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### XVII.—Observations on relative position; including a new arrangement of phanerogamous plants

B. Clarke F.L.S.

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*1-flori, aut simpliciter pauciflori, breves, in paniculam foliosam vel subnudam dispositi.*

I have nothing to add to the excellent description and arrangement of the species, as determined by Mr. Bentham\*, in D.C. Prodr. x. 193.

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

[Continued from p. 90.]

PART II.

*On the Position of Carpels.*

As the progress of discovery shows that Jussieu's system in its primary divisions, viz. Monopetalous, Polypetalous, and Apetalous, leaves unassociated plants between which there is the closest resemblance in both structure and habit, and that in numerous instances,—it has become desirable to form primary divisions depending on different characters, but retaining as far as possible those of Jussieu as of subordinate value. How far the present attempt is successful the Tables will show, and the researches connected with the relative position of carpels to the axis will I trust prove of interest, and may also assist in determining questions of affinity which at present remain unsettled.

It being so common for the ovary to consist of two or only one carpel, in either case having a variable relation to the axis, it becomes interesting to trace the cause of this reduction, and more especially the causes of the variations in their position; and of these inquiries, the varying position of the two carpels of dicarpous ovaries affords the most satisfactory explanation. Thus, the cause of the difference of the position of the carpels when reduced to two, is explained by the mode in which the changes of position occur when a tricarpaceous ovary becomes dicarpous.

DIFFERENCES IN THE POSITION OF THE CARPELS WHEN TWO.

1. *When the two carpels are right and left with respect to the axis.* In the genus *Carex* the three carpels are ordinarily two of them right and left and one posterior, and when reduced to two, they are (in the species examined) uniformly right and left; in *Malpighia coccifera* the three carpels have also the same relation to the axis, the posterior one being smaller; and in *Banisteria* of the same family, the carpels when only two are right and left.

\* Analytical details of the aestivation and structure of the five different sections of this genus will be given in plate 63 of the Ill. So. Amer. Plants.

In *Omalthus* among Euphorbiaceæ, the tricarous and dicarous ovaries are to be seen on the same plant, and as tricarous ovaries have generally one carpel posterior, its disappearance sufficiently accounts for such ovaries when reduced to two carpels having them placed laterally. Two carpels right and left sometimes, however, arise from the suppression of two carpels of an ovary consisting of four, of which Caprifoliaceæ and Cruciferæ contain examples.

2. *When the two carpels are anterior and posterior.* In *Houttuynia cordata* the ovary is tricarous, one carpel being posterior and two lateral ; but frequently it becomes dicarous ; in these instances a lateral carpel generally disappears, first leaving the other two anterior and posterior, as afterwards more particularly adverted to.

In *Agrimonia*, although the ovary is apocarous, the three carpels are almost uniformly two of them lateral and one posterior, and in abortion a lateral carpel first becomes rudimentary or ceases to be developed, the remaining two being left (with but very few exceptions) anterior and posterior ; thus corresponding in position with *Spiræa* when dicarous.

In *Reseda luteola*, which frequently has dicarous ovaries, the two carpels are anterior and posterior, or less frequently oblique from the absence of a lateral carpel, as the three carpels of *Reseda* have the same relation to the axis as in *Houttuynia* and *Agrimonia*.

These and other analogous examples make it evident that an ovary consisting of two carpels anterior and posterior generally results from a tricarous ovary, one of the lateral carpels of which is not developed, the other lateral carpel having become in consequence anterior, having been removed from its position to be opposite the posterior carpel. Another instance as occurring in *Heracleum* is mentioned by Mr. Ralph (vide Proceedings of Linn. Soc. vol. i. p. 284).

3. *When the two carpels have an oblique relation to the axis.* Although perhaps in no instance are the carpels when two always oblique, yet the oblique position frequently occurs, both in plants in which the carpels are generally anterior and posterior, and in those in which they are as predominantly right and left. This oblique position probably arises from the lateral carpel of a tricarous ovary not becoming anterior when the other lateral carpel has disappeared, but remaining nearly in its original position, in consequence of which the posterior carpel is somewhat displaced, becoming obliquely posterior ; and thus anterior and posterior and oblique may be regarded as one and the same character, and as a general rule this may prove available, but two lateral carpels do undoubtedly sometimes become oblique.

#### DIFFERENCES IN THE POSITION OF THE SINGLE CARPEL.

Ovaries in which the carpel is single are for the most part the result of the abortion or non-development of one of the carpels of a dicarpous ovary; and the position of the carpel depends consequently upon whether it is an anterior, or a posterior, or one of two lateral carpels which is absent.

1. *When the single carpel is anterior.* When the ovary in Myrtaceæ, Bruniaceæ, Onagraceæ, Polygalaceæ and Acanthaceæ is one-celled, it is the posterior cell which has disappeared, and to these may be added Tetragoniaceæ and Ulmaceæ among apetalous plants\*.

2. *When posterior.* A single carpel posterior may be explained in an analogous manner. In *Houttuynia* for example, the carpels when reduced to two are for the most part anterior and posterior, and in the instances of single carpels they are all directly posterior. This offers an explanation for the unusual position of the carpel in Piperaceæ, where when single it is constantly posterior.

3. *When lateral or oblique.* The position of the single carpel on one side of the flower, either directly lateral or more or less oblique, is frequently owing to the same circumstance, as in *Elatostemma* and *Morus*, where the carpels are frequently lateral. The stigmas here being two, one of them is continuous with the dorsal rib of the fertile carpel, and the other corresponds with the placenta, being a part of the rudimentary carpel.

From the causes particularly noticed as occasioning the differences of the position of the two carpels in dicarpous ovaries, it necessarily follows that in such cases a single carpel anterior and a single carpel lateral would be the same carpel in different positions†; and consistently with this inference, those Orders which have the carpel always lateral are also very nearly allied to those in which it is always anterior, with the exception of Nyctagineæ (and some others in which the carpel is lateral only in part) as afterwards explained. Such Orders are therefore placed in the Proterocarpous Division.

#### POSITION OF THE CARPELS WHEN THREE.

From the foregoing and other analogous examples it seems to follow as a theoretical inference, that the regular number of carpels in all ovaries where they are definite is three, or a multiple

\* The term anterior is used as synonymous with inferior, and posterior with superior.

† Those cases must be excepted where two carpels right and left occur in an ovary in which the third carpel is anterior, as in *Menispermum laurifolium* and *Maranta dichotoma*.

of that number, the additional series being frequently reduced by abortion or non-development in the same manner as the first, thus giving rise to the formation of ovaries with five or four carpels. And as tricarpeous ovaries in Exogens have generally two carpels lateral and one posterior, it might be supposed that ovaries having a greater or a less number of carpels would, if they became tricarpeous, have the three carpels so placed. There are, however, exceptions to this rule, of which *Viola*, *Fagus* and *Menispermum* are instances, where the carpels are two of them lateral and one anterior; and in other instances the three carpels vary in their position in the same plant, as in *Clethra*, *Pittosporum* and *Delphinium*. In Endogens the position of the three carpels is perhaps less regular, as *Dioscorea*, *Maranta*, *Phoenix*, and others have them placed as in *Viola* or irregularly, the irregularity being apparently the consequence of the ovary being turned on its axis so that a lateral carpel becomes anterior.

#### VALUE OF THE CHARACTERS.

From the Tables as they now stand, the following inferences are deducible\* :—

1. That the position of carpels when two, right and left of the axis, is common to all subdivisions, but predominates in the Heterocarpeous Division, where the position of the single carpel is for the most part different from flower to flower, and generally variable to the greatest degree.

2. That species with carpels anterior and posterior also occur in all subdivisions, but that this arrangement obtains more generally in the division designated as Proterocarpeous, from the single carpel being usually anterior, and from the ovaries when dicarpeous not unfrequently exhibiting a tendency to suppression of the posterior cell.

3. But that in plants with irregular flowers or didynamous stamens, the position of the carpels when two is constant, and with very few exceptions anterior and posterior.

4. That a certain portion of the class Exogens never has the single carpel posterior.

5. That a single carpel lateral may possibly occur in all subdivisions, but that this character does not, among Heterocarpeous plants, extend through an entire family, unless Nyctagineæ should prove to be an exception.

As however the position of the single carpel in many families remains to be ascertained, some changes will doubtless have to

\* Since the formation of the Tables, it has been found that part of the details are obliged to be omitted in the printing, but those most deserving notice are contained in Part III.

be made, and transition-classes, not strictly referable to either of the two primary divisions, must be expected, such as Berberideæ, Moreæ, and Mimoseæ. The latter remark however applies principally to the Proterocarpous Division, as in the Heterocarpous Division the position of the single carpel is in all probability variable and nearly in the same degree throughout the Orders: thus its position in the Orders of the Anonal Alliance must be expected to be variable, as in *Tasmannia*, in those of the Clusial and Anacardial Alliances, as in Anacardiaceæ, &c. And the remaining inquiry therefore appears to be more especially as to whether the Orders included in the Proterocarpous Division have the single carpel always anterior or lateral, or with so few exceptions as that they might be associated with them.

It is worthy of remark, that although the position of the carpels when two may be variable to the greatest degree in a single genus, as in *Ribes*, yet, on the other hand, it does not separate genera, which Jussieu's and other systems would, if strictly adhered to; thus, the position of the two carpels is the same in monopetalous, polypetalous and apetalous Oleaceæ, as also in the perigynous *Eschscholtzia* and hypogynous *Glaucium*.

But the position of the carpel when single does not appear liable to such exceptions, and may assist in determining affinities which at present remain much obscured; thus, its position in *Ceratophyllum* corresponds with that of the Piperal Alliance, and differs, as far as is at present known, from that of any other Orders with which it could be associated, unless it is compared with *Nelumbium*.

It constitutes a differential character between families otherwise scarcely distinct, as does also in some cases the position of the fertile cell of compound ovaries; thus, *Viburnum* differs from *Centranthus*, *Valeriana*, *Valerianella* and *Fedia*, whether the axis or (in the latter genera) the irregularity of the corolla is regarded, or the position of the stamens in *Fedia* (see also Part III. and the accompanying figures).

#### TWO-CELLED OVARIES WITH UNEQUAL CELLS.

When the two cells of an ovary are equal in size, each containing an ovule, and the fruit becomes one-seeded, the position of the fertile cell cannot be relied on as an indication of the position the single carpel would occupy. Thus, in *Galenia africana* the ovary consists of a single carpel anterior, but in a two-celled one-seeded species (the carpels being anterior and posterior) either cell indifferently is fertile; and this deserves more attention, because in the nearly allied genus *Trianthema*, a one-celled species (*T. micrantha*) occurs having the carpel anterior or less

frequently lateral. The position of the fertile cell therefore (in such cases) is subsequently noticed only to show how far the inquiry has extended.

But there is a circumstance occurring not unfrequently in compound ovaries, by which the position the single carpel would occupy may be with confidence assumed, viz. the diminished size of one of the carpels. Thus, in *Circæa alpina*, when the ovary is two-celled the posterior cell is both shorter and less in its diameter, and when one-celled the cell is always anterior, and analogous examples occur in *Stylidium* and *Dampiera*. In *Valerianaceæ* the barren cells are sometimes so reduced as to be scarcely apparent, but occasionally they are larger than the fertile; and although this is an exception as to the size of the carpel, yet like the smaller cells they are destitute of ovules.

One of the stigmas of a dicarpous ovary being larger than the other is a character which is likely to prove of the same value, as in *Labiata* and *Verbenaceæ* the anterior portion of the stigma is sometimes enlarged, and in *Lantana* and *Lippia* the two-celled ovary is formed by a single carpel anterior. In *Acanthaceæ*, also, stigmas occur with the anterior lobe elongated, and in the one-seeded *Mendozia* it is the anterior carpel which is fertile\*.

To the inequality of the stigmas there are however exceptions (which may be compared to the barren cells of *Valerianella* having become inflated, or to sterile stamens having become petaloid), as in *Lentibulariæ* the posterior portion of the stigma is constantly larger, and also in *Polygala speciosa*. But as it is always the posterior lobe which becomes enlarged, while in *Polygalaceæ* it is the posterior cell which is suppressed in one-celled ovaries, these two exceptions are unimportant; and the larger lobe of the stigma being variable in its position should alone perhaps be taken as an evidence of variation in the position of the single carpel. *Schweiggeria* also supplies another instance (though less marked), in which the two larger stigmas are lateral or obliquely posterior, while the larger-ribbed carpel of the tricarpous ovary is anterior.

#### FREE CENTRAL PLACENTÆ.

It would not perhaps be expected, that in compound ovaries having a free central placenta, the position of the ovule when solitary would supply any evidence from which the position the

\* In *M. puberula* the fertile carpel is always anterior, and from the similarity of the species there seems no reason to doubt but that it is so in all. The two-celled fruit described by Martius as having its cells placed one above the other, is produced by an extension of the placenta across the anterior cell, as the remains of the posterior cell are behind the upper fertile cell.



single carpel would occupy might be inferred; yet from the constancy of its position in certain families, this may be considered as no longer a question, as in *Chenopodiaceæ*, *Amaranthaceæ*\* and *Plumbaginæ* the ovule is with rare exceptions posterior or lateral; but in *Scleranthus annuus* and *Calytrix virgata* always anterior, in the latter instance two ovules being present. *Scleranthus* therefore agrees with *Tetragoniaceæ*, and *Calytrix* with *Myrtaceæ*, &c.; and its variable position in *Thesium* tends rather to confirm the evidence, as showing a correspondence with *Aucuba*, &c. in the variable position of the fertile carpel.

#### THE POSITION OF THE RAPHE.

From the remarkable regularity of the position of the raphe, both in erect and pendulous anatropal ovules, and also of the cotyledons and radicle in seeds produced from campylotropal ovules, these characters may, there appears no reason to doubt, be relied on as furnishing indications of the position of the carpel; and also (the ovule being erect) of the fertile carpel, when two or more being equally developed are united by their margins and form a one-celled ovary. Thus, in *Illecebrum* and *Atriplex*, where the ovary is dicarpous, the radicle of the embryo curves down posteriorly, showing, in the latter instance at least, that the placentation is anterior to the seed, as is the funiculus in *Beta* and *Rhagodia*; while in *Opercularia* the position of the raphe is variable, showing the position of the fertile carpel to be variable, as in *Cornaceæ* and *Caprifoliaceæ*, and more frequently posterior than in the latter†.

#### GENERAL CHARACTERS OF THE DIVISIONS.

The division thus separated as Proterocarpous is natural, in having no direct affinity either with Endogens or Rhizanth, with both of which the second or Heterocarpous Division is so inti-

\* *Gomphrena globosa*, in which the funiculus is lateral, is further remarkable for having the ovule almost always on its right side: may this be owing to the direction of the spires of bracts? In *Cliffortia ilicifolia*, where the carpels are all lateral, more than two-thirds of them have their bracts toward the ascending portion of the spire, whether the spire is from right to left, or from left to right; but so slight a variation is perhaps scarcely deserving attention, and such instances should rather be referred to their nearest affinities.

† The relation of the raphe to the placenta in any given family must be ascertained before such an inference can be made, except it is in those cases where the position of the raphe (in relation to the axis of the inflorescence) is variable, as then the position of the fertile carpel must be variable, of which *Brunonia* is an example; and the same rule applies to the position of campylotropal ovules.

mately connected, and hence it may be regarded as the more highly developed ; and the three subdivisions, Phytolaccal, Petiverial, and Proteal, being alone Proterocarpous in their apetalous form (excluding the Urtical), may especially on that account be so regarded ; and of these again the Proteal is the first, in the flowers being irregular and the carpel more constantly anterior. This subdivision, it will be seen, contains in its polypetalous form Leguminosæ, which Endlicher on other grounds came to the conclusion were the most complicated or highest developed form of Exogens.

It differs from the Heterocarpous Division also in the frequent occurrence of irregularity of the corolla, which is comparatively rare in that division and confined to sections of the Orders. It is also very rarely apocarpous, less frequently polycarpous (and then seldom with more than one whorl of carpels), and more frequently exalbuminous.

And lastly, there is some difference in the medical properties, the Proterocarpous Division being remarkable for the absence of febrifuge alkaloids, the bitter tonics also being less stimulant ; while, on the other hand, narcotics strictly so called are almost exclusively to be found here.

#### THE SUBDIVISIONS.

The principal object in arranging the Alliances in Subdivisions is to endeavour to show the mutual relation borne to each other by the monopetalous, polypetalous, and apetalous divisions of Exogens, an affinity so close, that most of the subdivisions form natural assemblages\*. In the formation of these and of the Alliances, I am much indebted to Dr. Lindley's valuable work the 'Vegetable Kingdom.'

#### RHIZANTHS.

From the affinities of Rhizanth's it might be expected that the position of the carpels would correspond with that of the Aral

\* The following remarks of Schleiden on the development of the corolla and other parts of the flower also show the monopetalous corolla to be a character of minor value :—"All foliar organs of the flower, though they may subsequently unite in growth, first arise entirely free parts ; and if they belong to one circle, they are at their earliest rudiments, and for some longer or shorter time after, exactly like each other ; so that the coherence of these several members and their symmetrical development is a later process. I have been able readily to trace the most irregular flowers up to the condition of bud in reference to this ; as, for instance, the flowers of the Leguminosæ, of the Labiata, the Scrophulariaceæ, and the species of *Aconitum*, and these fully established the laws laid down here." (Dr. Lankester's Translation of Schleiden's Principles of Scientific Botany, p. 330.)

and Piperal Alliances, especially in such *Balanophoreæ* as have but one carpel, in which the inflorescence resembles that of *Araceæ*. This opinion perhaps may derive some support from the figures of the species of *Balanophora* by Mr. Griffith in 'Trans. Linn. Soc.' vol. xx., where the carpels are apparently irregular in their position; and should this prove to be the fact, it will be an additional reason for regarding *Rhizanth*s as the common basis of *Endogens* and a part of *Exogens*, which seems to be indicated by his proposed distribution of them.

#### ENDOGENS.

That all the great sections of *Exogens* in their higher developed forms may become *Proterocarpous* is evident from the Tables (vide Table II. Derivations), and hence it might almost be anticipated that *Endogens* would also; but as it is very rare in those sections of *Exogens* which approach *Endogens*, so it may be very rare in *Endogens* themselves, and hitherto I have only observed it in *Pontedera*. It seems however not unlikely to occur in the greater part of *Orchidææ*, but as in the lower forms of *Endogens* the position of the carpels when two is variable, the exceptions may be confined to petaloid forms with irregular flowers, such as *Pontederaceæ*.

#### GYMNOSPERMS.

In *Pinus* the flattened expanded ovary is always anterior, as is also the succulent carpel of *Podocarpus*; and as far as the other genera of this section of *Phanerogams* show any traces of a carpel, or an envelope which possibly may be a rudimentary carpel, it is always anterior, as the external tunic of *Saxe-Gothæa* and *Gnetum*.

#### DIDYNAMOUS STAMENS.

From the fact that as far as the didynamous monopetalous families show any tendency to suppression in the carpels of their dicarpous ovaries, it is for the most part or always in the posterior one, it might be supposed that the stamens and carpels follow the same order in this character, as it is the posterior stamen which is deficient, and thus the cause of didynamous stamens might be explained. And possibly this may be Mr. Ralph's reason for considering the anterior as the odd carpel in *Scrophulariaceæ* (vide Proceedings of Linn. Soc. vol. i. p. 284). But this correspondence in position between the fertile carpel and stamens is perhaps confined to the *Proterocarpous* Division, as in repeated instances in which the stamens of *Pimelea decussata* were reduced to one, it proved to be always on the opposite side of the flower to the carpel, the stamen being anterior and the

carpel posterior, and *Lachnæa* shows the same tendency in the anterior stamens being longer. In *Stilbe* also the posterior stamen is rudimentary or absent, yet the larger cell of the ovary which becomes the fertile is for the most part posterior, the anterior cell in *S. ericoides* being frequently obliterated. And *Pleurophora* has the same structure when the posterior stamens are deficient. Possibly the truth may be, that when the single carpel is anterior or lateral, the fertile stamens are also anterior, rarely lateral ; but that when the position of the carpel is variable there is no longer any constant relation between them, although the posterior stamens continue to be far more frequently suppressed.

Characters therefore derived from the position of fertile stamens are of less value than those derived from the position of the single carpel, and the same remark may apply to the relative position of floral envelopes, it being a question if Mimoseæ always agree with Leguminosæ in this character. The number five however in Exogens may prove to be the consequence of the non-development of a sepal or petal, as in the instance of the calyx of a *Phyllanthus* consisting of six sepals becoming occasionally reduced to five by the suppression of one of the external three, and this would also account for the alternation of petals and stamens in Exogens ; thus, supposing six stamens to be opposite six petals, and the anterior petal and the posterior stamen to be removed, an ordinary pentamerous flower with the stamens alternate to the petals would be produced.

#### THE AXIS.

In ascertaining the position of carpels, an uncertainty sometimes arises as to their position in consequence of a doubt existing as to which is the axis, there being two or more branches, either of which might be regarded as the axis to a flower growing in connection with them ; but an attentive examination of the mode of growth and of the position of the bracts, in specimens more than usually developed, generally obviates this difficulty ; it is necessary however to observe, that in the construction of the Tables, whenever any irregularity exists in the flower, that irregularity is taken as a guide, as for example in *Grevillea* ; and some allusions to modes of growth are subsequently added in connection with the structure of ovaries.

#### CONCLUSION.

By arranging the Natural Orders in two divisions, it is not intended so much to draw any exactly definite line by which to separate them, as to show that there exists in Exogens two facies

TABLE III.—SHOWING THE LATERAL RELATIONS OF THE DIVISIONS OF EXOGENS

MONOPETALOUS.	PROTEROCARPOUS.	§ 2 Race of the Gymnosperms	ALL 1 Loganiacæ. Asclepiadææ. Apocynacææ													
		§ 1 Derived from the Heterocarpoous Division	Papaveral.  ALL 1 Solanacææ.	Phytolaccal.  ALL 1 Cuscutacææ Convolvulacææ. Polemoniæacææ.	Petwerial.  ALL 1 Pedaliacææ. Gesneracææ. Bignoniæacææ.	Proteal.  ALL 2 Jasminacææ. Verbenacææ. Labiatææ.	Sapotal.  ALL 1 Sapotacææ.	Crassuloidal  ALL 1 Hydrophyllacææ Ehretiæacææ. Nolanacææ. Cordiæacææ. Boraginæææ.	ALL 2 Selaginææ. Callitrichacææ	Tetragomal  ALL 1 Valerianacææ. Dipsacææ Globulariæacææ Calyceracææ.	Onagrariæ  ALL 1. Campanulacææ Lobeliæacææ. Stylidiæacææ Goodeniæacææ	Myrtal.  ALL 1. Cichoracææ Compositææ				
		§ 2 Derived from the Lauro-Eleagnal Subdivision	Polygonal  ALL 1 Diapensiæacææ Myoporacææ. Stilbæacææ. Empetræacææ ? Batidææ.										ALL 2 Salvadoracææ Myrsinæacææ. Primulæacææ. Plumbaginæææ. Brunoniæacææ. Plantaginæææ			
		§ 1 Continued from Polypetalous forms	Piperal.  ALL 1. Orobanchæacææ. Gentianæacææ.	Lauro-Eleagnal.  ALL 1 Ebenæacææ				Aquifoliæacææ. Styracææ. Oleacææ	Daphnal.  ALL 1 Monotropæacææ. Pyrolacææ			Vacciniæacææ Epacridææ Ericæææ	Garryal  ALL 1 Stellatææ. Cinchoracææ Caprifoliæacææ			
		§ 2 Race of the Gymnosperms	ALL 2. Paypayacææ. Pangiæacææ.		ALL 3 Euphorbiæacææ Scepacææ		ALL 4. Cistacææ Samydæacææ. Flacourtiæacææ. Passifloracææ. Malesherbiæacææ Sauvagesiæacææ. Turneræacææ. Violæacææ		ALL 5 Lacistemæacææ. Stilaginææ Juglandæææ.		ALL 6 Chaillotiæacææ. Dipterocarpeææ		ALL 7 Homalacææ Loasacææ. Cucurbitæacææ			
	HETEROCARPOUS.	§ 1 Derived from the Heterocarpoous Division	Papaveral.  ALL 2 Papaveracææ. Fumariæacææ. Berberidææ. Vitæacææ.	Phytolaccal  ALL 2 Sterculiæacææ. Malvacææ Byttneriæacææ. Surianææ. Tiliæacææ.	Petwerial  ALL 2 Cruciferææ. Capparidæææ. ALL 3. Vivianæacææ Geraniæacææ Oxalidææ. Linacææ. Chlænæacææ. Zygophyllacææ. Balsaminæacææ. Resedæacææ. Tropæolacæææ Lumnanthæææ.	ALL 4 Cedrelæacææ. Meliæacææ Amyridææ Aurantæacææ. Smarubæacææ Rutacææ Xanthoxylæacææ. Connaræacææ	ALL 3 Vochysiæacææ Polygalæacææ. Tremandræacææ.	ALL 4. Moringæacææ. Papilionæacææ. Cæsalpiniæææ. Mimosæææ. Chrysobalanæææ.			Tetragomal.  ALL 2 Cactacææ Mesembryanthemæææ. ALL 3 Tetragoniæacææ Scleranthæacæææ.	Onagrariæ  ALL 2 Onagrariææ. Hippuridæææ.	Myrtal.  ALL 2. Chamælauciæacæææ. Myrtæacææ. Lecythidæææ Melastomæacæææ	Brumal  ALL 1 Umbelliferææ Araliæacææ ALL 2 Brumæacææ Hamamelidæææ		
		§ 2 Derived from the Lauro-Eleagnal Sub-division	Polygonal.  ALL 3 Elatinææ. Lythracææ. Podostemæacæææ.												ALL 4 Crassulæacææ. Reaumuriæacæææ. Tamaricæacæææ Frankeniæacæææ.	ALL 5 Portulacæææ. Caryophyllæacæææ. Ilecebræacæææ. Chenopodiæacæææ. Amaranthæacæææ
		§ 1 Continued from Apetalous forms	Piperal.  ALL 2 Nymphaæacææ. Hydrophelidæææ. Nelumbiæacæææ Ceratophyllæacæææ		ALL 3 Ranunculæacæææ Cephalotææ ? Triuridæææ. Sarracenæacæææ.	ALL 5 Dilemnæacæææ Magnoliæacæææ. Anonæacæææ Schizandræacæææ Lardizabalææææ. Monimiæacæææ. Atherospermeæææ	ALL 2 Ternstroemæacæææ. Hypericæacæææ. Clusiæacæææ Canellæacæææ Brexicæacæææ. Maregraviæacææææ.	ALL 3 Stackhousiæacæææ Hippocrateæacææææ. Celastræacææææ Malpighiæacææææ. Coriariææææ. Anacardiæacææææ. Ochnæacææ?ææ	ALL 4 Staphyleæacæææ. Rhamnæacææææ. ALL 5 Icacinææææ. Olacæacææææ Santalæacææææ Loranthæacææææ.	ALL 2 Francoæacæææ. Droseræacææææ	ALL 3 Humiriæacæææ. Cyrillæacææææ.	ALL 4 Pittosporæacææææ Grossulariæacææææ Escallonæacææææ	ALL 5 Granatæææ Combretæacææææ. Pomæacææææ ALL 6 Calycanthæacææææ Amygdalææææ Rosæacææææ. Saxifragæacææææ.	Garryal.  ALL 2 Cornæacæææ. Alangiæacææææ Begoniæacææææ Datiscæacææææ. Belvisiæacææææ. Rhizophoræacæææææ Barringtoniæacæææææ Columelliæacæææææ Philadelphæacæææææ Hydrangeæacæææææ Cunomæacæææææ		
		§ 2 Race of the Gymnosperms	ALL 8 Artocarpeææ Moreææ		ALL 9 Urticæacæææ Cannabiniææææ.		Ulmæacæææ Celtidææææ. Casuariniæææææ.		ALL 10 Myricæacæææ Cupuliferææææ. Betulæacææææ		ALL 11 Altingiæacææææ. Platanæacæææææ.		ALL 12 Salicæacæææææ			
		§ 1 Derived from the Heterocarpoous Division	Phytolaccal.  ALL 3 Gyrostemonæææ Phytolaccæacææææ.	Petwerial.  ALL 6 Petiveriæacææææ	Proteal.  ALL 5. Proteæacææææ											
	§ 2 Derived from the Lauro-Eleagnal? Subdivision	Polygonal.  ALL 6 Nyctaginææææ   Polygonæacæææææ   Basellæacæææææ														
	HETEROCARPOUS	§ 1 Continued progressively from the Piperal Subdivision	Piperal  ALL 6 Chloranthæacææææ Piperæacææææ Saururæacææææ		ALL 7 Myristicæacææææ. Menispermæacæææææ.		Lauro-Eleagnal.  ALL 6 Lauræacæææææ. Cassythææææææ		Elaegnæacæææææ.		Daphnal  ALL 7 Daphnæacæææææ.		Sangusorbatææ			

of organization, one of them conterminous with or passing into Endogens, and the other the most remote from them, differing from each other more in the position of the carpel when single than in any other character. And as placentæ are prolongations from one common pith, and as ovules are analogous to buds, in connection with which the wood is formed, it becomes a question whether there is not an analogy between the formation of wood externally on the stem, and the development of ovules and carpel on the external or anterior side of the flower, especially in such forms of inflorescence as spikes, racemes, &c. If so, it would be a reason for regarding those Orders in which the single carpel is anterior, as having a more perfectly exogenous character, the first ovules and carpel being constantly formed on the external or anterior side, showing more tendency to exogenous structure than where they are produced irregularly or posteriorly.

Consistently with such an analogy, stems imperfectly exogenous are confined to the Heterocarpous Division; and it may be observed also, that in Endogens the first leaf of an axillary bud is for the most part lateral or posterior, and that the succulent leaf forming the clove of *Allium*, although not the first leaf, is posterior or occasionally lateral, while among Exogens the first leaf is commonly lateral or anterior, of which latter *Xylophylla* and *Phyllanthus* are remarkable instances\*. And finally, this anterior or external development sometimes extends to the floral envelopes, as in *Acanthus spinosa* the calyx and corolla are deficient posteriorly in common with the stamens and (in *Mendozia*) the ovary of *Acanthaceæ*, and a comparison may be made with the modes of growth and branching of the axis.

#### NOTE ON TABLE III.

The main purpose of this Table is to show that the arrangement adopted in Tables I. and II. is not inconsistent with well-established affinities. The Subdivisions therefore stand in the same succession to each other as in Tables I. and II., by which the epigynous Alliances are now brought into relation with each other, and most of the Natural Orders become so placed as to be within the range of their more immediate affinities; and, indeed, by contracting or widening the separated portions of the Subdivisions *ad libitum*, but few of them would remain unassociated with their nearest allies. To this, the Leguminous

\* The leaves of *Xylophylla* are regarded as true leaves, because—1. The woody circle in the petiole is incomplete in its upper part, a character common in petioles, and which has been termed “the horse-shoe mark.” 2. The venation, viz. the branches terminating in the depressions of the serratures, is frequent in *Mercurialis annua*. 3. The scales at the bases of the leaflets occur also in *Schottia*.

Alliance among Polypetalæ, and Phytolaccaceæ, Petiveriaceæ, and Proteaceæ among Apetalæ, are the more remarkable exceptions; but this apparent inconsistency might be obviated by extending the Leguminous Alliance along the vacant space so as nearly to approach Rosaceæ, and by placing Phytolaccaceæ, Petiveriaceæ and Proteaceæ opposite Nyctagineæ and Daphnaceæ; but as this would obscure the design of the Table, it is thought better to leave them so far misplaced.

It should be observed also, that this Table partially differs from Table II. in the distribution of the families of the Proterocarpous section of Monopetalæ, as the true station of Sapotaceæ, from a more recent analysis, appears rather to be between Ebenaceæ and Salvadoraceæ, and nearer the latter; and Convolvulaceæ are placed in the Phytolaccal Subdivision. The Lauro-Elæagnal and Daphnal subdivisions are also folded over the Polygonal, by which separations between some near allies are avoided.

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XVIII.—*Note on the Gryphæa of the Bed called Gryphite Grit in the Cotteswolds.* By JOHN LYCETT, Esq.

THE lower bed of the upper ragstones in the Cotteswold Inferior Oolite exhibits an immense profusion of a well-known Gryphæa, and this circumstance, together with the very limited stratigraphical range of the shell, combines to render it of much importance to the geologist, as it affords a certain guide to that portion of the Inferior Oolite. This Gryphæa has been universally accepted as the *G. cymbium* of Lamarck, but the position of that species upon the continent is known to be the Middle Lias, of which it is considered to be one of the characteristic forms, and a reference to the figures and descriptions of Lamarck's shell proves that it is perfectly distinct from the Cotteswold species. In the first edition of the 'Geology of Cheltenham,' by Sir R. Murchison, the Gryphæa is tabulated *G. cymbium*, and this name was copied into the second edition, in which however, fortunately, an illustration was given of it at pl. 7. fig. 3. Subsequent lists of Inferior Oolite fossils have included *Gryphæa cymbium*. It does not appear that Lamarck's species has been recognised in the lias of England; it possesses a general resemblance to *G. incurva* and *G. obliquata*, except that the larger valve has much less convexity, the beak is much less incurved, and has a small area by which it was attached to other bodies; the upper valve is also much larger; the margins of the valves are regular and not sinuous; the height of the shell always much exceeds the lateral diameter, sometimes in the proportion of 6 inches by 3; it is nearly, and in some instances perhaps alto-