ. *Numerous, ascending, r. dorsal.* JUNCAGINEÆ. Erect, r. next pl. ALL. 10. POTAMOGETONEÆ. Convexity of the cotyledon dorsal, radicle inferior. NAIADEÆ***. ZOSTERACEÆ.		ALL. 3. PALMACEÆ††. Ascending, r. lateral, or next pl.; or depressed and r. dorsal. TYPHACEÆ††. Pendulous, r. dorsal.	ALL. 4. ORONTIACEÆ. When ascending, r. next pl. PANDANACEÆ** or ***. When single and erect, r. next pl. ARACEÆ***. When horizontal, r. irregular, frequently on the upper surface; when ascending, r. lateral or variable. Dieffenbachia, 1, *erect, r. dorsal.*	ALL. 5. LILIACEÆ. Numerous, horizontal, r. lateral; or 1, ascending, r. next pl. GILLESIACEÆ. MELANTHACEÆ. When ascending, r. next pl.	ALL. 6. SMILACEÆ. TRILLIACEÆ. Ascending, r. lateral, or obliquely towards the pl. PHILESIACEÆ. ALL. 7. ROXBURGHIACEÆ*. (Carpel always lateral). Numerous, erect, r. lateral or variable.
CRYPTOGAMS. *Aphyllous. Polycelious. embryonous.* §1. Mycelious.			MARCHANTIACEÆ. RICCIACEÆ. Derived from Jungermanniaceæ, v. Table II.							
	LICHENALES. FUNGALES.									

The Natural Orders with 3 asterisks affixed (***), have the single carpel always anterior; in those with 2 it is for the most part anterior being otherwise lateral; and in those with only 1 it is indifferently anterior or lateral, unless further notice is added. Those with 3 daggers affixed (†††), have the single carpel always posterior; in those with 2 it is indifferently anterior, lateral, or posterior or more frequently the latter; and in those with only 1 it is anterior, lateral or posterior, but less frequently the latter. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules, whether 1 or more in each cell, or to the seed; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous, with the raphe next the placenta, is printed in italics, and also (as being an equivalent character), the ovule erect with the raphe dorsal.

TABLE II.

PHANEROGAMS.

EXOGENS.

THE BALANOPHORAL DIVISION;

OR RACE OF THE BRYACEÆ.

CRYPTOGAMS.

§2. Amycelious. *Aphyllous.*

Polyembryonous. APETALOUS.

PÒLYPETALOUS.

MONOPETALOUS. SUB-DIVS.

SANTALINAL.		LORANTHAL.			BALANOPHORAL.	MYRTAL.		ARISTOLOCHIAL.
HETEROCARPOUS.	PROCARPOUS.	HETEROCARPOUS.		PROCARPOUS.	PROCARPOUS.	HETEROCARPOUS.	PROCARPOUS.	PROCARPOUS.
		All. 1. **Cinchonaceæ††.** When single and erect, r. next pl.; when single and pendulous, r. dorsal. **Rubiaceæ.** 1 ascending, r. next pl. | **Caprifoliaceæ†.** When single and pendulous, r. lateral. §**Adoxeæ.** R. lateral.			All. 1. **Valerianaceæ***.** (The position of the fertile carpel equivalent to anterior). R. lateral. **Dipsaceæ***.** R. lateral, or dorsal. **Calyceraceæ***.** R. dorsal.	All. 1. **Brunoniaceæ†.** *Erect, r. dorsal.* | **Cichoraceæ*.** (Fertile carpel lateral). *Erect, r. dorsal.* **Compositæ***.** *Erect, r. dorsal.*	All. 2. **Campanulaceæ.** **Lobeliaceæ.** **Goodeniaceæ***.** 1, erect, r. next pl.; or 2 or more ascending, r. lateral. **Stylidiaceæ***.** R. lateral, or partially variable.	All. 1. ? **Stylidiaceæ.** (V. Myrtal Sub-Division All. 2.) **Columelliaceæ.** Numerous, horizontal, r. apparently lateral.
All. 1. **Styraceæ.** Ascending or suspended, r. lateral. Styrax, ascending, r. next pl. | **Symplocaceæ.** *When suspended, r. next pl.* All. 2. **Olacaceæ.** Nucleus pendulous, funiculus attached to its dorsal side;—its apex superior, beneath the funiculus which curves over it. All. 3. **Diclidantheræ.** 1, *pendulous, r. next pl.* **Humiriaceæ.** *When suspended, r. next pl.* All. 4. **Bruniaceæ***.** 1 or 2 pendulous, r. lateral. *Or (more frequently) r. next pl.*		All. 2. **Cornaceæ††.** R. lateral. Aucuba, r. dorsal. §**Alangieæ††.** R. lateral.	All. 3. **Umbelliferæ†††.** *R. next pl.* **Araliaceæ.** *R. next pl.* **Gunneraceæ.** 1, *pendulous, r. next pl.* All. 4. **Saxifragaceæ†.** When ascending, r. next pl. Aphanopetalum, 1 pendulous, r. dorsal. §**Escallonieæ.** §**Ribesieæ.** Horizontal, r. lateral; in the uppermost, r. on the under surface, in the lowermost, r. on the upper surface.	All. 5. **Hamamelideæ**.** When single, pendulous, r. lateral, perhaps not always. *When numerous, suspended, r. next pl.* **Rhizophoraceæ.** 2, *pendulous, r. next pl.* **Cassipoureæ.** *In part suspended, r. next pl.; in part horizontal, r. on the under surface.* **Cunoniaceæ.** *2 or 4 suspended, r. next pl.;* when numerous, sometimes lateral. §**Belangereæ.** Ascending, r. lateral. **Hydrangeaceæ.** §**Philadelpheæ.** *Numerous, suspended, r. next pl.*	All. 2. **Haloragaceæ***.** 1, pendulous, r. lateral.	All. 3. **Melastomaceæ.** When horizontal, r. lateral. §**Memecyleæ.** Erect, r. next pl. **Lythraceæ†††.** When ascending, r. next pl. §**Granateæ.** Ascending, r. next pl. **Vochysiaceæ†††.** *Numerous, suspended, r. next pl.;* or 2 erect, r. next pl. | **Chamælauciaceæ***.** 2, erect, r. lateral; *or 2, ascending, r. obliquely dorsal.* **Myrtaceæ***.** When single and ascending, r. next pl. §**Lecythideæ.** §**Belvisieæ.** 2, suspended, r. dorsal, (foramen beneath the funiculus); or obliquely suspended, r. lateral. §**Barringtonieæ.** When 3 or 4 and suspended, r. dorsal. | **Onagraceæ***.** 1 or more, ascending, r. next pl.; when horizontal, r. lateral; when suspended, r. dorsal.	All. 2. **Rafflesiaceæ.** All. 3. **Cucurbitaceæ*.** Numerous, horizontal, r. lateral; when single and pendulous, r. dorsal. **Begoniaceæ**.** **Datiscaceæ.** All. 4. **Homaliaceæ.** *2 or more on each placenta, suspended, r. next pl.* **Loasaceæ.** *Numerous, depressed, r. next pl.; when single and pendulous, r. next pl.* **Cactaceæ.** R. lateral.
All. 5. **Santalaceæ†.** Ovule as in Olacaceæ; or funiculus attached laterally.		All. 6. **Garryaceæ.** Fadgenia, 2 pendulous from the apex of the ovary, r. always lateral as regards the 2 carpels. V. Appendix. | All. 7. **Loranthaceæ.** §**Mysodendreæ††.** Funiculus attached to the dorsal side of the ovule, curving over its apex. | All. 8. **Helwingiaceæ.** 1, pendulous, r. dorsal.			All. 3. **Balanophoraceæ***.** Funiculus attached to the dorsal side of the ovule.			All. 5. **Hydnoreæ.** | **Cytinaceæ.** **Aristolochiaceæ.** Numerous, horizontal, r. always on the upper surface; in a part of the genera apparently lateral.
					Bryaceæ. **Andræaceæ.** **Jungermanniaceæ.**			
					ALGALES. **Characeæ.** (An Order of Algales.)			

The Natural Orders with 3 asterisks affixed (***), have the single carpel always anterior; in those with 2 it is for the most part anterior, being otherwise lateral; and in those with only 1 it is indifferently anterior or lateral, unless further notice is added. Those with 2 daggers affixed (††), have the single carpel indifferently anterior, lateral, or posterior, or more frequently the latter; and in those with only 1, it is anterior, lateral, or posterior, but less frequently the latter. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules, whether 1 or more in each cell; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous, with the raphe next the placenta, is printed in italics, and also (as being an equivalent character) the ovule erect, with the raphe dorsal.

TABLE III.

PHANEROGAMS.

EXOGENS.

THE CHLORANTHAL DIVISION;

OR RACE OF THE LYCOPODIACEÆ.

SUB-DIVS.	SCLERANTHAL.		CHLORANTHAL.	
	HETEROCARPOUS.	PROCARPOUS.	HETEROCARPOUS.	PROCARPOUS.
MONOPETALOUS.	All. 1. ? Primulaceæ. Plumbagineæ†. R. dorsal.	Myrsinaceæ. Ascending, r. next pl. Primulaceæ. Ascending, r. next pl.	All. 1. Stilbaceæ†††, or ††. 1 erect, r. lateral, or apparently next the placenta.	All. 2. Globulariaceæ***. 1, pendulous, r. dorsal. Plantagineæ***, or *. When ascending, r. next pl. All. 3. Hydrophyllaceæ. *When suspended, r. next pl.* Polemoniaceæ. When single and erect, r. next pl. Cordiaceæ. 1, *suspended, r. next pl.* Ehretiaceæ. 1, pendulous, r. lateral. Boragineæ. 1, *amphitropal with the foramen uppermost, r. next pl.* All. 4. Myoporaceæ. 1 or 2, pendulous, r. lateral. Selagineæ***. Pendulous, r. lateral, *(very rarely next pl.?)* Labiatæ***. When erect from the base, r. lateral; when ascending, amphitropal, r. next pl. Verbenaceæ***. Erect, r. lateral. Spielmannia 4, pendulous, r. lateral; seed 1, pendulous, radicle horizontal, directed laterally.
POLYPETALOUS.	All. 2. Illecebraceæ†††. 1, pendulous, cotyledons dorsal, or lateral.	All. 3. Ficoideæ. R. lateral or variable. Tetragoniaceæ***. 1, pendulous, cotyledons dorsal; or 2 ascending, cotyledons lateral. All. 4. Portulaceæ†. When ascending, cotyledons lateral. Caryophyllaceæ. When ascending, cotyledons next pl. or lateral. §Molluginæ***. *When single and suspended, r. next pl.* Frankeniaceæ. Ascending, r. lateral.		All. 5. Reaumuriaceæ. Erect, r. next pl. Tamaricaceæ. When parietal and ascending, r. slightly variable but mostly lateral. Tamarix, erect from the base r. axile. All. 6. Crassulaceæ. When numerous, ascending, r. lateral. When single and erect, r. next pl. ? §Tetradicleæ. The lateral ovules horizontal, r. lateral. Callitrichaceæ. *Suspended, r. next pl.* Elatinaceæ. When numerous and suspended, r. lateral, or variable from twisting of the funiculus. All. 7. Batideæ. Erect, r. lateral.
APETALOUS. § 2.	All. 5. Nyctagineæ†††. Erect, cotyledons next pl. Amaranthaceæ†††. When pendulous, cotyledons dorsal. Chenopodiaceæ†††. When pendulous, cotyledons dorsal; rarely lateral. §Baselleæ†††.	All. 6. Scleranthaceæ***. *Pendulous, cotyledons next the funiculus.*	All. 8. Podostemoneæ (*** ?) Ascending, r. next pl.	All. 9. Polygonaceæ. Phytolaccaceæ***. Ascending, r. next pl. Petiveriaceæ***. Seed erect, cotyledons next pl.
APETALOUS. § 1.			All. 10. Piperaceæ†††. Saururaceæ†††.	All. 11. Chloranthaceæ***.
GYMNOSPERMOUS FORM.				Gnetaceæ. — Welwitschieæ. (A § of Gnetaceæ.)
CRYPTOGAMS. *Prothallious.*				Lycopodiaceæ. — Isoteæ. (A § of Lycopodiaceæ.)
Derivation.				Derived from Bryaceæ. (V. Table II.)

The Natural Orders with 3 asterisks affixed (***), have the single carpel always anterior, and 1 only, indicates that it is indifferently anterior or lateral. Those with 3 daggers affixed (†††), have the single carpel always posterior; and 1 only, indicates that it is anterior, lateral or posterior, but less frequently the latter. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules, whether 1 or more in each cell, or to the seeds; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous with the raphe next the placenta is printed in italics, and also (as being an equivalent character) the pendulous campylotropal ovule, where the embryo subsequently formed has the cotyledons next the placenta.

TABLE IV.

PHANEROGAMS.

EXOGENS.

THE CERATOPHYLLINAL DIVISION,

OR RACE OF THE MARSILEACEÆ.

§ 1. RECURVED ANTHER VALVES. | § 2. CIRCINATE OR PITCHER-LEAVED.

SUB-DIVS. | MONOPETALOUS. | POLYPETALOUS. | APETALOUS. | CRYPTOGAMS *Prothallous.*

LAURINAL.

HETEROCARPOUS.

ALL. 1.

COMBRETACEÆ†.
Pendulous, r. dorsal, or occasionally lateral or next the wall of the ovary.

ILLIGERACEÆ†.
1, pendulous, r. dorsal.

§**HERNANDIEÆ†.**
1, pendulous, r. dorsal.

ALL. 2.

LAURACEÆ†.
Pendulous, r. dorsal.

§**CASSYTHEÆ†.**
Pendulous, r. dorsal.

ALL. 3.

MAGNOLIACEÆ†.
When erect, r. next pl.; when horizontal, r. lateral.

§**EUPTELEÆ.**
When 3, the lower suspended, r. dorsal; in the 2 upper, lateral or on the under surface.

§**SCHIZANDREÆ.**
Suspended, r. lateral.

§**ILLICIEÆ.**
When erect, r. next pl. When horizontal or somewhat ascending, r. lateral.

CALYCANTHACEÆ.
2, ascending, r. next pl.

DILLENIACEÆ††.
1, erect, r. next pl.; or 2, r. lateral, in one obliquely towards the placenta and in the other obliquely dorsal.

ANONACEÆ.
Erect, r. next pl.

§**MYRISTICEÆ†.**
Erect, r. next pl.

MONIMIACEÆ.
1, pendulous, r. dorsal.

§**ATHEROSPERMEÆ.**
1, erect, r. next pl.

PROCARPOUS.

ALL. 4.

BERBERIDEÆ or †.**
Numerous, ascending, r. next pl.
When 2 erect, r. dorsal.

§**PODOPHYLLEÆ.**

§**LARDIZABALEÆ.**
Numerous, horizontal, r. lateral.

MENISPERMACEÆ († ?).
Carpel most frequently lateral.
1 *or* 2, *suspended, r. next pl.*

PAPAVERAL.

PROCARPOUS.

ALL. 1.

RESEDACEÆ.
When amphitropal, suspended, r. next pl.

CRUCIFERÆ.
Suspended, campylotropal, with the foramen external.

CAPPARIDEÆ.
Horizontal, foramen lateral, but sometimes variable, being either superior or inferior.

ALL. 2.

PAPAVERACEÆ.
Numerous, horizontal, r. variable; in Macleya 6-8, r. always on the upper surface.

§**FUMARIEÆ***.**
1 or more, horizontal, r. on the upper surface.

CERATOPHYLLINAL.

HETEROCARPOUS.

ALL. 1.

VILLARSIEÆ.
(A § of Gentianaceæ.)

ALL. 3.

NYMPHÆACEÆ.
Numerous, suspended, r. variable, but most frequently dorsal.

HYDROPELTIDEÆ.
2 or 3, suspended, r. dorsal.

NELUMBIACEÆ†††.
R. dorsal.

ALL. 6.

CERATOPHYLLACEÆ†††.

PROCARPOUS.

ALL. 1.

GENTIANACEÆ.
Numerous, horizontal, r. lateral.

ALL. 2.

MONOTROPACEÆ.

PYROLACEÆ.

ALL. 4.

RANUNCULACEÆ*; but when the flower is regular †.**
Erect, r. next pl.; or pendulous, r. dorsal.

§**CEPHALOTEÆ.**
1, *erect, r. dorsal.*

SARRACENIACEÆ.
Numerous, horizontal, r. lateral or variable.

ALL. 5.

DROSERACEÆ.
Roridula, 1 pendulous r. dorsal.

FRANCOACEÆ.
Obliquely ascending, r. lateral.

NEPENTHACEÆ.
Obliquely ascending, r. lateral.

ERICAL.

PROCARPOUS?

ALL. 1.

VACCINIACEÆ.

EPACRIDEÆ†.
When single and pendulous, r. lateral or dorsal.

ERICACEÆ.
When ascending, r. next pl.

§**DIAPENSIEÆ.**
Numerous, r. lateral, or variable.

ALL. 2.

CYRILLACEÆ.
Pendulous, r. dorsal.

PITTOSPORACEÆ.
Numerous, horizontal, r. lateral.

TREMANDRACEÆ.
Suspended, r. next pl.

TERNSTRŒMIAL.

PROCARPOUS OR NEARLY SO.

ALL. 1.

SAPOTACEÆ.**
(Carpel very rarely posterior?)
Ascending, r. next pl.

EBENACEÆ.
2, pendulous, r. dorsal, or lateral.

ALL. 2.

CLUSIACEÆ†.
When horizontal, r. lateral; when ascending, r. next pl.

CANELLACEÆ.
5 or 6, suspended, r. variable but most frequently dorsal.

HYPERICACEÆ.
R. lateral or variable, often on the upper surface.

BREXIACEÆ.
When suspended, r. next pl.

§**PARNASSIEÆ.**
Numerous, horizontal, r. lateral, sometimes variable.

ALL. 3.

OCHNACEÆ.
When erect, r. next pl. *When suspended, r. next pl.*

§**SAUVAGESIEÆ.**
Horizontal, r. lateral.

ALL. 4.

TERNSTRŒMIACEÆ.
When suspended, r. dorsal.
Gordonia, *suspended, r. next pl.*

§**MARCGRAVIEÆ.**
Numerous, ascending, r. next pl.

§**RHIZOBOLEÆ.**
1, *suspended, r. next pl.*

LINACEÆ.
2 *suspended, r. next pl.*

§**HUGONIEÆ.**
2 *pendulous, r. next pl.*

§**ERYTHROXYLEÆ*.**
1 *pendulous, r. next pl.*

§**IXIONANTHEÆ.**
2 *or more, suspended, r. next pl.*

ALL. 5.

DIPTEROCARPEÆ.
2, *pendulous, r. next pl.*

§**ANCISTROCLADEÆ†.**

§**LOPHIREÆ.**
Erect, r. next pl.

CHLÆNACEÆ.
, *pendulous, r. next pl.*

CRYPTOGAMS *Prothallous.*

MARSILEACEÆ.
Derived from Ophioglossaceæ, v. Table V.

A Natural Order with 3 asterisks affixed (***), has the single carpel always anterior; and in those with only 1 it is indifferently anterior or lateral. Those with 3 daggers affixed (†††), have the single carpel always posterior; in those with 2 it is indifferently anterior, lateral or posterior, or more frequently the latter; and in those with only 1 it is anterior, lateral, or posterior, but less frequently the latter. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules whether 1 or more in each cell; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous with the raphe next the placenta is printed in italics, and also (as being equivalent characters), the ovule erect with the raphe dorsal, and the suspended campylotropal ovule with the foramen above or external to the funiculus.

TABLE V.

PHANEROGAMS.

EXOGENS.

THE CASUARINAL DIVISION,

OR RACE OF THE MARATTIACEÆ.

PROCARPOUS OR NEARLY SO.

SUB-DIVS.	URTICAL.	CASUARINAL.
MONOPETALOUS.	All. 1. **Apocynaceæ.** *Numerous, horizontal, r. on the under surface.* Rauwolfia 2 *suspended, amphitropal, r. next pl.*	All. 1. **Asclepiadeæ.** *Numerous, horizontal, r. on the under surface; or pendulous, r. next pl.*
POLYPETALOUS.	All. 2. **Euphorbiaceæ***.** 1 *or* 2, *suspended, r. next pl.* §**Putranjiveæ.** 2, *suspended, r. next pl.* §**Gyrostemoneæ.** *Ascending campylotropal with an inferior foramen on the inner side immediately above the funiculus; endostome and secundine distinct from the primine.* §**Buxeæ.** 2, suspended, r. dorsal. **Empetraceæ.** 1, ascending, r. next pl. All. 3. **Flacourtiaceæ.** *When suspended, r. next pl.* §**Pangieæ.** *Numerous, suspended, r. next pl. or occasionally lateral.* **Papayaceæ.** *Numerous, horizontal, r. partly variable, but most frequently on the under surface.*	All. 2. **Cistaceæ.** Ovules showing a tendency to be suspended with a lateral, *or inferior raphe.* **Samydaceæ.** *When suspended, r. very short, next pl.* All. 3. **Lacistemaceæ**.** *Suspended, r. next pl.* **Stilagineæ.** *Suspended, r. next pl.* All. 4. **Passifloraceæ.** Horizontal, r. lateral. **Turneraceæ.** Horizontal, r. lateral. **Malesherbiaceæ.** Ascending, r. lateral. **Violaceæ***.** *Numerous, horizontal, r. on the under surface; or pendulous, r. next pl.*
APETALOUS.	All. 4. **Cannabineæ***.** *Pendulous, cotyledons next pl.* **Urticaceæ***.** **Ulmaceæ**.** *Pendulous, r. next pl.* §**Celtideæ**.** *Pendulous, cotyledons next pl.* All. 5. **Artocarpeæ***.** *When suspended, r. next pl.* **Moreæ** *, rarely †. Elatostemma**. *Suspended, r. next pl.*	All. 5. **Juglandeæ.** **Salicaceæ.** *When parietal and ascending, r. dorsal.* **Cupuliferæ** (*** ?) *Pendulous, r. next pl.* **Myricaceæ.** All. 6. **Scepaceæ.** 2, *pendulous, r. next pl.* **Betulaceæ.** *Pendulous, r. next pl.* **Casuarineæ***.** *Seed suspended, short raphe next pl.*
GYMNOSPERMOUS FORMS.		**Taxeæ.** (A § of Coniferæ.) **Cycadeæ.** **Coniferæ.**
CRYPTOGAMS. *Prothallious.*		**Marattiaceæ.** **Polypodiaceæ.** **Ophioglossaceæ.** **Equisetaceæ.** Derived from Lycopodiaceæ, v. Table III.

The Natural Orders with 3 asterisks affixed (***), have the single carpel always anterior; in those with 2 it is for the most part anterior, being otherwise lateral; 1 only, indicates that it is indifferently anterior or lateral; and 1 dagger (†) that it is usually anterior or lateral, and but very rarely posterior. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules whether 1 or more in each cell; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous with the raphe next the placenta is printed in italics, and also (as being equivalent characters), the ovule horizontal with an inferior raphe, the ovule ascending with a dorsal raphe, and the ascending campylotropal ovule with an internal foramen.

TABLE VI.

PHANEROGAMS.

EXOGENS.

THE PLATANO-PROTEAL DIVISION,

OR RACE OF THE PLATANACEÆ.

SUB-DIVS.	GERANIAL.	PLATANAL.		PROTEAL.	
	PROCARPOUS OR NEARLY SO?	HETEROCARPOUS.	PROCARPOUS.	HETEROCARPOUS.	PROCARPOUS.
MONOPETALOUS.	All. 1. **Convolvulaceæ.** 1 or 2, erect, r. next pl. **Cuscutaceæ.** **Nolanaceæ.** Seed erect, cotyledons at the inner angle of the cell next the axis of the fruit.	All. 1. **Loganiaceæ.** 1 or numerous, ascending, r. next pl.; or horizontal, r. lateral or in part on the upper surface. | **Solanaceæ.** Numerous, horizontal, r. lateral or irregular.	All. 2. **Pedaliaceæ.** *When erect, r. dorsal.* **Crescentiaceæ.** *When suspended, r. next pl.* **Gesneraceæ.** **Orobanchaceæ.** V. Appendix. Lathræa, *suspended, r. next pl.* **Bignoniaceæ.**		All. 1. **Utriculariaceæ** (*** ?) (The elongated stigma anterior). Numerous, ascending, r. next pl. **Scrophulariaceæ***.** When ascending, r. next pl.; *when suspended, r. next pl.* | **Acanthaceæ***.** When 2 ascending, r. lateral. §**Thunbergieæ.** 2, *suspended, amphitropal with a superior foramen.* V. Appendix.
POLYPETALOUS.	All. 2. **Malvaceæ.** Ascending, r. next pl. **Byttneriaceæ*.** When ascending, r. next pl.; *when suspended, r. next pl.* Ayenia, 2 *pendulous, r. next pl.* **Sterculiaceæ††.** When single and pendulous, r. dorsal. **Tiliaceæ.** Horizontal, r. lateral; when ascending, r. next pl. | All. 3. **Geraniaceæ.** 2, *the upper ascending, r. dorsal, the lower horizontal, r. inferior.* §**Limnantheæ.** 1 erect, r. next pl. §**Balsamineæ.** Numerous, suspended, r. dorsal; or, from torsion, lateral. Hydrocera, 3 pendulous, r. dorsal. §**Vivianeæ.** 2 amphitropal, the upper ascending, the lower suspended, r. in both lateral. §**Tropæoleæ** (*** ?). *Pendulous, r. next pl.* **Oxalideæ.** *Suspended, r. next pl*	All. 3. **Aquifoliaceæ†.** Ilex 1, r. dorsal, sometimes with a tendency to be lateral, i.e. at one of the external angles of the triangular seed. **Phytocreneæ†.** 2, pendulous, r. lateral. **Celastraceæ.** Ascending, r. lateral. Cassine, 2 pendulous, r. in the early stage either lateral or dorsal. Euonymus and Goupia, 1 or 2 or more, ascending, r. next pl.; E. latifolius 2, suspended, r. dorsal. §**Hippocrateæ.** Ascending (in two rows), r. lateral, i.e., between the ovules. **Rhamnaceæ.** 1 or 2, erect, r. lateral. **Vitaceæ.** 1 or 2, erect, r. next pl. | All. 4. **Jasminaceæ.** 1 or 2, ascending, r. lateral or next pl. | **Oleaceæ.** 2, pendulous, r. lateral, dorsal, *or obliquely towards pl.* **Salvadoraceæ††.** 1, erect, r. lateral. §**Forestiereæ.** 2, pendulous, r. lateral. All. 5. **Anacardiaceæ††.** Pendulous, r. dorsal. §**Spondieæ,** Pendulous, r. dorsal. **Icacinaceæ†.** When single, pendulous, r. dorsal.	All. 6. **Meliaceæ.** *Suspended, r. next pl. or obliquely so.* §**Cedreleæ.** Numerous, horizontal, r. lateral; in part variable. **Amyrideæ†.** *R. next pl.* **Rutaceæ.** *When suspended, r. next pl.* §**Aurantieæ.** *R. next pl.* §**Xanthoxyleæ.** *R. next pl.* **Simarubaceæ.** *R. next pl.* **Zygophyllaceæ.** *When suspended, r. next pl.* **Connaraceæ***.** *Ovules ascending, but showing a tendency to be suspended, with an inferior raphe.* | All. 7. **Malpighiaceæ.** Pendulous, r. (or funiculus) lateral or dorsal. §**Nitrarieæ.** R. lateral. **Coriarieæ.** Pendulous, r. dorsal. | **Sapindaceæ.** 1 ascending, r. next pl.; or 2, 1 ascending, r. next pl. *and the other suspended, r. next pl.* Aitonia, 2 *suspended, r. next pl.* §**Staphyleæ.** Ascending (in two rows), r. lateral. §**Meliantheæ.** When erect, r. next pl. §**Stackhousieæ.** 1, erect, r. next pl. All. 8. **Sabiaceæ.** 2 suspended, nearly orthotropal, both with an inferior foramen. Convexity of the cotyledons dorsal. **Aceraceæ.** Ovules and seed as in Sabiaceæ	All. 2. **Rosaceæ†.** *Suspended, r. next pl.* §**Dryadeæ.** *When suspended, r. next pl.*; when ascending, r. next pl. §**Spiræeæ.** *Suspended, r. next pl.* §**Neuradeæ.** 1 depressed or obliquely pendulous, r. dorsal. **Sanguisorbaceæ†.** *When suspended, r. next pl.* | **Pomaceæ†.** 1 or more ascending, r. next pl. **Amygdaleæ††.** 2 *suspended, r. next pl.*	All. 3. **Polygalaceæ***.** *R. next pl.* §**Moutabeæ.** *Suspended, r. next pl.* **Moringaceæ.** *Suspended, r. next pl.* All. 4. **Krameriaceæ***.** 2 suspended, r. lateral. **Trigoniaceæ** (*** ?) (Stigma elongated anteriorly). Horizontal, r. lateral. **Chailletiaceæ.** 1 *or 2, pendulous, r. next pl.* All. 5. **Papilionaceæ***.** *Suspended, with the foramen above the funiculus.* Very rarely horizontal, with the foramen lateral. **Cæsalpinieæ***.** *When 1 or 2 and suspended, r. next pl.* **Mimoseæ**** or †. *Suspended, with the foramen above the funiculus.* **Chrysobalaneæ***.** 2 *erect, r. dorsal,* or lateral.
APETALOUS.		All. 9. **Platanaceæ.**		All. 6. **Daphnaceæ†††**; very rarely all lateral. *Suspended, r. next pl.* **Penæaceæ.** *Ascending, r. dorsal.* §**Geissolomeæ.** 2 pendulous, r. dorsal. **Elæagnaceæ†.** 1 erect, r. lateral. | **Aquilariaceæ.** 1, *suspended, r. next pl.*	All. 7. **Proteaceæ***.** 2 or more, erect, r. next pl.
Derivation.		Derived from Coniferæ § Abieteæ. (V. Table V.)			

The Natural Orders with 3 asterisks affixed (***), have the single carpel always anterior; 2 indicate that it is for the most part anterior, being otherwise lateral; and 1 only, that it is indifferently anterior or lateral. Those with 3 daggers affixed (†††), have the single carpel always posterior; in those with 2 it is indifferently anterior, lateral, or posterior, or more frequently the latter; and in those with only 1 it is anterior, lateral, or posterior, but less frequently the latter. All the variations referred to are to be understood as occurring in the same species,—on the same specimen.

The Numbers refer to the Ovules, whether 1 or more in each cell; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous with the raphe next the placenta is printed in italics, and also (as being equivalent characters) the ascending and erect ovules with the raphe dorsal, and the suspended campylotropal ovule with the foramen above or external to the funiculus.

TABLE VII.

THE FOREGOING DIVISIONS OF THE EXOGENS SO PLACED, AS TO SHOW THEIR LATERAL RELATIONS TO EACH OTHER IN THEIR MONOPETALOUS, POLYPETALOUS, APETALOUS AND GYMNOSPERMOUS FORMS.

MONOPETALOUS.

PLATANO-PROTEAL.

Geranial.
All. 1.
Convolvulaceæ.
Cuscutaceæ.
Nolanaceæ.

Platanal.
All. 1.
Loganiaceæ. | Solanaceæ.
All. 2.
Pedaliaceæ.
Crescentiaceæ.

Gesneraceæ.
Orobanchaceæ.
Bignoniaceæ.

Proteal.
All. 1.
Acanthaceæ.
Utriculariaceæ.
Scrophulariaceæ.

CHLORANTHAL.

Scleranthal.
All. 1.
Myrsinaceæ.
Primulaceæ.

Chloranthal.
All. 2.
Globulariaceæ.
Plantagineæ.

All. 3.
Cordiaceæ.
Ehretiaceæ.
Boragineæ.

All. 4.
Labiatæ.
Verbenaceæ.
Myoporaceæ.
Selagineæ.

CERATOPHYLLINAL.

Ceratophyllinal.
All. 1.
Gentianaceæ.

CASUARINAL.

Urtical.
All. 1.
Apocynaceæ.

Casuarinal.
All. 1.
Asclepiadeæ.

Scleranthal.
All. 1.
Plumbagineæ.

Chloranthal.
All. 1.
Stilbaceæ.

All. 3.
Hydrophyllaceæ.
Polemoniaceæ.

CERATOPHYLLINAL.

Ceratophyllinal.
All. 2.
Monotropaceæ.
Pyrolaceæ.

Erical.
All. 1.
Vacciniaceæ.
Epacrideæ.
Ericaceæ.

Ternstrœmial.
All. 1.
Sapotaceæ. | Ebenaceæ.

BALANOPHORAL.

BALANOPHORAL.

Loranthal.
All. 1.
Cinchonaceæ. | Caprifoliaceæ.
Rubiaceæ.

Balanophoral.
All. 1.
Valerianaceæ.
Dipsaceæ.
Calyceraceæ.

Myrtal.
All. 1.
Cichoraceæ.
Compositæ.
Brunoniaceæ.

All. 2.
Campanulaceæ.
Lobeliaceæ.
Goodeniaceæ.
Stylidiaceæ.

Aristolochial.
All. 1.
Columelliaceæ.

POLYPETALOUS.

PLATANO-PROTEAL.

Geranial.
All. 2.
Malvaceæ.
Byttneriaceæ.
Sterculiaceæ.
Tiliaceæ.

All. 3.
Geraniaceæ.
§Limnantheæ.
§Balsamineæ.
§Vivianeæ.
§Tropæoleæ.
Oxalideæ.

Platanal.
All. 3.
Aquifoliaceæ.
Phytocreneæ.

All. 4.
Celastraceæ.
§Hippocrateæ.
Rhamnaceæ.
Vitaceæ.

All. 5.
Jasminaceæ. | Oleaceæ.
Salvadoraceæ.

All. 6.
Anacardiaceæ.
Icacinaceæ.

All. 7.
Meliaceæ.
§Cedreleæ.
Amyrideæ.
Rutaceæ.
§Aurantieæ.
§Xanthoxyleæ.
Simarubaceæ.
Zygophyllaceæ.
Connaraceæ.

Malpighiaceæ.
Coriarieæ.

All. 8.
Sapindaceæ.
§Stackhousieæ.

All. 9.
Sabiaceæ.
Aceraceæ.

Proteal.
All. 2.
Rosaceæ. | Pomaceæ.
Sanguisorbaceæ. | Amygdaleæ.

All. 3.
Polygalaceæ.
Moringaceæ.

All. 4.
Krameriaceæ.
Trigoniaceæ.
Chailletiaceæ.

All. 5.
Papilionaceæ.
Cæsalpiniæ.
Mimoseæ.
Chrysobalaneæ.

CHLORANTHAL.

Scleranthal.
All. 3.
Ficoideæ.
Tetragoniaceæ.

All. 4.
Portulaceæ.
Caryophyllaceæ.
Frankeniaceæ.

Chloranthal.
All. 6.
Crassulaceæ. | Callitrichaceæ.
Elatinaceæ.

All. 7.
Batideæ.

CERATOPHYLLINAL.

Papaveral.
All. 1.
Resedaceæ.
Cruciferæ.
Capparideæ.

All. 2.
Papaveraceæ.
§Fumariæ.

Ceratophyllinal.
All. 3.
Nymphæaceæ.
Hydropeltideæ.
Nelumbiaceæ.

All. 4.
Ranunculaceæ.
§Cephaloteæ.
Sarraceniaceæ.
Nepenthaceæ.

CASUARINAL.

Urtical.
All. 2.
Euphorbiaceæ.
§Putranjiveæ.
§Gyrostemoneæ.
§Buxeæ.
Empetraceæ.

All. 3.
Flacourtiaceæ.
§Pangieæ.
Papayaceæ.

Casuarinal.
All. 2.
Cistaceæ.
Samydaceæ.

All. 3.
Lacistemaceæ.
Stilagineæ.

All. 4.
Violaceæ.
Passifloraceæ.
Turneraceæ.
Malesherbiaceæ.

Scleranthal.
All. 2.
Illecebraceæ.

Chloranthal.
All. 5.
Reaumuriaceæ.
Tamaricaceæ.

CERATOPHYLLINAL.

Laurinal.
All. 1.
Combretaceæ.
Illigeraceæ.

All. 2.
Lauraceæ.
§Cassytheæ.

All. 3.
Dilleniaceæ.
Magnoliaceæ.
§Schizandreæ.
Calycanthaceæ.
Anonaceæ.
§Myristiceæ.
Monimiaceæ.
§Atherospermeæ.

All. 4.
Berberideæ.
§Lardizabaleæ.
Menispermaceæ.

Ceratophyllinal.
All. 5.
Droseraceæ.
Frankeniaceæ.

Erical.
All. 2.
Cyrillaceæ.
Pittosporaceæ.
Tremandraceæ.

Ternstrœmial.
All. 2.
Clusiaceæ.
Canellaceæ.
Hypericaceæ.
Brexiaceæ.
§Parnassieæ.

All. 3.
Ochnaceæ.
§Sauvagesieæ.

All. 4.
Ternstrœmiaceæ.
§Marcgravieæ.
§Rhizobolеæ.
Linaceæ.

All. 5.
Dipterocarpeæ.
Chlænaceæ.

BALANOPHORAL.

Aristolochial.
All. 4.
Homaliaceæ.
Loasaceæ.
Cactaceæ.

BALANOPHORAL.

Santalinal.
All. 1.
Styraceæ. | Symplocaceæ.

All. 2.
Olacaceæ.

All. 3.
Diclidantheræ.
Humiriaceæ.

All. 4.
Bruniaceæ.

Loranthal.
All. 2.
Cornaceæ.
§Alangieæ.

All. 3.
Umbelliferæ.
Araliaceæ.
Gunneraceæ.

All. 4.
Saxifragaceæ.
§Escallonieæ.

All. 5.
Hamamelideæ.
Rhizophoraceæ.
§Cassipoureæ.
Cunoniaceæ.
Hydrangeaceæ.
§Philadelpheæ.

Balanophoral.
All. 2.
Haloragaceæ.

Myrtal.
All. 3.
Chamælauciaceæ.
Melastomaceæ.
Lythraceæ.
§Granateæ.
Vochysiaceæ.

Myrtaceæ.
§Lecythideæ.
§Belvisieæ.
§Barringtonieæ.

Onagraceæ.

Aristolochial.
All. 2.
Rafflesiaceæ.

All. 3.
Cucurbitaceæ.
Begoniaceæ.
Datiscaceæ.

APETALOUS AND GYMNOSPERMOUS.

PLATANO-PROTEAL.

Platanal.

Proteal.
All. 6.
Daphnaceæ. | Aquilariaceæ.
Penæaceæ.
Elæagnaceæ.

All. 7.
Proteaceæ.

All. 10.
Platanaceæ.

CHLORANTHAL.

Scleranthal.
All. 6.
Scleranthaceæ.

Chloranthal.
All. 8.
Podostemoneæ.

All. 9.
Phytolaccaceæ.
Petiveriaceæ.

CERATOPHYLLINAL.

Ceratophyllinal.
All. 6.
Ceratophyllaceæ.

CASUARINAL.

Urtical.
All. 4.
Cannabineæ.
Urticaceæ.
Ulmaceæ.

All. 5.
Artocarpeæ.
Moreæ.

Casuarinal.
Alls. 5 & 6.
Gymnospermous.
Coniferæ.
Cycadeæ.

Juglandeæ.
Salicaceæ.
Cupuliferæ.
Myricaceæ.

Scepaceæ.
Betulaceæ.
Casuarineæ.

Scleranthal.
All. 5.
Nyctagineæ.
Amaranthaceæ.
Chenopodiaceæ.
Basellaceæ.

Chloranthal.
Alls. 9, 10 & 11.
Piperaceæ.
Saururaceæ.

Polygonaceæ.
Chloranthaceæ.
Gymnospermous.
Gnetaceæ.

CERATOPHYLLINAL.

BALANOPHORAL.

BALANOPHORAL.

Santalinal.
All. 5.
Santalaceæ.

Loranthal.
All. 6.
Garryaceæ.

All. 7
Loranthaceæ.

All. 8.
Helwingiaceæ.

Balanophoral.
All. 3.
Balanophoraceæ.

Aristolochial.
All. 5.
Hydnoreæ.

Cytinaceæ.
Aristolochiaceæ.

APPENDIX.

Page 15.

Garryaceæ.

Fadgenia laurifolia has the ovary and ovules of a *Cornus* supposing the dissepiment in the latter to be removed;—in all the flowers examined the dissepiment if present would pass between the ovules, as the stigmas are always opposite them;—the thick, twisted raphe and funiculus, like that of *C. sanguinea,* may be seen turning up in opposite directions in the two ovules, and the canal in the style in most instances opens over the outside of each ovule. The difference in the wood, more perhaps than any other character, requires this family to be placed in the Apetalous Division, because in the absence of the dissepiment they may be well compared with *Vahlia* among *Saxifragaceæ.*

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Orobanchaceæ.

The two carpels in *Lathræa squamaria* are anterior and posterior, which is clearly proved by the placentæ being right and left of the axis, and the stigmas anterior and posterior in the expanded flower, and also in the unopened flower when so young that scarcely any style is formed;—in the expanded flower the anterior lobe is larger as in some genera of *Acanthaceæ.* Each placenta however separates partially into two as it ascends, so far at least as to become naked and less prominent in the middle. As *Orobanche* is so near *Lathræa,* differing more in the stigmas being right and left than in any other character, it follows that the placentation in that genus is not dorsal because it is the same as that of *Lathræa,* the separation in each placenta being rather wider but yet not extending half-way from the margin towards the mid-rib of the carpel. In all other instances of dorsal placentation I have examined there is no placenta formed, the ovules arising from the substance of the carpel, but in *Orobanche* as in *Lathræa* two very thick placentæ are present, but they divide as they ascend into four, the halves thus separated however closely approximating again at the apex of the ovary. This being the case, the apparent dorsal placentation of *Orobanchaceæ* may be entirely owing to a displacement of the placentæ as in *Mesembryanthemum,* which is the more probable as it occurs only in a part of the genera. The stigmas being right and left in *Orobanche* is accounted for by the early condition of the flower in *O. major* and *elatior,* and especially the latter, which might be described as having the stigmas anterior and posterior as in *Lathræa,* but by the time the flower has expanded two lateral lobes have grown and obliterated this appearance, but the tranverse fissure remains in the same direction in both genera. In *Acanthus spinosa* the two carpels are anterior and posterior, but the stigmas right and left, which would perhaps be sufficient to account for this deviation in *Orobanche.*

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Acanthaceæ.

The radicle in *Thunbergieæ* is described as inferior, but this seems impossible as the foramen in *Thunbergia* has distinctly the appearance of being superior, and the inferior portion of the secundine is broadly oval or almost flat; and Prof. Agardh, who I have always found correct as to the position of the foramen as far as regards its being superior or inferior, states that it is superior (Theor. Syst. Plant., p. 189), which is also seen in his figure of *T. alata,* Pl. XVII., fig. 2. The probability appears to be that the ovule curves more or less as it advances in growth, so that the radicle is directed to the hilum, and is therefore horizontal as in *Spielmannia.* v. Table III. *Spielmannia* has also been described as having an inferior radicle although the seed is pendulous, being attached close to the apex of the cell, but the radicle is directed away from the hilum laterally, the embryo lying horizontally across the seed.

EXPLANATION OF THE FIGURES.

Fig. 1. The embryo of *Tacca involucrata* attached by a funiculus to the albumen.

Fig. 2. A longitudinal section of the ovary of *Hernandia sonora*, showing that the tube of the calyx is completely adherent to it;—the involucre is seen surrounding the lower part of the ovary. A small canal which is sometimes pervious, is seen extending from the base of the style to the cavity of the ovary.

Fig. 3. The ovule of the same, showing the apex of the secundine protruding through the foramen of the primine.

Fig 4. A stamen of a *Hernandia* before the dehiscence of the anther. The anther valves are quite smooth; the connective is distinguished from them by being hairy in its lower part, and impunctate with points like very short hairs towards the apex.

Fig. 5. A stamen of *Hernandia sonora* after the dehiscence of the anther.

Fig. 6. A hermaphrodite flower of *Callitriche verna* magnified;—the figure shows also the venation of the leaves.

Fig. 7. The same more magnified, the bracts having been removed to show the point of insertion of the stamen.

Fig. 8. Flattened glands on the stem of *Callitriche pedunculata.*

Fig. 9. A longitudinal section of the anther of *Callitriche pedunculata.*

Fig. 10. The ovule of *Callitriche verna* at an early period, at or very near the time of flowering, showing that the raphe is scarcely half the length of the ovule;—a, its point of attachment to the placenta: b, the foramen. The apex of the nucleus is visible through the semi-transparent primine.

Figs. 11. & 12. The same more advanced;—a and b, as before. The tissues being semi-transparent, the nucleus is seen incompletely filling the external tunic.

Fig. 13. The mature seed showing that the raphe has scarcely increased in length, and that the undistended portion of the external tunic remains as a minute wing above the hilum; a and b as before.

Fig. 14. A longitudinal section of the seed, showing the relative proportion of the embryo to the albumen and the length of the cotyledons, as compared with that of the radicle. The radicle is seen distant from the hilum by one fourth of the longitudinal circumference of the seed.

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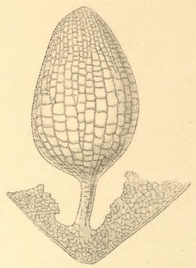

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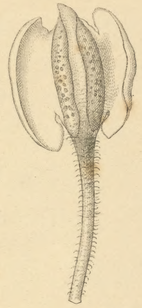

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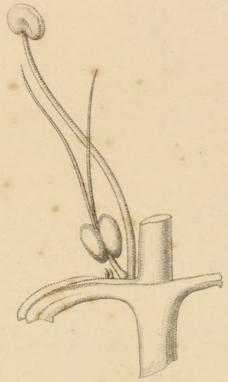

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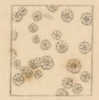

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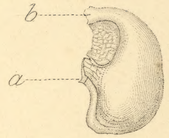

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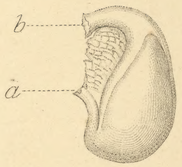

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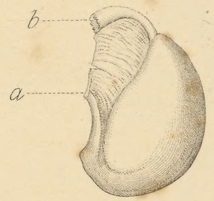
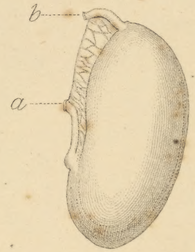
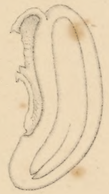


13



14



B. Clarke del.

G. Jarman sc.