TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

TRANSACTIONS and PROCEEDINGS

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V

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PROCEEDINGS FOR JULY 1857.

APPENDIX.

The Society as a body is not to be considered responsible for any facts or opinions advanced in the several papers, which must rest entirely on the credit of their respective authors.

N.B.—The papers in this volume, from page 1 to 140 inclusive, as well as plates 1–4, have already been published in the "Annals of Natural History."

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

I. *Notice of the discovery of* Desmarestia Dresnayi *on the coast of Ireland.* By R. K. Greville, LL.D. &c.

Read 12th January 1854.

The Alga to which this notice refers was collected towards the close of last year, at Moville, near the mouth of Lough Fyle in the north of Ireland, by William Sawers and — Morrison, Esqrs., and communicated by the former gentleman to Professor Balfour, by whom specimens were placed in my hands for examination. It is a form quite new to the British flora; and as its affinity is involved in some obscurity, its discovery on our shores is invested with considerable interest. Specimens transmitted to the celebrated French cryptogamist, Dr. Montagne, have been pronounced by him to be identical with an Alga found by himself at Fort St. Sebastian in 1823, and published in the 'Annales des Sciences Naturelles' for 1842, p. 251. t. 7. f. 2, under the name of *Desmarestia pinnatinervia.* Dr. Montagne obtained only a single individual, scarcely more than 4 inches high, fully 2 inches wide, and truncate; being evidently an abnormal development. M. Crouan has likewise met with it, though rarely, at Brest, and regards it as a variety of *Desmarestia Dresnayi* of Lamouroux, described and figured in the 'Dictionnaire des Sciences Naturelles,' t. xiii. p. 105, the figure being half the natural size. Professor J. Agardh—the most recent authority—in his great work, 'Species, Genera et Ordines Algarum,' refers both the above Algæ to varieties of *Desmarestia ligulata,* but still includes *D. pinnatinervia* among his "Species inquirendæ," with the additional remark, "videtur pars inferior frondis latioris Desmarestiæ ligulatæ."

D. Dresnayi, Lam., which was published in 1819, was found on the French coast. It has a slender stipes about half an inch high, which immediately gives off two lateral fronds about 2 feet long and 1 to 2 inches broad, linear-lanceolate, with a fine longitudinal nerve and very delicate opposite lateral nerves, which are sometimes forked. The margin is sinuate, more or less toothed, and towards the base some of the lateral nerves are prolonged into very short leaves of the same form as the frond, thus manifesting a tendency to the pinnate development characteristic of the genus. The colour is described as olivaceous, and the substance membranaceous.

D. pinnatinervia, judging from the figure given by Dr. Montagne, has so close a resemblance to *D. Dresnayi*, that were the two side branches in the figure of the latter plant removed, the remaining central portion (which appears to have been shortened by some injury) would be almost a fac-simile of it. The character of the nervation and of the margin is precisely the same in both—so also is the stipes, the colour and the substance. The frond, however, is quite simple, and Dr. Montagne compares it to large specimens of *Laminaria debilis*.

With regard now to the Irish plants, they appear to constitute an intermediate link between the two forms above mentioned. They have a slender well-defined stipes half an inch long or more, a linear-lanceolate frond from 12 to 18 inches long and 2 to 4 inches broad, the margin more or less sinuate and dentate. An exceedingly fine but very perceptible nerve runs from the base to the apex, from which, lateral ones, opposite, and frequently forked, are given off at intervals of nearly a quarter of an inch. These lateral veins, which are somewhat inconspicuous, at least in the dried specimens, terminate in the marginal denticulations. Mr. Sawers observes, that the colour in the fresh state is that of a *Laminaria*, while the substance is thinner. That gentleman also describes the margin in one or two specimens as slightly proliferous; bringing the plant so very near to *D. Dresnayi*, that I do not see how the two can be separated; and the latter name having the priority must be retained, if they are to be considered as distinct from *D. ligulata*.

It must be confessed that the transition from the ordinary narrow and decompound state of *D. ligulata*, as it occurs on the British coast, to that of the Alga under consideration, is very remarkable; and as far as I know, intermediate states have not occurred. But Professor J. Agardh speaks of the frond of some French specimens of *D. ligulata* as an inch in breadth. Professor J. Agardh's var. β. (*D. herbacea*, Lamx.) and var. γ. (*Sporochnus herbaceus*, var. *firma*, Ag. Syst.) do not at all agree in their pinnated forms and spinuloso-serrate margin with our plant; and if his conjecture should eventually prove to be correct, it would be difficult to adduce a more extraordinary deviation from a specific type. It might be described as var. δ. *subsimplex*. In the mean time a figure (Pl. I. fig. 1) of so interesting an Alga will, it is hoped, be not unacceptable to the British botanist.

II. *On the Occurrence of "Cinchonaceous Glands" in* Galiaceæ, *and on the Relations of that Order to* Cinchonaceæ. By George Lawson, F.R.P.S., F.B.S.E., Demonstrator of Botany and Vegetable Histology to the University of Edinburgh.

Read 13th July 1854.

A few years ago, Dr. Weddell of Paris, in his magnificent monograph of the Cinchonas*, drew attention to a singular feature in these plants, viz. the constant presence of peculiar glands on their interpetiolar stipules; and the attention of this Society was called by Professor Balfour to Dr. Weddell's observations.

The inner faces of the stipules are in many cases firmly glued to the terminal bud, which they embrace, by a gummy or gum-resinous matter exuded by the small sessile glands to which reference has been made. This secretion is stated by Dr. Weddell to be fluid and transparent in Cinchonas and Cascarillas, but solid and opake in several other genera, remarkably so in *Pimentelia glomerata*. In the genus *Rondeletia* it is soft like wax, and of a beautiful green colour. The inhabitants of Peru, who give it the name of *Aceite-Maria* (oil of Mary), carefully collect it, and employ it as an external application in various maladies. It is well known to horticulturists that Cinchonaceous plants under cultivation are very liable to the attacks of *Acaridæ* and other parasites; and Mr. M'Nab has drawn my attention to the fact, that it is invariably in the neighbourhood of the stipules on the young shoots that these pests are most abundant, viz. at the points of the plant where the secretion is most copiously given off.

The glands occur at the extreme base of the stipule on its inner or upper surface, and are most plentiful in the immediate vicinage of the nervures of the stipule, where spiral vessels are abundant; but these do not enter the tissue of the gland. In those plants whose stipules early become reflexed (*Rogera* for example) the glands are conspicuously exposed to view; but in those whose stipules remain closely glued to the stem, it requires careful dissection to show them. It is in the young state of the stipule, when it envelopes the terminal bud, that the glands are

* Histoire Naturelle des Quinquinas, ou Monographie du genre *Cinchona*, suivie d'une Description du genre Cascarilla et de quelques autres plantes de la même tribu, par M. H.-A. Weddell, M.D. Paris, 1849.

in best condition for examination; they get quite dried up before the stipule decays.

These stipular glands appear to be of universal occurrence throughout the whole order *Cinchonaceæ*, but as this has not been ascertained from actual observation of all the species, it seems desirable here to record the names of those in which they have been particularly noticed, in order that botanists who have the opportunity may, from time to time, extend the list of observations. These glands have been examined in the following species, viz.—

Cinchona Calisaya, *Wedd.*
—— Condaminea, *Humb. et Bonpl.*
—— lancifolia, *Mutis.*
—— amygdalifolia, *Wedd.*
—— scrobiculata, *Humb. et Bonpl.*
—— australis, *Wedd.*
—— boliviana, *Wedd.*
—— ovata, *Ruiz et Pav.*
—— rufinervis, *Wedd.*
—— Chomeliana, *Wedd.*
—— micrantha, *Ruiz et Pav.*
—— pubescens, *Vahl.*
—— cordifolia, *Mutis.*
—— purpurascens, *Wedd.*
—— carabayensis, *Wedd.*
—— asperifolia, *Wedd.*
Cascarilla Carua, *Wedd.*
Ladenbergia dichotoma, *Kltsch.*
Rondeletia odorata, *Jacq.*
Burchellia capensis, *Brown.*
Cephaëlis Ipecacuanha, *A. Rich.*
Coffea arabica, *Linn.*
Ixora javanica, *DC.*
—— coccinea, *Linn.*
Mussænda frondosa, *Linn.*
Pavetta indica, *Linn.*
Luculia gratissima, *Sweet.*
—— Pinciana, *Hook.*
Pentas carnea, *Benth.*
Gardenia Stanleyana, *Hook.*
Pimentelia glomerata, *Wedd.*
Exostemma longiflorum, *R. & S.*
Rogera Rœgelia.
—— versicolor.
—— elegans.

In all 35 species.

The Cinchonaceous glands are, in general, minute, more or less conical bodies, rising from the surface of the stipule, and are mostly colourless, but in some instances highly coloured, and are then conspicuous objects.

Their plan of structure is perhaps more distinctly seen in *Cinchona Calisaya* than in any other species, and is well illustrated in Dr. Weddell's book. In that plant the gland is sessile, of an oval or lanceolate form, and somewhat pointed at the apex. It consists of a mass of dense tissue of somewhat elongated cells, forming a central nucleus of a conical shape. This axial nucleus is surrounded by a layer of much more elongated obconical, somewhat prismatic cells, which are closely set around the nucleus in a radiant manner, lying upon it like achenes upon a conical receptacle.

These elongated cells are described by Weddell as having, in the centre of the outer extremity or apex of each, a minute canal or perforation in the cell-wall, communicating with the interior of the cell, and serving to discharge the secreted fluid. This he says is particularly evident in *Cinchona Calisaya*; and the Commission appointed by the Academy of Sciences to report upon Dr. Weddell's investigations (MM. Richard, Gaudichaud and Jussieu) specially drew attention to the circumstance, as of rare occurrence in vegetable glands.

I have not been able as yet to demonstrate the canal satisfactorily, although the glands of *Cinchona Calisaya*, and of other species, have been carefully examined with this view. But, by this expression of my own failure to see what no doubt requires a combination of favourable circumstances, supplemented by patient examination, I do not mean to impute error of observation to so excellent an observer as Dr. Weddell; and refrain, in the meantime, from entering upon a discussion of the point, as it has specially occupied the attention of my friend Dr. John Kirk, whose researches I trust will ere long be laid before the Botanical Society. It may here, however, be remarked, that the secretion is certainly discharged from the apex of the elongated cells forming the outer layer of the gland, and under certain circumstances appears in the form of minute globules on their surface. It is not likely that such globules were taken by Dr. Weddell for canals, but they have sufficiently that appearance to be mistaken by an inexperienced observer.

In size and form the glands vary considerably in different species. In *Cinchona Calisaya* they are of an ovato-lanceolate form, and measure $\frac{1}{40}$th of an inch in length by $\frac{1}{70}$th in breadth; while in *Ixora coccinea* they are very much attenuated, of a linear lanceolate form, and measure $\frac{1}{30}$th of an inch in length by only $\frac{1}{250}$th in breadth.

In occasional cases, though rarely, two glands are found in adhesion.

These stipular glands have been hitherto regarded as quite peculiar to the Natural Order *Cinchonaceæ*, and have been employed as a character whereby to distinguish that order from *Galiaceæ*, in which their presence has not hitherto been suspected, or has rather by implication been denied.

I have recently ascertained, however, that the so-called Cinchonaceous glands are by no means limited to *Cinchonaceæ*. They likewise occur in the *Galiaceæ*, and I believe that the strong odour (in some agreeable, in others fetid) which many of these plants give off may be found to proceed from the secretions of their glands. It is not in isolated cases merely that I have been able to trace the presence of glands in *Galiaceæ*. In every plant of the order of which I have been able to obtain fresh examples for examination, I have found them to occur; and being quite unable to find a single instance of a Galiaceous plant in which they are absent, I think I am, in the meantime, fairly entitled to presume their general occurrence throughout the order.

The plants examined (and found to exhibit these glands) were the following, viz.—

Rubia peregrina, *Linn.*
—— tinctorum, *Linn.*
Asperula taurina, *Linn.*
—— odorata, *Linn.*
—— valantioides.
Crucianella suaveolens.
—— mollugìnoides, *Bieb.*
—— stylosa, *DC.*
—— aspera, *Bieb.*
Galium Aparine, *Linn.*
—— rubioides, *Linn.*
—— tomentosum, *Thunb.*
—— tauricum, *Rœm. et Schult.*
—— saccharatum, *All.*
Galium Mollugo, *Linn.*
—— Chersonense, *Rœm. et Schult.*
—— glabrum, *Thunb.*
—— cruciatum, *With.*
—— saxatile, *Linn.*
—— rostratum.
—— urceolatum.
—— purpureum, *Linn.*
—— lucidum, *All.*
—— verum, *Linn.*
—— pusillum, *Linn.*
—— boreale, *Linn.*
Sherardia arvensis, *Linn.*

In all 27 species.

In *Galiaceæ* the glands occur apparently in the axils, but in reality on the inner or upper surface of the bases, of the leaves. In structure they bear a considerable resemblance to the stipular glands of many *Cinchonaceæ*, with this difference, however, that they are generally either distinctly stipitate or club-shaped, whereas those of *Cinchonaceæ* are usually thickest at the base, and taper (more or less gradually in different species) towards the apex. When stipitate, the stalk (of the Galiaceous gland) is composed of two or three (sometimes more) series of cells, those running up the centre sometimes containing green chlorophyll granules; none of these, however, being usually exhibited in the body of the gland. In *Rubia tinctorum* each cell of the gland contains a large green central nuclear body. In form the glands of *Galiaceæ* present even greater variety (in different species) than those of *Cinchonaceæ*.

Another feature in which the glands of *Galiaceæ* differ from those of *Cinchonaceæ* is their small size, which is especially observable in some of the dwarf, small-leaved species of *Galium*, as in *Galium saxatile*, for instance, whose glands are not more than $\frac{1}{150}$th of an inch in length by $\frac{1}{800}$th in breadth, whereas I have stated those of *Cinchona Calisaya* (which are not unusually large for that genus) to average $\frac{1}{40}$th of an inch in length by $\frac{1}{70}$th in breadth.

The *Cinchonaceæ* and *Galiaceæ* form two well-marked groups of plants, abundantly distinct from each other in habit and in geographical distribution; the one consisting of trees, shrubs, and herbs, almost exclusively inhabiting the hotter parts of the world, most of them eminently conspicuous for their œconomical products and the beauty of their broad foliage and flowers, although some of their number are mean weeds; the other composed entirely of straggling herbaceous plants, with weak angular stems and narrow verticillate leaves, inhabiting northern countries, and (if we except the Madder) alike inconspicuous for use and ornament. Unfortunately, however, fructification does not supply any character whereby those two ideally distinct groups of plants can be clearly separated from each other; and in the limitation of natural orders, something more than a difference of habit is considered desirable by all, and by many absolutely requisite. Therefore, although the *Cinchonaceæ* and *Galiaceæ* are kept separate by several of our best systematic writers, there is still a considerable difference of opinion as to the propriety of so doing, notwithstanding the detailed discussion of the subject at different times by some of the most distinguished botanists of Europe.

The principal character whereby these two orders are separated, depends upon the leaves of *Cinchonaceæ* being opposite (sometimes verticillate), and *furnished with interpetiolar stipules*; while *Galiaceæ* have normally verticillate leaves *without stipules*.

DeCandolle, Bentham, and others, who regard *Cinchonaceæ* and *Galiaceæ* as forming only one natural order, *Rubiaceæ*, reduce the distinguishing character above indicated in the following manner. They regard the *Galiaceæ* as opposite-leaved plants, their foliaceous organs being in part true leaves, and in part leaf-like stipules, for the following reasons:—

1. That the foliaceous organs in *Galiaceæ*, if viewed as consisting entirely of leaves, do not bear that relation to the angles of the stem which is usual in Dicotyledons; but that the relation becomes apparent if only two of them are taken as leaves and the rest as stipules. Only two of the apparent leaves have buds in their axils.

2. That in a number of cases, especially in *Asperula*, two opposite leaves are much larger than the others.

3. That in *Spermacoceæ* and other tribes of *Cinchonaceæ*, the stipules are connected with the petiole of the leaf into a sheath, and that this sheath exists in *Galiaceæ*.

4. That the number of parts in each whorl is not necessarily some power of 3, as argued by Dr. Lindley (each leaf having two stipules), but that taking two of the parts for leaves, it is immaterial by what number of similar parts those two are separated, because the intermediate processes are analogous to the setæ of *Spermacoceæ*, the number of which is variable*.

Dr. Lindley objects to this line of argument, (1.) that in *Labiatæ* and similar orders the apparent leaves are never opposite the angles of the stem, but are always placed between them, and

* Vegetable Kingdom, 3rd edit. p. 769.

that the number of angles in the stem of verticillate plants does not necessarily correspond with the number of their leaves, *Dysophylla* for example (a Lamiaceous genus) having whorls of ten parts, while the stem has but four angles; that the non-production of buds in their axils is no proof of bodies not being true leaves, all foliaceous organs, and especially stipules, having that power or not according to circumstances. (2.) That the greater length of two opposite leaves occasionally observed in *Asperula* is to be ascribed to their greater development consequent upon their higher functions. (3.) That the argument derived from the occasional connection of the leaves by a membrane loses weight, when it is remembered that in such cases the intermediate leaves are less like stipules than in those cases where no membrane exists. (4.) That the comparison of the supposed stipules of *Galiaceæ* and the setæ of *Spermacoceæ* is inadmissible, because the former are at all events single simple organs, be they what they may; while the setæ of *Spermacoceæ* are the result of the splitting of two parallel-veined stipules, and therefore will necessarily be uncertain in number.

Dr. Lindley likewise draws attention to the fact, that in *Galiaceæ* the supposed stipules are always what first disappear in the process of reduction in the number of foliaceous appendages; but that in *Cinchonaceæ* it is in many cases the leaves which are first lost when such a reduction takes place, which is illustrated by the capitate Spermacoces, where the bracts are evidently stipules, and especially by *S. calyptera,* in which the leaves are gradually merged in the large membranous cup that subtends the flower, while the stipules suffer no diminution.

From these arguments it will be seen that the principal distinction between the orders *Cinchonaceæ* and *Galiaceæ* depends entirely upon the theoretical notion we adopt of their foliaceous organs, and that from whatever point of view they be regarded, the two orders are structurally closely related to each other.

The observation of the glands now described, in the *Galiaceæ,* establishes another point of relationship between the orders, the presence of stipular glands in the *Cinchonaceæ,* and especially in the arborescent species, having been hitherto looked upon as a singular feature of their structure, serving to remove them from the herbaceous *Rubiaceæ* of cold countries. It appears to me that these glands may likewise be instrumental in throwing light on the nature of the foliaceous organs of *Galiaceæ,* as well as on the morphology of those of *Cinchonaceæ.*

In *Cinchonaceæ* the glands are invariably confined to the stipule; and, on observing their occurrence in *Galiaceæ,* it at once occurred to me that if a portion of the foliaceous organs of

Galiaceæ were in reality leaves and the others stipules, then we had here a key whereby to determine what were leaves and what stipules. With the view of doing so, I have carefully examined the position of the glands of all the *Galiaceæ* within my reach; and, although I came to the subject with a prepossession in favour of the view of DeCandolle, I have been quite unable to find any indication, by the arrangement of the glands, of two kinds of foliaceous organs in these plants. In *Galiaceæ* the stipules occur at the base of the foliaceous organs; they are not limited to a certain number in each whorl, but occur in all, being equally present in those opposite "leaves" which bear branches in their axils, as in those so-called "stipules" that are barren, although more abundant in the latter.

In the *Cinchonaceæ* I have said that the glands constantly occupy the base of the stipule, and are in no case found on a leaf or petiole. Here then the presence of these glands is a certain indication of the stipulary nature of the organ on which they occur, no dubiety whatever having hitherto been expressed respecting the nature of the usual foliaceous organs of *Cinchonaceæ*. I am not sure in how far we are warranted in applying this fact to the case of *Galiaceæ*; but where all other characters have failed, it is not to be entirely overlooked. If then we follow the rule which obtains in *Cinchonaceæ*, that stipules are bodies furnished with glands at their base, we shall come to a conclusion differing essentially from all those that have hitherto been brought forward, viz. that *Galiaceæ* are *leafless plants with whorls of stipules*.

It is worth while to keep in view, that this idea, although at first sight sufficiently paradoxical to caution us against its too hasty adoption, is perhaps in reality less liable to objection than either the views of Lindley or of DeCandolle and Bentham. At the same time, even if it were proved to be correct, I do not precisely see in what manner it could help us out of the difficulty.

In organography, as well as in regard to the disposition of these two natural orders, the subject is one of considerable interest in a theoretical point of view.

In viewing the whole question, it appears to me, even admitting (with Lindley) the foliaceous organs of *Galiaceæ* to be true leaves, that the character thus established between the two orders is not of that great importance with which it seems to be generally regarded. The leaves are truly verticillate in a certain portion of the *Cinchonaceæ*, and, without any violence to truth, they may be regarded as verticillate in the whole of these plants, in this way. All botanists will admit that stipules are merely reduced or rudimentary, partially-developed leaves. In *Galiaceæ* we have plants with leaves in whorls, all equally developed, but in many cases with an undoubted tendency to reduction in part of the whorl. In *Cinchonaceæ* a certain number of the leaves of the whorl are invariably much more fully developed than the others, which latter assume the character of stipules, but do not appear in the form of ordinary stipules, as appendages to other leaves, but occupy independent positions around the stem like true leaves. If the argument had proceeded in this direction, we should probably have had less discussion upon a point which still remains to be satisfactorily cleared up*.

EXPLANATION OF PLATE II.

Fig. 1. Stipular gland of *Cinchona Calisaya.* 70 diameters.
Fig. 2. Stipular gland of *Ixora coccinea.* 70 diameters.
Fig. 3. Vertical section of gland of *Cinchona Calisaya* (after Weddell), showing (*a*) central nucleus of compact tissue, and (*b*) outer layer of elongated cells.
Fig. 4. Diagramatic view of two of the cells of the outer layer of the gland (*C. Calisaya*), exhibiting the canals (*c, c*) at their apex, as shown by Weddell.
Fig. 5. Stipular gland of *Exostemma longiflora.* 70 diameters.
Fig. 6. Twin gland from stipule of *Luculia Pinceana*, formed by the adhesion of two glands throughout the greater part of their length. This is only of occasional (accidental) occurrence, the usual form of the gland being not unlike that of *Exostemma longiflora,* but of greater size. 70 diameters.
Fig. 7. Glands of *Galium saxatile.* 70 diameters.
Fig. 8. Gland of *Crucianella stylosa.* 70 diameters.
Fig. 9. Glands of *Galium cruciatum.* 70 diameters.
Fig. 10. Gland of *Galium urceolatum.* 70 diameters.
Fig. 11. Gland of *Asperula odorata.* 70 diameters.

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* To Professor Balfour, Mr. M'Nab, and Mr. Evans, my best thanks are due, for the unlimited use of plants from the Royal Botanic and Experimental Gardens, for examination.

III. *Notice of a new species of* Caulerpa.

By R. K. Greville, LL.D. &c.

Read 13th July 1854.

The Alga which forms the subject of the present notice was communicated to me for determination along with several others, by my friend Professor Balfour; and was collected in Bass's Straits, Australia, by Mr. James E. Cox.

Singularly variable in external conformation as are the species of this fine and most natural genus, presenting no fewer than six or seven well-defined groups, it will be at once perceived that the present one differs entirely from them all. In general habit it stands alone; and upon a closer view may be said to unite those which possess a dendroid character with others which have a more simple, plane, and pinnate or pinnatifid frond.

The prostrate stem is robust, branched, 12 inches or more, probably, in length, rough with linear simple or forked processes (abortive ramuli), and altogether strongly resembling the creeping stem of a *Lycopodium*. The fronds are erect, arising singly, or often two together, 4 to 7 inches high, of an ovate-oblong outline, and bushy like some species of *Bryopsis*. The numerous ramuli are given off on all sides, an inch or more long, spreading, pectinato-pinnate, compressed; the pinnæ very narrow, linear and acute. When magnified, the apices of the pinnæ are found to be frequently minutely forked in a divaricate manner, like some *Cladoniæ*. The lower part of the stalk of each frond is naked for about half an inch, and covered with linear scales or processes, like those of the creeping stem.

I propose the following name and character for this very beautiful Alga: —

Caulerpa superba, frondibus ovato-oblongis, ramulis numerosis pectinato-pinnatis undique obsitis.

EXPLANATION OF PLATE III.

Fig. 1. A frond of *Caulerpa superba*, natural size.
Fig. 2. A portion of a pinna.
Fig. 3. Apices of ditto, magnified.

IV. *Remarks on Associations of Colour, and the Relation of Colour and Form in Plants.* By G. Dickie, M.D., Professor of Natural History, Queen's College, Belfast.

Read 9th November 1854.

Relations in the form, structure, number and position of organs are familiar to every botanist. *A priori* it might have been inferred that order prevails in the distribution of colours; that there is no mere fortuitous relation, but that all must be subject to law. This is not only the fact, but there are, besides, obvious indications of a relation between the colour and form of organs.

In April and May 1853, the facts to be here recorded were first observed and demonstrated to scientific friends in Belfast. Professor M'Cosh, in a lecture before the Natural History Society in May 1853, intimated that he had for some time entertained a belief in the existence of complementary colours in the vegetable kingdom. The results of my own observations were embodied in a paper read at the October Meeting of the same Society in that year. It would seem, however, that certain associations of colour have been long known to artists who have cultivated the special department of flower-painting. Any relation, however, between form and colour appears to have escaped notice, and even erroneous ideas have been promulgated respecting this point. Thus Ruskin, in his 'Lamps of Architecture,' states that "the natural colour of objects never follows form, but is arranged on a different system;" and again, "colour is simplified where form is rich, and *vice versâ.*" "In nature," he further says, "the boundaries of forms are elegant and precise; those of colours, though subject to symmetry of rude kind, are yet irregular—in blotches." All these statements are far from representing the truth.

Without alluding to differences of opinion which have been recently published regarding the law of harmonious colours, it may be sufficient to allude briefly to the views usually entertained by physicists and most generally adopted. White or compound light consists of three simple colours called primaries, viz. yellow, red, and blue; combinations of these yield secondaries;—yellow and red give orange, yellow and blue give green, red and blue give purple. Combinations of secondaries yield tertiary colours, —green and orange give citrine, purple and green give olive, orange and purple yield russet.

A primary and secondary, together containing all the primaries, are complements to each other; for example, yellow and purple; red and green; blue and orange. The presence of all the colours either separate or combined (which form white or compound light) is a physical want of the organ of vision.

The artist recognizes a melody of colours, that is, gradations of hues and shades, and speaks of harmony when complementary colours are present. A white line (or black) between two colours not complementary subdues discord. There is a correspondence between the depth of any hue and that of its complement; for example, red-purple and yellow-green are associated. Every association of colour in the organic world may be regarded as an actual embodiment of results, which cannot be otherwise than in strict harmony with those great principles which have guided the plans of the Great Author of nature.

It is worthy of notice, that colour is the foundation of one of the more recent classifications of Algæ, that of Professor Harvey. They are divided by him into red, green, and olive; among the red series are comprehended many which present various tints, of purple for example, and in the olive series not a few are yellow-green. All this is in strict accordance with the views just adverted to.

Among the family of the Mosses the red or red-purple teeth of the peristome are associated with the green or yellow-green capsule; the same is true of the different parts of their stems and leaves.

In flowering plants the cases are so numerous, that only one example or two need be recorded.

Primula vulgaris.

Young leaves $\begin{cases}\text{stalk, red-purple.}\\ \text{leaf, yellow-green.}\end{cases}$

Caladium pictum.

Leaf $\begin{cases}\text{centre, red or red-purple.}\\ \text{border, green or yellow-green.}\end{cases}$

Coleus Blumei.

Leaf $\begin{cases}\text{centre, red or red-purple.}\\ \text{border, green or yellow-green.}\end{cases}$

Victoria Regia.

Leaf $\begin{cases}\text{lower surface, red-purple.}\\ \text{upper surface, yellow-green.}\end{cases}$

Taxodium sempervirens.

Young shoots, yellow-green.
A year old, red-purple.
Older still, citrine.

In this last instance, as well as in many others, advanced growth seems to be accompanied with greater composition of colour. In the curious pitcher-like organs of *Sarracenia, Nepenthes* and *Dischidia,* we find that red-purple and yellow-green are associated.

In the flower, similar associations are the rule.

Ranunculus repens.
Corolla, yellow.
Calyx, purple spots.

The same may be observed in many other species of the same genus.

Hieracium pilosella.
Flower, yellow.
Those of the circumference variegated with purple.

Anthyllis vulneraria.
Corolla, yellow.
Tip of calyx, purple.

Saxifraga ligulata.
Corolla, white with purple spots.
Anthers, yellow.

Kalmia (species).
Ten spots of *purple* on the corolla at points in contact with the yellow anthers.

Juncus compressus.
Anthers and pollen, yellow.
Ovary and stigma, purple.
Perianth $\begin{cases}\text{edge, russet.}\\ \text{centre, dark green.}\end{cases}$

Strelitzia Reginæ.
——— *juncea, &c.*
Sepals, orange.
Petals, blue.

In most Orchideæ we find constant associations of yellow and purple.

We need not expect to find in a corolla or any other organ pure red and pure yellow, or blue and red, *in contact with each other.*

Of the primaries, blue is the least common, and in fact, generally speaking, may be called *very rare*; many so-called blues being blue-purples: transmitted light shows this. Pure blue being so uncommon in any organism, Professor M'Cosh suggested to me that this is compensated for in the atmosphere, and I may add, in the ocean too. Yellow is probably the most general of the primaries, in the flower at least; the most common association is therefore yellow and purple. We can now understand why yellow is the usual colour of the pollen, and some exceptional cases seem to confirm this; in the Turn-cap Lily for instance, the decidedly red pollen is associated with the green filaments of the anthers.

The statistics of colour in different natural orders have not been fully examined; it may be remarked, however, that purple and citrine prevail in the flowers of the Grasses, and russet and dark green in the Junci. In the Fir-tribe and its allies, secondaries and tertiaries are common, such as the purple and citrine scales of young and old cones, the russet and dark green in the stems and leaves respectively; at the same time the copious yellow pollen must not be lost sight of.

In examining this subject, we must keep in view that the colour of the flower may have its complement in that of other organs, as stem, leaf, &c. It sometimes happens that one of the associated colours is not visible to the eye at all times. The inside of a nearly ripe fig is red-purple, the outside yellow-green; the same is true of the pericarp in some species of Pæony. In some Cactaceæ the yellow corolla is succeeded by a purple fruit. The newly ripened cone of the *Pinus Pinaster* is citrine; when the scales open, the complementary purple is revealed at the base of each. In the fruit, fixed relations of colour are probably too familiar to require illustration. In certain varieties of the Apple, red and red-purple, green and yellow-green of various hues and shades are associated. In some varieties of Pear, yellow-green, red-purple and citrine occur together.

Direct exposure to light, although usually, and in general correctly admitted to have a direct relation to intensity of colour in organisms, appears not to be necessary in every instance; the plant, however, must receive the light at some part or other in order to produce that depth of colour observed in the coats of seeds, the interior of fruits, and in the tissues of subterranean organs.

In conclusion—

1. *The primaries, red, yellow, and blue, are generally present in some part or other of the plant.*

2. *When a primary occurs in any part of a plant, its complement will usually be found in some other part* (*or at some period or other of the development of the plant,* as was suggested to me by Professor M'Cosh).

Observations on the same subject in the animal kingdom have occupied my attention during the past twelve months; Birds, Mollusca, and Radiata present associations of colour not less remarkable than those here recorded.

The relation between colour and form may now be examined, and the remarks, for the present, have reference to the parts of the flower.

When the calyx and corolla are equal in size and similar in form, the flower is regular; differences in size and form are found in irregular flowers. For example, the Violet has an irregular flower, that of the Wallflower is regular; a Primrose has a regular flower, a Snapdragon presents an example of irregularity. Such expressions are equally applicable to monocotyledonous and to dicotyledonous plants, to polypetalous and gamopetalous corollæ.

Law 1. *In regular polypetalous and gamopetalous corollæ the colour is uniformly distributed, whatever be the number of colours present.*

That is to say, the pieces of the corolla being all alike in size and form, have each an equal proportion of colour. The common Primrose is an example where one colour only is present. In the Chinese Primrose the same holds where two colours (one the complement of the other) are present; the eye or centre is yellow, the margin purple. These two colours in this regular flower are uniformly diffused, that is, each piece has an equal proportion of yellow and of purple respectively. In *Myosotis, Anagallis, Erica, Pyrola, Gentiana,* &c., we have instances. All corolliflоral Exogens with regular flowers are examples; the same is true of certain Thalamifloræ, as Papaveraceæ, Cruciferæ, &c. In *Iberis coccinea,* belonging to Cruciferæ, we find unequal size of petals, but equal distribution of colour, because regularity of flower is the law in that family.

Calycifloral Exogens with regular flowers are also examples, as Rosaceæ, Cactaceæ, &c.

Law 2. *Irregularity of corolla is associated with irregular distribution of colour, whether one or more colours are present.*

The odd lobe of the corolla is most varied in form, size, and in colour.

When only one colour is present, it is usually more intense in the odd lobe.

When there are two colours, one of them is very generally confined to the odd lobe. Sometimes when only one colour is present and of uniform intensity in all the pieces, the odd lobe has spots or streaks of white. This piece of the corolla therefore in irregular flowers is distinguished from the others not merely by size, form and position, but also by its colour.

Papilionaceæ present examples of this law; a few instances may suffice.

Cytisus Laburnum.
4 petals yellow.
5th yellow with purple veins.

Lathyrus pratensis.
Much the same as *Laburnum.*

Trifolium pratense.
Odd lobe distinguished from the others by its darker purple veins.

Kennedia monophylla.
4 petals purple.
5th yellow eye and purple margin.

Swainsonia purpurea.
4 petals purple.
5th white eye on purple ground.

Even when the odd lobe of a papilionaceous plant is smallest, —not a common case,—it may be distinguished by its colour; for instance, in *Brachysema acuminatum* the odd lobe is comparatively small, but has yellow eye and purple margin.

Irregular gamopetalous corollæ also present examples of this law.

Ajuga reptans.
Corolla { 4 divisions purple.
5th has yellow spot on inner surface.

Thymus Serpyllum.
Corolla, generally red-purple.
Two pale spots on odd lobe.

Galeopsis Tetrahit.
Odd lobe has generally two colours, yellow and purple.

Numerous other examples from Labiatæ might be quoted.

Among Scrophulariaceæ we may instance the following :—

Euphrasia officinalis.
Corolla purple, generally.
Odd lobe has yellow spot.

Digitalis purpurea.
Has white on odd lobe.

In some species of *Schizanthus* and *Collinsia* we find purple the prevailing colour; the primary, yellow, appears in the odd lobe.

In some genera with irregularity of flower often less marked than in the examples alluded to, it is worthy of notice that the two divisions on each side of the odd lobe frequently partake of its characters as regards colour, half of each resembling the odd piece; *Viola*, *Gloxinia*, *Achimenes*, *Rhododendron*, &c. are examples. In some Thalamiflorous Exogens with irregular flower, as *Pelargonium* and *Tropæolum*, we find that the two upper pieces are usually largest, and present also the greatest variety in depth of colour. In the Horse-chestnut there is a very decided relation between the size of the petals and the intensity of the colour. On each petal there is usually a crimson spot at the junction of the limb and claw; the size of this spot and its intensity are in direct relation to the size of each petal; the two upper being largest, the two lateral smaller, and the odd piece least of all.

It may therefore be stated, that *in some Thalamiflorous Exogens with irregular corolla, owing chiefly to difference in size of the petals, the largest are most highly coloured.*

LAW 3. *Different forms of corolla in the same inflorescence often present differences of colour, but all of the same form agree also in colour.*

The Compositæ are illustrations of this: when there are two colours, the flowers of the centre have generally one colour of uniform intensity; those of the circumference agree together also.

The common Daisy has all the tubular flowers of the centre yellow, and all the ligulate flowers of the ray are white, variegated with purple. A yellow centre with purple ray is a common association in compound flowers, for instance, in species of *Aster*, *Rudbeckia*, &c.

The same general laws prevail in Monocotyledons as in Dicotyledons. In the former the calyx and corolla generally resemble each other in structure and shape, and in colour also; hence an idea entertained by some that the perianth is single, relative position having been overlooked. In Dicotyledons we generally find a greater contrast between calyx and corolla as regards colour.

The law of the contrasts is therefore simpler in Monocotyledons than in Dicotyledons.

The former may be symbolized by the triangle, 3 and 6 being the typical numbers in the flower; the latter by the square or pentagon, 4 and 8, 5 and 10 being the prevalent numbers.

The simplicity of figure corresponds with simpler contrast of colour in the one, while greater complexity of colour and of structure are in direct relation in the other.

In families of Monocotyledons having regular flowers there is regular distribution of the colours, for instance, in Amaryllidaceæ, Liliaceæ, &c.

Orchidaceæ are notable examples of the other law, that irregularity of form and of colour are associated. In a large proportion of this family the colours are yellow or yellow-green, and purple or red-purple; the latter being confined to the part of the corolla usually called *lip*.

Proceeding on the principle, that since plants of all epochs of the earth's history were constructed on the same general plan, so the same associations of colour, and of colour and form, must have prevailed also, we shall glance finally at a few conclusions which may be derived from this source.

During the earlier periods when Acrogenous Cryptogamia were abundant, the secondary and tertiary colours, as russet, purple, citrine, green, must have prevailed.

During the reign of Gymnosperms, when Cycadeæ and Coniferæ were numerous, the secondary and tertiary colours must still have given a sombre aspect to the vegetable world.

From the commencement of the Chalk formation there appears to have been a very marked and progressive increase of Angiospermous Dicotyledons, which form at least three-fourths of existing vegetation. Among them we find the floral organs with greater prominence in size, form and colour; and such prominence of the "nuptial dress" of the plant, to use the quaint expression of Linnæus, is peculiarly a feature of species belonging to natural families which have attained their maximum in man's epoch, and are characteristic of it.

V. *On* Linaria sepium *of Allman.*
By Charles C. Babington, M.A., F.R.S. &c.

Read 9th November 1854.

At a meeting of the Royal Irish Academy, held June 6th, 1843, the occurrences at which are reported in the 'Proceedings' of that body, Dr. G. J. Allman described what he supposed to be a new species of *Linaria,* and upon which he conferred the name of *L. sepium.*

In the second edition of my 'Manual of British Botany' (p. 232), the opinion was stated that the plant is "scarcely more than a variety of *L. italica,*" and in the third edition of the same book I ventured to consider it and the *L. italica* of the Manual as hybrids between *L. vulgaris* and *L. repens.*

In consequence probably of the latter remark, I was favoured by Dr. Allman, in June 1852, with a large packet of living specimens and roots of the disputed plant. A careful examination of these, and a comparison of them with living specimens of *L. repens,* led me greatly to doubt the correctness of the supposition that it was a variety of *L. repens;* and Dr. Allman justly states in a letter to me that the "total absence of *L. vulgaris* from the neighbourhood where the plant in question abounds must render hybridization impossible." In another letter he remarks, "I only know of one spot in the neighbourhood of Bandon where *L. vulgaris* grows apparently wild, and there very sparingly. It may possibly have escaped from a neighbouring garden. This spot is more than a mile in a direct line from the nearest patch with which I am acquainted of *L. sepium,* and three or four miles from other localities where the *L. sepium* is abundant." Also, "in the same hedge with the apparently wild plants of *L. vulgaris* just mentioned, and removed perhaps from these about 100 yards, grows *L. repens,* and yet not a trace of *L. sepium* have I found to grow within a mile of them." These remarks show the great improbability, if indeed I might not say impossibility, of the *L. sepium* being a hybrid. Two of the roots received from Ireland have grown well and flowered profusely in the Cambridge Botanical Garden, and have thus afforded an excellent opportunity for studying the plant.

As I now believe the plant to be a distinct species, I have drawn up the following character and description of it, and in doing so have followed the type of the descriptions of the allied species to be found in the valuable 'Monographie des Antirrhinées' of Chavannes.

Linaria sepium (Allm.); radice repente, caulibus erectis glabris, foliis lineari-lanceolatis acutis sparsis, floribus racemosis, sepalis ovatis acutis glabris calcare brevioribus, *seminibus tuberculato-scabris trialatis.*

L. sepium, *Allman in Proceed. R. Irish Acad.* (1843) p. 404.

Caules e rhizomate repente incrassato sæpeque tuberculis instructo prodentes, plurimi, simplices vel ramulosi, læves, basi lignescentes (cortice fuscescente), bipedales; ramuli alterni, erectiusculi. Folia pollicaria vel sesquipollicaria, lineari-lanceolata, utrinque attenuata, acuta, subtrinervia (nervis lateralibus tenuibus), erectiuscula, glaucescentia, inferiora sæpe subterna ceteraque sparsa. Bracteæ lineari-lanceolatæ, acutissimæ, erectæ, inferiores pedicello longiores, superiores pedicello breviores. Racemus strictus, laxiusculus. Calyx parvus; segmentis e basi lato attenuatis, acutissimis, glaberrimis, trinerviis, post anthesin apice paululum reflexis. Corolla minor quam in *L. vulgari*; calcar conicum, paululum incurvum, corollam æquans; tubus, calcar et labium superius grisei striis pallide purpureis signati; labium inferius dilute luteum striis pallide purpureis et parum distinctis notatum; palatum villis luteis vestitum, villis pallide purpureis quemque marginem investientibus, valde prominens, bilobum, lobis aurantiacis; lobis labii superioris ellipticis, dorso invicem applicatis sed apicibus incurvis; lobis labi inferioris lateralibus reflexis conniventibus, oblique rotundatis intermedio patenti latioribus et paululum longioribus. Stigma capitatum. Capsula subovata, dehiscens superne sex valvulis lanceolatis, calycem subæquans. Semina subtrialata; testa nigra, muricata.

Found plentifully near the river at Bandon, in the county of Cork, flowering from June to September.

L. sepium forms dense masses of strong stems, and presents a very different appearance from *L. repens* or *L. vulgaris.* Its flowers and seeds are unlike those of either of them; and in size the flowers are almost exactly intermediate between those of its allies. The same part of the rhizome does not appear to flower a second time, but numerous stems spring up at a short distance from it, which flower in the succeeding year.

In *L. vulgaris* the middle lobe of the lower lip of the corolla is relatively much smaller and is *strongly reflexed,* whilst the lateral lobes are patent-deflexed.

In *L. repens* the lobes of the upper lip of the corolla are erect with incurved points, and all those of the *lower lip patent.*

It will be seen above that in *L. sepium* the lobes of the upper lip are pressed closely back to back; and that the lateral ones of the lower lip are reflexed, but the intermediate one is patent. The colours also are different.

After a careful examination of all the descriptions of *Linariæ* with which I am acquainted, I have not found any recorded species to which this plant can be referred. I am therefore reluctantly compelled to consider it as a new species. It agrees in many respects with *L. linifolia* (Chav.), differing chiefly in the presence of a few three-leaved whorls towards the base of the stem, the shorter upper bracts, the striped flowers, and the three-winged seeds.

The seeds of *L. sepium* are different from those of any species that I have examined. They are discoidal, and surrounded by a wing; but have in addition another wing on one of the sides which is variable in its size and direction, being sometimes nearly at right angles with the disk, and at others laid so closely upon it as to be with difficulty detected. Rarely the additional wing is reduced to a reduplication of the wing of the disk through more or less a distance. The disk is covered on each of its sides with elevated ridges radiating more or less regularly from the centre. The whole seed is black.

VI. *Sketch of the Life of the late* Professor Edward Forbes. By J. H. Balfour, M.D., Professor of Botany, Edinburgh.

Read 14th December 1854.

While Europe is mourning over many a gallant officer whose life has been sacrificed for his country on the field of battle, the scientific world has been called upon to deplore the loss of one of its leaders who has fallen in the front ranks. Edward Forbes, Regius Professor of Natural History in Edinburgh, has been cut off in the zenith of his fame, and has left a blank which is not easily supplied. Every department of science acknowledges its obligations to him, and his premature death has inflicted a heavy blow on the progress of Natural History. We have lost an original thinker, a careful observer, a correct reasoner, an able writer, a pleasing and painstaking instructor, and a valued friend. His sun is gone down ere it is yet day, and the extinction of such a luminary has cast a shade over the scientific horizon. Truly God's ways are not as our ways, nor his thoughts as our thoughts. Let us learn the lesson which the solemn event teaches, and so number our days as to apply our hearts to heavenly wisdom.

Edward Forbes (of Scottish extraction) was born in the Isle of Man, on the 12th day of February, 1815. His father was a banker in that island. Even in his early years he had a taste for natural history, and at the age of seven he had collected and arranged a small museum. When not more than twelve years old, Mr. James Wilson informs us, Forbes had imbibed a fondness for geological studies, and had perused such works as Buckland's 'Reliquiæ Diluvianæ,' Parkinson's 'Organic Remains,' and Conybeare's 'Geology of England.' He had also compiled a Manual of British Natural History in all its departments.

He visited London at the age of sixteen, and was engaged there in studying the art of drawing under Sass. His power of delineating with the pencil was called into constant exercise during his after career, and was displayed alike in his published works and in the illustration of his lectures. His early associates remember well the clever and amusing sketches which he made with the pen during moments of leisure.

He came to Edinburgh in 1831, and entered the medical classes, as being the course of study best fitted for initiating him to those departments of science to which he meant to devote himself. His earliest friend in Edinburgh was John Goodsir (now Professor of Anatomy), with whom he lived in the same lodgings for many years. They had congenial tastes, and prosecuted their studies together with an earnestness and enthusiasm rarely equalled. He attended nearly all the classes required for graduation, but he did not take the degree of M.D. He studied natural history and botany under Jameson and Graham, and became an intimate friend of both, more particularly of the latter, who by his zeal in the prosecution of practical botany inspired his pupils with an enthusiastic love of science.

In 1833, Forbes visited Norway with a fellow-student, and made considerable collections both geological and botanical. Many of the specimens of the plants are now in the Herbarium of the University of Edinburgh. They are by no means well preserved, but they are well selected, more especially as regards their bearing on botanical geography. For at this period of his history Forbes began to look with a comprehensive glance on the flora of Europe, and gave indication of those views of distribution which were afterwards developed fully in the Memoirs of the Geological Survey of Britain. An account of his observations in Norway were published in the Magazine of Natural History. On the 12th of May, 1836, I find a notice by Dr. Graham, in the Proceedings of the Botanical Society, of the flowering of a *Primula*, sent to the Garden by Forbes from Norway. Forbes sent it as a variety of *P. farinosa*, which he called *alpina*, while Graham considered it a variety of *P. Scotica*.

He became a member of the British Association in 1834, and afterwards was one of the most regular attenders of its meetings, contributing on all occasions valuable papers and reports. He it was who called the attention of the Association to the subject of dredging, and secured their cooperation and aid in this most important matter.

He appears to have visited the Alps in 1835; and in the Magazine of Zoology and Botany for 1837, he contributed a communication on the Comparative Elevation of the Testacea in the Alps.

His zeal for botany was at this time very great, and he saw the importance of not confining his attention to the flora of Britain. He therefore determined, along with his fellow-students in Edinburgh, to commence the formation of a public herbarium, by means of contributions and exchanges. This led to the establishment of the Botanical Society, an event which took place on Tuesday, the 9th of February, 1836. Well do I recollect the evening when he and I, with eight others, viz. W. H. Campbell, now LL.D.

and attorney in Georgetown, Demerara; Dr. Parnell, afterwards author of the work on British Grasses, &c.; Dr. R. C. Alexander, who subsequently published accounts of botanical tours in many parts of Europe and America; William Brand, now Secretary of the Union Bank; Dr. Gilbert McNab, now practising in Jamaica; James McNab, now Curator of the Botanic Garden; Nicholas Tyacke, now physician in Chichester; Edward Charlton, now M.D. and Lecturer in the Medical School of Newcastle; George C. Wallich, now in India; and Giles Munby, who wrote the 'Flora of Algiers,' met to lay the foundation of our Society. We received most important directions and aid from Forbes; and when, after launching the vessel, we supped together, his social and convivial powers were called forth in their fullest energy. His death constitutes the first blank in the little band. The first public meeting of the Society took place on the 17th of March, 1836, when the following office-bearers were appointed:—Prof. Graham, *President*; Dr. Greville and Dr. Balfour, *Vice-Presidents*; Dr. Neill, Mr. Falconar, Dr. Barry, Mr. Munby and Mr. Tyacke, *Councillors*: W. H. Campbell, *Secretary*; Edward Forbes, *Foreign Secretary*; William Brand, *Treasurer*; and James McNab, *Curator of the Herbarium.* Forbes contributed many valuable communications and papers to the Society between the years 1836 and 1841.

On the 9th of June, 1836, Forbes gave a description of a species of *Viola*, found by him in the Isle of Man. He considered it the *V. ericetorum* of Schrader, *V. canina* of Reichenbach. On the 8th of December, 1836, a communication was transmitted by him, as to a supposed new British *Polygala*, found in the Isle of Man and on Dalmahoy Hill. He also brought under notice the various British forms of *Euphrasia*, some of which he was disposed to consider as distinct species. This view he continued to entertain; and when visiting the hills at the head of Loch Lomond in July 1854, he pointed out three of these forms to his pupils and mine.

On April 12, 1838, he read a paper to the Botanical Society, on the specific claims of *Primula acaulis, veris,* and *elatior*.

He continued during life to take a warm interest in the Botanical Society; and he resumed his place among us last summer, with no small feelings of satisfaction—with pleasant reminiscences of the past and brightest hopes of the future. He has sent contributions to the Herbarium of the Society from various parts of the world, and these are now incorporated with the University Herbarium.

He continued to prosecute his studies more or less continuously in Edinburgh till 1839. During that period he made himself beloved by all who came into contact with him. He inspired almost all his companions with zeal in science, and became as it were a centre whence emanated numerous active and enterprising naturalists.

In 1837, he prosecuted his studies in Paris under Prévost, Beudant, Geoffroy St. Hilaire, and De Blainville. In May of that year he went to Algiers; and in the Annals of Natural History for May 1839, he writes on the Land and Freshwater Mollusca of Algiers and Bougia. In 1838 appeared his '*Malacologia Monensis*, or Catalogue of the Mollusca of the Isle of Man and of the Irish Sea.' At this time also he wrote many papers on zoology and geology.

In the winter of that year his literary, artistic, and humorous powers were called into play in a publication named 'The Maga,' which became for a time a most popular work with students, more especially at the period subsequent to the snowball riots of the 11th and 12th of January of that year. He was one of those who took up the defence of the students on that occasion, acting as chairman of their committee; and he succeeded, with the aid of Patrick Robertson, now Lord Robertson (who is figured as their glorious defender), in carrying them through the trial in a most triumphant manner. This publication, with the poems which came from his pen at that time, as well as his sketches of men and manners, have left an indelible impression on all of us.

While all this was going on, he continued sedulously to pursue his natural-history studies. His usual working hours were from breakfast-time till 2 or 3 in the afternoon, after which he considered that he was entitled to a certain amount of relaxation from severer study. The same plan has been adopted by him ever since, when practicable: and one reason among others for his objecting to take an early hour for lectures was the encroachment which would thus have been made on the hours devoted to original observations.

In 1838 he visited Styria and Carniola, with the view of examining their natural history. His observations were recorded in the Proceedings of the Botanical Society. Thus on the 13th of November 1838 he read a paper on the *Primula elatior* of Jacquin, gathered by him during the summer of 1838 on the mountains of Styria; on the 13th of December 1838 he gave an account of three days' excursion to the mountains of Ternova in Carniola, made in company with Signor Tommasini of Trieste. On the 10th of January and 11th of April 1839 he read communications on certain continental plants allied to British species, the plants having been chiefly collected in Carniola and in the neighbourhood of Trieste.

In the summers of 1839–40 he delivered a scientific course of lectures on zoology, as well as one of a more popular nature, in which he pointed out the bearings of zoology on geology, a subject of which he was afterwards the most able expounder in Britain.

In 1839, at the Birmingham Meeting of the British Association, he and other naturalists finding that they had not their proper place at the convivial meetings, instituted a separate ordinary. The first Natural History Section dinner happened to take place in an inn of that town having the sign of the Red Lion; and ever afterwards the Natural History Club thus commenced was designated the Red Lion Club. The Red Lions have had their annual social reunions at every meeting of the Association since that time; and on these festive occasions, Forbes, who was perpetual president, had always a scientific song of a playful and humorous nature. Many of these songs were printed in the 'Literary Gazette.' It is interesting to notice, that among his papers was found an unfinished song, which he meant to have given at the Liverpool Meeting, and which contains a clever view of the geological dispute between Murchison and Sedgwick.

During this year he seems to have taken up in an especial manner the subject of fossil botany; and we find, on the 10th of May, that he proposed that the Botanical Society should print a Catalogue of the Fossil Plants of Britain. The Society entertained his proposal, and appointed him, along with his friends Torrie and Cunningham, to prepare the list.

He published this year 'Zoological Researches in Orkney and Shetland,' and zoological papers in connexion with Goodsir. In the 'Report of the Botanical Society's Proceedings' of the 12th of December 1839, and also on the 10th of December 1840, he is entered still as Foreign Secretary, as Member of the Wernerian Society, and as Lecturer on Natural History.

In 1840 he published in the 'Edinburgh Student's Annual,' a paper on the Distribution of the Mollusca of Britain, more especially with reference to the Pleistocene Geology.

In 1841 he published his beautiful Monograph on the British Star-Fishes, and other Echinoderms. The accurate drawings of the animals, and the exquisite tail-pieces and vignettes, were drawn by himself on wood, so as to be ready for the woodcutter. During my morning visits to him at this time, I found him always busy with his pencil.

On the 11th of March of this year he read to the Botanical Society a paper on the Specific Value of the Antherine Appendages of the genus *Viola*, in which he developed philosophical views in regard to what he calls the law of *undulation* of character in plants and animals. This law, he says, "has not been properly studied by naturalists, nor its value rightly appreciated; otherwise we should not have that common scientific phenomenon of imperfect descriptions presented as specific characters." The paper embraced not merely a description of the characters of the genus *Viola*, but an illustration of this law in the arrangement of the species, and their geographical distribution. It contains the germ of those views which he afterwards so fully enunciated, relative to types and representations.

In the spring of 1841 he accepted an invitation from Captain Graves, of the Beacon, to join the surveying party in the Mediterranean, in the capacity of naturalist. He and I met in London in April, along with Vogel, McWilliams, and Stanger, who were about to join the expedition to the Niger.

He was occupied until 1842 in examining the Ægean and the coasts of Asia Minor. During part of the time he visited Lycia and assisted Sir Charles Fellowes, along with Mr. Hoskyn, Mr. Daniell and Lieut. Spratt, in the exploration of some of the lost cities. His researches in the Ægean, in regard to marine life at different depths, led to those speculations which he afterwards promulgated relative to submarine life in connexion with geological changes. During this expedition his friend the Rev. E. T. Daniell died of fever brought on by malaria, and Forbes's life was also placed in imminent danger by a similar attack. He struggled through the fever, after lying for nearly a fortnight in a helpless state, without tasting food or receiving any medical advice. This Ægean fever materially affected his constitution, and he had frequent aguish attacks afterwards, which he looked upon as referable to that illness.

During his researches at this time he looked with a naturalist's eye at everything, as is well shown in his 'Travels in Lycia,' which he afterwards (in 1846) published, in conjunction with Lieut. Spratt. Botany, zoology, geology, geography and antiquities were alike subjects of study and observation.

In July 1821 he wrote thus from Paros:—

"Paros, 24 July, 1841.

"Dear Balfour,

* * * * * * * * * *

Here I am out of the world, working away like *bricks* (so to speak) in the midst of ruins. Hitherto my working has been almost entirely mineralogical and zoological, owing to delays on the part of the Oriental Steam Packet Company. Only three days ago did any of my parcels reach me, but they are now all here,—the box from the Botanical Society, a parcel of paper in oil-cloth from Dr. Graham, and a box from Sir William Jardine. I have dried a lot of plants in the paper which I got at Malta, but have hitherto regarded rather the collection of specimens to illustrate the flora of the Isles, than of duplicates, not having materials for the latter. Unfortunately the lateness of arrival of the box will prevent much being done in that way *here* this year, as the flora is almost gone, burnt up already, and there are no mountains sufficiently high for subalpine plants. Those of Naxos which I have ascended are 3500 feet high, but the vegetation of their summits is the same as that of their bases.

"I have just returned from a cruise among the islands, and I have been five weeks away in a little cutter with every convenience. The botanical result is, that the vegetation of all the islands I have seen is *exactly* similar.

"I set off next week in another of our tenders on a six weeks' cruise, to visit the Volcanic isles and the south end of the Morea,—I hope with better botanical results. But as I said before, for botany one should be at work here in April. Next year I shall be better prepared for it. If one of the Commander's schemes, however, is put into execution, I expect yet to reap a rich harvest of plants this autumn. He proposes to send the 'Isabella,' one of our tenders, to the Gulf of Macri in Asia Minor to complete a survey. He will remain there six weeks, and I propose to go with him and ascend the snowy ridges of Taurus, which are within a few miles of Macri. As these mountains are from 5000 to 10,000 feet high, I may yet get a rich store of valuable plants from a country almost, if not wholly, unexplored.

"I hope yet we shall go to Candia in spring, which will be a great point for the botany. The zoological results, so far chiefly marine, have fully satisfied me, and I expect will prove most valuable. I am at work every day, and although I have a glorious set of companions, work very hard. I wish there was some one with me to do the dredging and preserving, as it takes up much time. As yet I have left birds alone. I expected Thompson to have done them, but he is off home again, as I suppose you know already. Fishes, I let none of them escape me."

Another letter is dated—

"H.M.S. Beacon, Macri, Asia Minor,
February 28, 1842.

"In my last letter I mentioned my intention of proceeding to Asia Minor in one of the Beacon's tenders in autumn. Having done so in the early part of last October, it has been out of my power to write to you or any of my friends, as there is no communication between these shores and Europe. Still I expected to have written to the British dominions letters in abundance before the new year began; but circumstances most unexpected have sent the Beacon down here to join us, and prevented our joining it at Athens, as was intended.

"To give my itinerary in due order, my proceedings have been as follows:—Returning in October from a round of the islands of the Archipelago,—a cruise which was exceedingly fruitful in results as regarded marine zoology and tertiary geology, but in consequence of the season almost fruitless in botany,—I found the Beacon at Paros with half her crew laid up by the terrible fever which kills so many people here in summer, one of her best officers dead, and all in low spirits. The people under my charge,—for (you will laugh, I doubt not when I say so,) I have not only acted out here as naturalist, but when accompanying the tenders, as surgeon,—escaped altogether. In several cases here I really find my medical knowledge, small though it may be, of the greatest service. Indeed, at the present moment I am acting as physician in ordinary to the greatest personage in the country near us, namely, the Mohussil or Governor of Severo, 'a very great Turk with a very long name,' as the song goes.

"From Paros I set sail in our little schooner the *Isabella* to the shores of Asia Minor, and remained in her from October to the end of the year. I was thus able to make my promised excursion to the Taurus, ascending the mountains to the height of 9000 feet, and journeying among them for fourteen days. But though I loaded a mule with boards and paper, I grieve to say I could not fill it. Everything seemed to have gone out of flower to spite me, and what remained were odds and ends of plants past flowering.

"As this country, especially the alpine part (I speak of Lycia), has been visited by no botanist, I gathered every fragment most religiously, with a view to depositing the reliques (such as they are) in the Botanical Society; and they are now packed up and boxed in the charge of the captain of an English vessel which has unexpectedly come in here, and will be carried by him free of charge to some English port. I have directed them to Pamplin. Open and examine them when they come. Bad as they are, they have a geographical importance, and I do not take blame to myself for their badness.

"Next week the Beacon goes to Malta; if she had only stayed a month longer, I should have had lots of plants, now only beginning to flower. I remain behind with a view of rejoining her in Candia in May. I go up the country, but as it will be impossible during that journey to collect many specimens of everything, I shall confine myself to making a pretty perfect set of Lycian plants for the herbarium of the Botanical Society, Ward, Graham and yourself, which on consideration I think will be the best way of benefiting science in a country as yet unexplored, and better than laying by dubious stores. I enclose a table of the winter vegetation here to give you an idea of it. Lay it on the table at some meeting of the Society. I have not been fortunate hitherto in seeking after materia medica information, but hope to be so."

After having carried on his researches in the Ægean Sea, he had determined to proceed to Egypt and the Red Sea on a dredging excursion, when intelligence reached him that he had been chosen Professor of Botany in King's College, London, as successor to the late Professor Don. Application for this had been made by Goodsir and some other friends in his behalf, and his claims were at once recognized by the electors.

In 1842 he came to Britain with collections and drawings of scenery, of antiquities, of plants, of animals, and of men and manners, which in extent, variety, scientific value and artistic skill have never been equalled. A sum was voted by the Treasury for the publication of these, which Forbes intended to append to a treatise on the Natural History of Aristotle, a work for which he had collected ample materials. He commenced the preparation of 'Rambles of a Naturalist,' and in 1843 he writes, "my leisure now I give to my long advertised 'Rambles.' The cuts are done, but the middle of the book is yet unwritten."

His introductory lecture on botany was delivered in King's College on May 8, 1843, and is a valuable one, full of original views and of potent arguments in favour of the educational value of Natural History. He now rose rapidly in favour. In 1843 he was appointed Curator and Assistant Secretary of the Geological Society of London, and became a Fellow of the Linnæan Society. At the meeting of the British Association at Cork this year he read a Report on the Mollusca and Radiata of the Ægean Sea; and as connected with his Ægean 'Travels,' he subsequently published remarks on the light thrown on geology by submarine researches. In October 1843 he writes thus:—

"Geological Museum, Somerset House.

"Dear Balfour,

"I have intended to write to you for a very long time, but intentions are not always deeds with me, in consequence of having a mass of work in hand,—mostly not my own,—which must be done, and which absorbs all my time. The fact is I have too much to do,—this geological post being a desperately fatiguing one, and leaving but little time for my more legitimate occupation at King's College. My class last summer went off very well. I had a most excellent set of men, who behaved admirably and never flagged in attendance. I had three or four excursions of much interest, managed in our old fashion, alarming the neighbouring villages by an invasion of twenty or so *vasculiferi*. Shaw acted as my esquire and jester on all these occasions, and Lankester, with some other amateurs, also occasionally joined my ranks. My pupils were 48 in number, next to Lindley's, the best botanical class in London. If the 48 all paid the fees into my pocket 'more Scotico,' it would be very satisfactory, but the College absorbs more than a fourth of it, so that my receipts were much under the hundred, and as in one's first course there are many expenses, I get but little out of the total. As the College has a diagram painter, there was a saving on that score; for being obliged to be at the Geological all day long, I have no time to paint diagrams. The most provoking want is having no botanic garden, and I have no spare days to run after and make friends with gardeners, so that

I have great difficulty in procuring fresh illustrations. Hooker offered me them from Kew, but on condition that I should go and select for myself personally, which is impossible as I am situated. We have a capital herbarium at the College, but when it is to be put into the state it should be I really cannot tell. It vexes me much thus to find myself unable to give sufficient time to any one thing.

"The Medical Professors at King's are a capital set of men, enthusiastic and talented. I have a fine room for a Museum, and should desire nothing better than time and fortune to do as I like there. I am now only beginning to touch my Eastern plants. When they are sorted they shall be distributed, but I cannot promise as to the time. My pupils in the Beacon are collecting with great success, and sent me a few days ago a beautiful little parcel from Mount Ida in Crete, including some things which may be new.

"I commend your intention of writing a text-book. What we want is a clear statement of the present state of vegetable physiology and anatomy, and a concise and *contrasting* view of the orders in a portable class volume. I speak now from having felt the want of such."

In the position of Geological Curator, "his extensive knowledge of recent vegetable and animal species, and his remarkable acquaintance with the laws of their distribution (particularly as regards invertebrate animals), became available for general palæontological research. Here, too, he was enabled to apply to geological research that peculiar knowledge of the conditions of existence of species, which his continual operations with the dredge had led him to. We owe to him the methodical use of the dredge as an instrument of research in natural history; to use his own words, 'the dredge is an instrument as valuable to a naturalist as a thermometer to a natural philosopher.' At his instance, the British Association has appointed for many years a dredging committee, charged with the duty of completing our knowledge of marine animals, with a view to geological inquiry."

In 1845 he became a Fellow of the Royal Society, and was afterwards a Member of Council. He was appointed Palæontologist to the Geological Survey of Great Britain, under Sir Henry De la Beche, and subsequently became Professor of Zoology and Palæontology in the Government School of Mines. He gave lectures in King's College, in the Royal Institution, in the School of Mines, and at Marlborough House; and he arranged the fossils of the splendid Geological Museum in Jermyn Street. He continued to prosecute his practical geological work in various parts of the kingdom, and published from time to time the results of his researches.

About the year 1846, he was attacked with a severe illness of a nephritic nature, during which his life appeared to be in great jeopardy. Although he recovered from the attack, yet the effects of it were frequently felt by him afterwards; and it seems to have laid the foundation of his fatal illness. He often remarked, that he appeared to possess great vitality, from having struggled through two such serious attacks; and, in his last illness, his hopes were for a time kept up by the idea he entertained of his vital powers.

Towards the end of the year 1846, he published, with Lieut. Spratt, his 'Travels in Lycia,' a classical work, containing interesting episodes in natural history, with a 'Sketch of the Botany of Asia Minor and the Ægean.' About the same time appeared his Monograph of the Southern Indian Fossils, in the Geological Transactions, illustrated by the best plates of fossil Invertebrata ever done in England.

About this time he wrote on the connexion between the distribution of the existing Fauna and Flora of the British Isles, and the geological changes which have affected their area.

In 1848 his admirable Monograph on the British Naked-eye Medusæ was published by the Ray Society.

Subsequently appeared his Palæontological and Geological Map, contributed to Johnston's Physical Atlas; and in 1850 he completed, with Mr. Hanley, the splendid work on the 'Natural History of the British Mollusca and their Shells.'

His wonderful facility in all departments of science was due, Hooker says, to the early age at which he acquired its rudiments and to the efficient practical training in systematic botany and collecting which he received in Edinburgh; to his quick perception of affinities; to his philosophical views of morphology, distribution, structure, functions, and the mutual relations of all these; to his mind being richly stored with the literature of the sciences; to the wide experience obtained during his travels; and, finally, to that heaven-given power of generalization and abstraction which he so eminently possessed.

In 1848 he married a daughter of the late General Sir C. Ashworth. It is curious to notice, that during that year four were married out of the ten who met to institute the Botanical Society.

In 1852 he published some valuable observations in regard to genera and species, in reference to which I received the following letter:—

"Jermyn Street, 19th June, 1852.

"My dear Balfour,

"The paper I sent you is a brief abstract of a long lecture*. It contains, in fact, only the table of contents, without the illustrations and comments: hence its obscurity.

* [Inserted in the 'Annals' for July, 1852.]

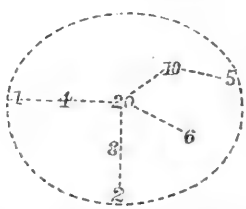
"My notions about *genus* are these :—

"What we call class, order, family, genus, are all only so many names for *genera*, of various degrees of extent. It is in this sense I use the word *genus* in my lectures. Technically, a *genus* is a group to which a *name* (as *Ribes*) is applied ; but *essentially*, *Exogens*, *Ranunculaceæ*, *Ranunculus*, are genera of different degrees.

"Now, one of the chief arguments in favour of the *naturalness* of genera (or *groups*, if you like), is that derived from the fact that many genera can be shown to be *centralized* in definite geographical areas (*Erica*, for example) ; *i. e.* we find the species gathered all, or mostly, within an area, which has some one point where the *maximum* number of species is developed.

"But, in *geographical space*, we not unfrequently find that the same genus may have two or more areas, within each of which this phænomenon of a point of *maximum* number of species is seen, with fewer and fewer species radiating, as it were, from it. [This is what I speak of under C, as *more centres than one in geographical* space.]

Area of a genus.

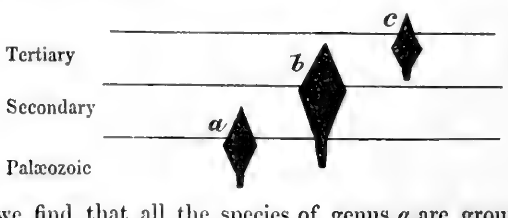


The numbers refer to species.

[This diagram is imaginary.]

Thus, *Viola* has an American as well as an Old World point of maximum of development, around which you may group the species, gradually diminishing in number.

"In *time*, however (or, in other words, in *geological distribution*), so far as we know, each generic type has had, so to speak, an unique and continuous range :—



Thus we find that all the species of genus *a* are grouped together within a succession of formations which commence at a certain point, and cease at another ; so with *b*, so with *c* ; but when once a *generic type* (as *Trilobites*) has ceased, it never reappears. Therefore I speak of a genus having an *unique centre* in time.

"Under *italic c* I say, that a genus is an abstraction, a divine idea. I think the very fact of the centralization of groups, of allied species, *i. e.* of genera, in space and time, is sufficient proof of this. Doubtless we make many so-called genera that are artificial; but a true genus is natural; and, as such, is not dependent on man's will.

"I dare say that I have only added obscurity to obscurity by this explanation; but, with diagrams, and time for talk, I think I could make the matter quite clear.

"Yours very sincerely,

"EDWARD FORBES."

He was elected in 1853 to the Presidentship of the Geological Society; and delivered, on leaving that office, an admirable address on the state of geology, which has been recently published.

In May 1854, on the demise of Prof. Jameson, he was called to the Chair of Natural History in this University. This had long been, to him, an object of his highest ambition. No one was so well qualified for it; and, had he been spared, he would undoubtedly have greatly extended its reputation, and would have made our university still more eminent as a school of science. Often had he stated in his letters, that he looked on Edinburgh as a place where the finest Natural History School in Europe could be formed. The Museum would, under his auspices, have mightily increased. Even during the short period he was with us, boxes of specimens were coming in from all quarters. He had resolved to dedicate himself to the work of arrangement; and his services in connexion with the New Museum of Economic Geology were looked forward to as of immense importance. The opening of the Museum to the public, and to all students of natural history, was an object he had in view; and he had already shown his liberal spirit by opening it to the pupils of natural history under Dr. Fleming at the New College.

He lectured last summer with the greatest success. His class amounted to 150, and all felt that they were listening to the prelections of a master-mind in science. Already had he inspired many with something of his own zeal; and his excursions to various places in the neighbourhood, such as Craigleith, Arthur's Seat, Inchkeith, Inchcolm, and Loch Lomond, were but foretastes of what he would have done in the way of practical geology. He had laid large and comprehensive plans, both as regards zoology and geology, and had commenced in earnest museum work.

Those who had the privilege of being with him in the class-room and in the field during his short career in Edinburgh as a

D 2

Professor, saw something of his merits as an expounder of nature in a comprehensive way. He took an enlarged grasp of science in all its departments, and in all countries; his prelections were of a nature never yet equalled in Britain. With all his knowledge, he combined an affability, a modesty, a kindness, and patient perseverance which endeared him to every one. No student of nature was beneath his notice; no fact recorded by a pupil, however humble, was passed with neglect. He was ready at all times to be questioned, and was prompt to point out any spark of merit in others. He had no jealousy, and never indulged in attacks on others. He gave full credit to all, and was more ready to see the bright than the dark spots in the character. Even to those who had criticised him severely, he bore no ill will, and he certainly did not return railing for railing. He had a truly generous spirit, and was totally devoid of narrow bigotry. He was desirous of promoting science, independent of all selfish views. He loved it for its own sake. He had a noble temper, unaffected by good or ill fortune, and he was universally and deservedly beloved.

After his summer lectures he was busily engaged arranging matters in London. He made excursions in different directions, and his last dredging was carried on with myself, Dr. MacDonald, and Prof. Wyville Thomson, at North Berwick, in September last, previous to the meeting of the British Association. He attended that meeting in Liverpool, and occupied the chair in the Geological section. He made communications both to the Zoological and Geological sections. Few will forget the brilliant eulogium passed upon him by Prof. Sedgwick, at the conclusion of the business of Section C.

After the Association Meeting he spent some time in Dumfriesshire, and was there exposed, during an excursion, to wet, which was followed by shivering and febrile symptoms. These were supposed by him to indicate a return of his Ægean fever. When he came to Edinburgh he was by no means well, but much was attributed by him to being overworked. In spite of this he continued to labour, visited Mr. Murray of Monckland, for the purpose of observing geological phenomena, and vigorously set about preparation for his winter work, as well as for the 'Edinburgh New Philosophical Journal' (previously Jameson's), of which he and Dr. T. Anderson were now the editors. He also revised his elaborate Paper on the 'Geological and Palæontological Map of Britain' for the new edition of Johnston's 'Physical Atlas.'

One of his latest productions was the article 'Siluria' in the last Quarterly Review, which concludes with this passage, so characteristic of his peace-making spirit:—

"Men whose work, both of head and hand, is done mainly under the broad sky, and along the craggy sides of mountains, heedless of weather and toil, are not likely to use mincing forms of speech or mollify their sentiments when engaged in discussions, though all the time mildness and mercy are at the foundation of their thoughts. Better and truer men, whether in field or council, there are not living than the two famous geologists, the nature of whose differences we have endeavoured to expound. They have worked long and well in co-operation, heart and hand united; and though the fortune of scientific war has led in the end to the crossing of their pens, the names of Sedgwick and Murchison will go down to posterity, side by side, and bracketed together in the glorious list of benefactors of mankind through the advancement of science."

He commenced his lectures on 1st November, 1854, and gave an introductory address, which has been found among his manuscripts, and will appear as a posthumous work in the January number of the Edinburgh New Philosophical Journal. He lectured for five or six days, and entered seventy-one pupils in his class roll. During all this time he complained more or less of febrile symptoms. These at last increased so much that he consulted Dr. Bennett, who at once ordered him to give up lecturing. This he did on Thursday the 9th of November, in the hope of being able to resume work on the Monday following.

On Saturday the 11th, I received a note from him, in which he enters fully into the reasons for not altering the hour of his lecture, as had been proposed by some of his colleagues. He very truly says, "For my own part I hold that to change any hour of lecture after the arrangements of the session are completed and advertised, is both deleterious and unbusinesslike * * *. The first consideration should be academical convenience; the next, the propriety, if there are to be changes, of announcing them a full session beforehand; the last, private convenience." He concludes by saying, "I was too ill to venture to the Botanical Society on Thursday."

During his illness he was very anxious about the Journal, and on Monday the 13th he wrote a note to me, in which he says, "I am completely shattered for the moment, and don't know how to get on with the Journal, being so ill. Could you look in upon me and advise? I am still in my bed." This is probably the last note he wrote.

I visited him on Tuesday, and found that he had been suffering great pain, and although the violent symptoms were relaxed, he was unable to converse with me. On Wednesday the 15th he was rather easier and was able to give me directions about the papers for the Journal; spoke with great anxiety about his pupils and his class, and gave a message to several of them.

From that time the disease increased, and the symptoms became of a very alarming nature. He was attended assiduously by his old friend Goodsir, along with Dr. Christison and Dr. Bennett; but all medical skill was unavailing. On the evening of Friday he gave his last directions, leaving his specimens to the College Museum, at Edinburgh, and his papers to Robert Godwin Austen, Esq. He continued to sink, and died at 5¼ P.M. on Saturday 18th November, being sensible to the last.

In announcing this sad event at the Council Board, the Lord Provost said it was his melancholy duty to notice the removal from amongst them by death of Professor Edward Forbes, one of the most distinguished ornaments of their University. Professor Forbes was appointed to the Chair of Natural History so recently as May last, and the appointment, made by the Crown at the unanimous suggestion of the Council, was hailed by them and by the whole scientific world as an acquisition to the University, and as one which would in all likelihood tend to increase its celebrity in that department to which he had directed his attention. He had given a course of lectures during the summer, and had entered upon his winter course, when a disease of some standing suddenly removed him from among them. He (the Lord Provost) knew that the Council would deeply mourn the loss which they had thus sustained. Professor Forbes had been cut off at the very commencement of what they had fondly hoped would be a career of increased usefulness in a position which it had been one of the dearest objects of his heart to attain. He (the Lord Provost) had to propose that the Council should express their deep sympathy with his bereaved widow and family at the loss which they in common with the community had sustained, and that, as a mark of respect to his memory, they should offer to attend his remains to the tomb.

The body was interred in the Dean Cemetery on Thursday 23rd November, near the burying-place of Professor Wilson, and the funeral was attended by his colleagues, the Lord Provost, magistrates, council, a large concourse of students, and nearly all the followers of science in Edinburgh.

Only a few days before his death he had been elected by the Royal Scottish Academy to fill the honorary office of Professor of Ancient History, in room of the late Professor Wilson.

Immediately after the funeral, a meeting was held at Dr. Bennett's house, which was attended by many of Forbes's friends in London, Edinburgh and the provinces, at which it was resolved to have a marble bust of him executed by Steel, to be placed in the College Museum. It was also proposed that a duplicate might be placed in the Jermyn Street Museum.

Mr. Goodsir had taken a cast after death, which supplies important materials for the bust. It is expected that the model will be ready for the London Exhibition in May 1855, and the busts by January 1856. It is announced that his pupils in King's College, London, have met for the purpose of procuring a similar memorial of their late Professor.

At the request of several of his friends, Dr. George Wilson, one of his early companions, has kindly consented to draw up a memoir of him, and is now collecting materials for that purpose. It is hoped that all who can supply information in regard to the career of our late departed friend, will communicate as soon as possible with Dr. George Wilson at Surgeons' Hall. The memoir will probably appear as a separate volume.

I cannot more appropriately conclude this sketch of my departed companion, friend and colleague, than by quoting the statements made regarding him by four men of eminence, viz.—an anatomist, a botanist, a geologist, and a zoologist, who well knew his merits. Goodsir says, "Professor Edward Forbes was pre-eminently a naturalist. His attention had never been exclusively directed to any one of the Natural Sciences. He was equally a botanist, a zoologist and a geologist, from first to last. With a remarkable eye and tact for the discrimination of species and the allocation of natural groups, he combined the utmost delicacy in the perception of organic and cosmical relations. He possessed that rare quality, so remarkable in the great masters of Natural History, Linnæus and Cuvier, the power of availing himself of the labours of his brethren—not, as is too often the case, by appropriating their acquisitions, but by associating them voluntarily in the common labour. Entirely destitute of jealousy in scientific matters, he rather erred in overrating than in underrating the services of his friends. He was consequently as much beloved and confided in by his seniors in science as by the youngest naturalists of his acquaintance.

"Possessed of such comprehensive intellectual sympathies, Professor Edward Forbes has always been considered by his friends in Edinburgh and other places as the co-ordinating spirit of his circle; and his return as Professor of Natural History was considered by all who knew him as a guarantee of the steady progress of his favourite science in the metropolis of Scotland. But, alas! by a dispensation of Providence, wise, doubtless, though inscrutable and painful to us, he has been cut off. Nevertheless, it may be, that short comparatively though his career has been, he has already, in his writings and in his influences on his friends and pupils, left behind him such germs of thought as shall hereafter develope themselves in the advancing science of the period, and so secure for our departed friend that full measure of scientific results which he ever longed after, not out of vain glory, for no man could be more free from such a feeling, but for the good of mankind and the glory of God."

Dr. Joseph D. Hooker writes:—"Endowed with real genius, possessing many and highly cultivated talents, no less conspicuous as an original thinker than as a hard and conscientious worker, accomplished in literature and art, equally graceful and ready with pencil or pen, in the lecture-room as in the closet, and with far rarer qualities than all these—the purest and most disinterested love of science, and the most generous appreciation of the labours of others—it is no wonder that he was beloved and admired beyond any natural historian of his day."

Hugh Miller, in the conclusion of his late admirable address on the fossiliferous deposits of Scotland, when resigning the chair of the Royal Physical Society, remarks: "I trusted to have had the honour of resigning the chair to a gentleman (Prof. E. Forbes) who, fifteen years ago, was one of the most active and zealous members of the Royal Physical Society; and who had, since that time, achieved for himself in natural science in general, and in geology in especial, a reputation co-extensive with the civilized world. But, alas! Death reigns. This distinguished man, in the full blow of his fame, and in the mature prime of vigorous manhood, has passed suddenly away; and wherever in either hemisphere physical science is cultivated, or the by-past history of our globe excites its legitimate interest, his early death will be felt and deplored as a heavy loss. The spoiler has broken abruptly off many a train of ingenious thought, cut short many a course of sedulous inquiry, arrested, just ere its formation, many a profound induction, and scattered hoards of unrecorded knowledge, the adequate re-gathering of which many years to come may fail to witness. But our idle regrets can neither restore the dead nor benefit the living. Let us rather manifest our regard for the memory of our illustrious brother—taken so unexpectedly from among us—by making his disinterested devotion to science our example, and by striving to catch the tone of his frank and generous spirit. And seeing how very much he succeeded in accomplishing within the limits of a life that has, alas! fallen short by more than thirty years of the old allotted term, let us diligently carry on, in the love of truth, our not unimportant labours, remembering that much may be accomplished in comparatively brief space, if no time be lost, and that to each and all that 'night cometh' at an uncertain hour, under whose dense and unbroken shadow no man can work."

Mr. James Wilson writes: "We should seek in vain to express the full measure of grief, we may say dismay, with which the unlooked-for death of this distinguished naturalist has filled all hearts. While his friends were in the first freshness of their elation at the prospect of the long and bright career which lay before him, and rejoiced in the force and efficiency of that impulse about to be given to the earnest study of the wonderful and manifold works of creation, this most skilful and accomplished interpreter has been suddenly removed from us, and his place now knows him no more for ever. Such dispensations are indeed inscrutable mysteries, and cannot be seen through even by those whose eyes are not bedimmed with tears. But, may all of us, and more especially the widow and the fatherless, bear in mind that 'the Lord reigneth.' He gives and He takes away, and let us bless His name, even amid the bitterness of unavailing sorrow."

VII. *On* Hypericum anglicum. By Charles C. Babington, M.A., F.R.S. &c.

Read 14th December 1854.

Since the publication of my remarks upon the supposed *Hypericum anglicum*, found near Cork by Dr. Balfour (Ann. and Mag. Nat. Hist. Ser. 2. xi. 360; Edin. Bot. Soc. Trans. iv. 169), I have received additional information concerning it, and have also been favoured with a specimen of an *Hypericum* gathered upon the cliffs above Falmouth harbour in Cornwall, which agrees very exactly with Bertoloni's description of his *H. anglicum*. It appears therefore proper to publish the results of the further study which I have been led to give to the subject, more especially as my opinion has undergone a change.

In my former paper it was stated to be doubtful if the plant there called *H. anglicum* ought to be separated specifically from *H. hircinum*, and I am now strongly disposed to believe that they are indeed one species. At the time of that publication I had been led to suppose, that the plant found near Cork was wild there; but am now informed by Mr. Isaac Carroll of that city, that the station noticed by Dr. Balfour closely adjoins, and, indeed, one side of it forms the "boundary of Lota Wood, whence many half-naturalized species have been recorded by Dennis Murray, such as *Geranium phæum*, *Atropa Belladonna*, &c., plants by no means native there; and from this place," Mr. Carroll thinks that the *Hypericum* in question has migrated. It is not contained in Dr. Power's very carefully prepared Flora of Cork (1845), and therefore was not known to him as a native, or even a naturalized plant. He was particularly careful to include all plants of both these kinds. It is now perfectly naturalized, but only, as Mr. Carroll informs me, in suspicious places. In addition to the station near Lota Wood, a single "plant of it grows on an old wall at Monkstown, but although there is no modern garden from which it might have escaped, yet the wall is close to an old castle and burying-ground, localities always famous for doubtful species." Mr. Carroll thinks that *Hyper. calycinum*, *Vinca major*, *V. minor*, *Hesperis matronalis*, *Iris Pseudacorus*, and *Sambucus Ebulus* are similarly escapes from cultivation in the neighbourhood of Cork. This information seems to settle in the negative the claims of this plant to be considered as a native of Britain*.

The probability of its distinctness from *H. hircinum* was chiefly founded upon a supposed difference of habit, which I now do not believe to be very great; also upon the shape of the leaves, upon which I am now inclined to place very little weight. The *H. anglicum* (Bab.), but not of Bertoloni, is therefore probably nothing more than *H. hircinum* escaped from cultivation, or perhaps intentionally planted at Lota Wood and elsewhere in the south of Ireland.

Having disposed of *H. anglicum* (Bab.), I have next to consider if there is any British plant according with the *H. anglicum* (Bert.), to which latter plant both of the synonyms quoted in my former paper belong. In the year 1853 I received from Mr. T. R. Polwhele, a student of St. John's College, Cambridge, a fine specimen of an *Hypericum* gathered by him on the "cliff above Falmouth Harbour, Cornwall." This specimen has the branching habit, winged peduncles, large flowers, and long styles of *H. hircinum*, combined with the leaves and sepals of *H. androsæmum*. These are the very points to which Bertoloni directs attention as the distinctive characters of his *H. anglicum*, and as the plant under consideration accords well with the figure erroneously named *H. androsæmum* in 'English Botany,' to which Bertoloni refers as representing his *H. anglicum*, I think that we may reasonably conclude that the Cornish specimen is really *H. anglicum* (Bert.). That some plant agreeing with the figure in 'English Botany' inhabits Britain may be concluded with certainty, when we call to mind the great accuracy of the figures which proceeded from the pencil of the late Mr. James Sowerby. As Bertoloni has made some slight mistakes in the synonymy of his plant, it is proper to consider each of his references separately. I proceed then to take them in order. *H. androsæmum*, Sm. Eng. Flora (iii. p. 323), probably includes both the plant so named and also *H. anglicum*, but the points which would decide the question are not noticed in the description there given. It has been already remarked that Eng. Bot. (t. 1225) represents *H. anglicum*. Curtis, Fl. Lond. (ii. t. 103, as it is quoted in the 'Fl. Italica,' but i. t. 164, as is apparently the more correct reference to that variously arranged work), is a beautiful figure of *H. androsæmum*, and is therefore erroneously placed under his *H. anglicum* by Bertoloni. Hooker's Brit. Flora (ed. 2. p. 332) may include both of the plants. Babington's Manual (ed. 1. p. 57) was intended

* Prof. Balfour states that it was found by Dr. Sibbald on the high road between Aghada and Cloyne, to the south-west of Aghada, and that that gentleman did not remember anything to make him suspect that it had been introduced.

to include the true *H. androsæmum* alone; for I was then totally unacquainted with the supposed *H. anglicum*, and was in error when quoting Eng. Bot. 1225 as a representation of my plant. The same error I continued to commit in the 2nd and 3rd editions of the 'Manual.' Reichenbach's figure named *H. grandifolium* is far too imperfect for satisfactory determination, but probably does not represent either of the plants under consideration, and what he may have received from the "Isle of Arran, Buteshire," it is impossible to tell.

It now only remains for me to place in a technical form the characters of *H. anglicum* according to my present views of it.

H. anglicum (Bert.); stem shrubby 2-edged much branched, *peduncles 2-winged*, leaves subcordate-ovate rather acute, cymes few-flowered, sepals broad unequal, petals twice as long as the sepals, *styles exceeding the stamens*, capsules "oval."
H. anglicum, *Bert. Fl. Ital.* viii. 310.
H. androsæmum, *Eng. Bot.* t. 1225.

The plant is tall, almost shrubby, producing a rather long simple branch from nearly all of the upper axils of the leaves, most of them ending in cymes of from 1 to 5 flowers. The flowers are large, and much resemble both in size and appearance those of *H. hircinum*. The peduncles are furnished with two well-marked wings, extending from their true base at the bracts up to the flower. The sepals are ovate, rather acute, and unequal, and are probably reflexed from the fruit. The styles have a tendency to break off at a short distance from their thick base as the capsule enlarges, and in that state may be mistaken for such short ones as belong to *H. androsæmum*. The capsule is probably rather pointed when ripe, but I have not seen it in that state. It is certainly of that shape in an earlier state.

This plant is more nearly allied to *H. hircinum* than to *H. androsæmum*. It flowers in July, August and September.

Since this paper was written, Dr. Balfour has kindly placed in my hands all his specimens of these plants, and I learn from them that he gathered *H. anglicum* on the banks of the Crinan Canal in Argyleshire (1827), near Culross on the Frith of Forth (1833), and near Galway (1838). It will probably soon be noticed in many other places. It is hoped that these remarks will cause botanists to examine carefully all specimens named *H. androsæmum*, in order that we may soon be informed of the true claims of *H. anglicum* to be separated from it; and may also learn what is the geographical range of each of the plants.

VIII. *Report on a Collection of* Diatomaceæ *made in the District of Braemar by* Professor Balfour *and* Mr. George Lawson. By R. K. Greville, LL.D. &c.

Read 8th February 1855.

In the course of the autumn of last year, Professor Balfour made a botanical excursion with a small party of friends and pupils to the mountainous district of Braemar; and his attention having been directed for some time past to the Diatomaceæ, he and Mr. George Lawson made a considerable number of gatherings in a great variety of situations, from the patches of snow which even in summer are always to be found in certain nooks and corners of Ben-na-Muic-Dhui, down to the valleys of the Dee, Glen Callater and Glen Tilt. The gatherings were subsequently placed in my hands, with a request that I would examine and report upon them to the Botanical Society. I have accordingly submitted the collections to a patient investigation, and in now presenting my account of them, I have to acknowledge the kind assistance of the Rev. William Smith, Professor of Natural History in the Cork College, to whom I referred the new and dubious forms as the individual most competent to give an authoritative decision in such cases.

The following is a general list of the species collected, which, although not so extensive as might have been anticipated, is rich in rare and interesting forms. The new species, and those recently or for the first time added to the British flora, are printed in *italics*.

Epithemia turgida (*Ehr.*).
—— alpestris, *W. Sm.*
—— rupestris, *W. Sm.*
—— gibba (*Ehr.*).
Eunotia Arcus (*Ehr.*).
—— incisa, *Greg.*
—— gracilis, *W. Sm.*
—— monodon, *Ehr.*
—— diodon, *Ehr.*, three forms.
—— *Camelus*, Ehr.
—— triodon, *Ehr.*, two forms.
—— *tridentula*, Ehr.
—— tetraodon, *Ehr.*
—— *quaternaria*, Ehr.
Cymbella cuspidata, *Kütz.*
—— affinis, *Kütz.*
Cymbella *ventricosa*, Kütz.
—— Scotica, *W. Sm.*
—— Helvetica, *Kütz.*
—— *lunata*, W. Sm., nov. sp.
—— *æqualis*, W. Sm., nov. sp.
Amphora ovalis, *Kütz.*
Cocconeis Pediculus, *Ehr.*
Cyclotella operculata, *Kütz.*
Surirella linearis, *W. Sm.*
—— biseriata, *Bréb.*
Cymatopleura Solea (*Kütz.*).
Navicula *cocconeiformis*, Greg., nov. sp.
—— rhomboides, *Ehr.*
—— crassinervia, *Bréb.*
—— serians, *Kütz.*

Navicula firma, *Kütz.*
—— ovalis, *W. Sm.*
—— angustata, *W. Sm.*
—— gibberula, *Kütz.*
—— cryptocephala, *Kütz.*
Pinnularia major (*Kütz.*).
—— viridis (*Ehr.*).
—— *hemiptera*, Bréb.
—— acuminata, *W. Sm.*
—— lata (*Bréb.*).
—— alpina, *W. Sm.*
—— late-striata, *Greg.*
—— radiosa (*Kütz.*).
—— acuta, *W. Sm.*
—— tenuis, *Greg.*
—— divergens, *W. Sm.*
—— stauroneiformis, *W. Sm.*
Stauroneis Phœnicenteron (*Ehr.*).
—— gracilis, *Ehr.*
—— anceps, *Ehr.*
Synedra lunaris, *Ehr.*
—— radians, *W. Sm.*, with vars. β. and γ.
Cocconema lanceolatum, *Ehr.*
—— cymbiforme, *Ehr.*
—— Cistula, *Ehr.*
Gomphonema acuminatum, *Ehr.*, with var. γ.
—— dichotomum, *Kütz.*
—— tenellum, *W. Sm.*
Gomphonema capitatum, *Ehr.*, with var. β.
—— olivaceum (*Lyngb.*).
—— intricatum, *Kütz.*
Meridion circulare, *Ag.*
—— constrictum, *Ralfs.*
Himantidium Arcus, *Ehr.*
—— majus, *W. Sm.*
—— pectinale (*Dillw.*).
—— undulatum, *W. Sm.*
Odontidium hyemale (*Lyngb.*).
—— mesodon (*Ehr.*).
—— *anomalum*, W. Sm., nov. sp.
—— Tabellaria, *W. Sm.*
—— ? *Harrisonii*, var. β, W. Sm.
Denticula tenuis, *Kütz.*
—— obtusa (*Lyngb.*).
—— sinuata, *W. Sm.*
Fragilaria virescens, *Ralfs.*
Achnanthidium flexellum, *Bréb.*
—— lanceolatum, *Bréb.*
Diatoma tenue (*Ag.*).
Diatomella Balfouriana, W. Sm., nov. gen.
Tabellaria flocculosa (*Roth*).
—— fenestrata (*Lyngb.*).
Melosira nivalis, *W. Sm.*
—— *distans*, Kütz.
Orthosira *spinosa*, W. Sm., nov. sp.
—— orichalcea (*Mert.*).

I shall now proceed to notice the new species and a few others of novelty or rarity.

Eunotia Camelus, Ehr.? Pl. IV. fig. 1. Length ·0009″.

This is recorded in Kützing's 'Species Algarum,' published in 1849, as a native of the two widely separated localities, Cayenne and Labrador. It occurred in a recent state in one of the Braemar gatherings, and has been observed by Professor Gregory in others from Carr Bridge and Ben Nevis, and by Professor Walker-Arnott in one from Fell End, Lancashire. I have likewise seen it fossil, but very rarely, in Lapland Bergmehl. This diatom, in the opinion of the Rev. Professor Smith, is certainly the *E. Camelus* of Ehrenberg and Kützing, notwithstanding the inaccurate figure given by the latter, in which the base of the frustule is represented as concave. In the form under consideration the base is so remarkably straight, that it is difficult to conceive how an artist could have made such an error in its delineation. Professor Gregory, moreover, informs me that he has seen in the Mull deposit a form exactly corresponding with Kützing's figure; so that it is possible that two species may have been confounded together. Under these circumstances I consider it advisable to refer our diatom doubtfully to *E. Camelus,* and to add a figure for the guidance of the student. I have unfortunately no access to Ehrenberg's illustration (Amer. t. 2).

Eunotia tridentula, Ehr. Pl. IV. fig. 2. Length ·0005″.

Found along with the preceding. It belongs to a little group of minute, linear forms, quite distinct from the more robust and convex series having the same number of undulations. The only station given by Kützing for this species is America. Dr. Gregory has observed it in a great variety of gatherings from Banffshire; Carr Bridge, Morayshire; from the Findhorn and from Ben Nevis. Professor Smith obtained it also last year at a high elevation in Auvergne. It is probably therefore of general distribution.

Eunotia quaternaria, Ehr. Pl. IV. fig. 3. Length ·0007″.

A species scarcely to be distinguished from the last, except by the additional tooth or undulation. Cayenne is the only locality recorded by Kützing, but, like the preceding, it has probably escaped notice on account of its minuteness. Since I detected it along with *E. tridentula* in one of the Braemar gatherings, Professor Gregory has observed it in those from Carr Bridge and Ben Nevis. Dr. Walker-Arnott has also met with it, and it is in Professor Smith's list from Auvergne. In this form, as well as in *E. tridentula,* the base is slightly concave, and there is a small undulation near each end.

Eunotia incisa, Greg. Length ·0008″.

First observed and well figured by Professor Gregory in his account of the rich fossil diatomaceous earth of Mull, published in the 'Journal of Microscopical Science.' He has since found it in various recent gatherings; in fact, it appears to be very generally diffused throughout the alpine districts of this country. It is of frequent occurrence in the Braemar gatherings. I have likewise seen it in fossil deposits from the United States. Professor Smith, I believe, entertains some doubts whether this diatom be a genuine *Eunotia*; and it must be confessed that it has much the aspect of a *Himantidium,* bearing a close resemblance in form to *H. Veneris,* Kütz., as Professor Gregory has remarked. Kützing however admits it as a new species, and as the striation is that of a *Eunotia,* I feel disposed to retain it as such. Although not strictly speaking a novelty, I refer to it in this place chiefly in order to correct a slightly erroneous view regarding the outline. In examining the frustule under a power of three or four hundred diameters, there does appear to be an incision or notch near each extremity of the frustule; hence the specific name. But on the application of higher powers the apparent notch is found to be a deception caused by the nodule and a slight contraction, commencing at the nodule and continued to the apex. It is, in fact, the nodule interrupting the marginal continuity of the frustule, which causes the appearance of an incision. I find among living specimens quite as extensive a range of form as is represented by Professor Gregory in the paper above referred to.

Cymbella æqualis, W. Sm. Pl. IV. fig. 4. Length ·0014″.

A very distinct new species, so nearly symmetrical as to be liable at a hasty glance to be taken for a *Navicula.* There is however a curve at the shortly produced, obtuse extremities. The striæ are fine, but not very close. This form was abundant in one gathering only, composed of coarse black peaty mud extremely difficult to clean.

Cymbella lunata, W. Sm. Pl. IV. fig. 5. Length ·0013″.

Another new species, about the same size as the last, but the striæ are much stronger and more distant, and the shape narrow and elongated. The larger segment of the valve has a gentle and equal curve, while the smaller segment is nearly straight, a character sufficient of itself to distinguish it from the larger *C. Helvetica,* which is ventricose. From *C. Scotica* it is separated by the coarse striæ and the obtuse ends.

Navicula cocconeiformis, Greg. MS. Pl. IV. fig. 6.
Length ·0008″ to ·0011″.

Navicula nugax, W. Sm. MSS.

A new species, somewhat similar in outline to *Achnanthidium flexellum,* with striæ so fine that I have not succeeded in resolving them. I find that this species has been known for above a year to Professor Gregory, who had both sketched and named it previous to my detection of it in the Braemar gatherings. He had obtained it from Elchies and various other places in Banffshire, and latterly from Loch Leven.

Pinnularia hemiptera, Bréb.

This species, found, as Professor Smith informs me, not unfrequently since the first volume of his work was published, I met with almost pure near the Pass of Killiecrankie early last summer. It was obtained by squeezing the moisture out of *Sphagnum,* and along with it occurred an undescribed species, *Pinnularia gracillima,* Greg. MSS. In the autumn I again found it in the mountainous district of Redesdale in Northumberland, by resorting to the same process, and singular enough, *P. gracillima* was there also, with scarcely any intermixture of other diatoms. *P. hemiptera* greatly resembles *P. viridis,* but is distinguished from it by the much finer striæ, and perhaps also by a more strictly linear outline. It was scarce in the Braemar gatherings, and unaccompanied by *P. gracillima.*

Pinnularia late-striata, described by Professor Gregory from the Mull deposit, and found recent by Professor Smith in Grassmere, is scattered through a number of the Braemar gatherings, generally associated with other of the alpine *Pinnulariæ,* as *P. lata, P. alpina, P. divergens,* &c. Though not plentiful anywhere, it seems to be generally diffused. Professor Gregory informs me that it occurs in more than half of the very numerous Scottish gatherings which he has examined. Professor Smith likewise found it in Auvergne.

Odontidium anomalum, W. Sm. Pl. IV. fig. 7–9.

Odontidium anomalum, W. Sm., Ann. of Nat. Hist. vol. xv. p. 7. pl. 1. fig. 8.

A new and very interesting diatom, discovered last summer by Professor Smith in the Cevennes at an elevation of about 4000 feet, and by Professor Balfour and Mr. Lawson in Braemar immediately afterwards. It was exceedingly scarce, and mixed with *Melosira distans,* Kütz. This species is described and figured by Smith in his paper on the Diatomaceæ of the South of France, recently published in the 'Annals of Natural History.' Its chief character rests on the linear valves, constricted towards the obtuse extremities; but the very peculiar structure of the valves as seen in the front view affords besides a most conspicuous distinction. This structure arises from the presence of "internal cells," which Professor Smith regards as an abnormal condition of the filament, because frustules of the more usual description (as occurring in other species) may be occasionally found side by side with others containing internal cells. Theoretically, this view may be correct; but it is certain, that in the only specimens hitherto observed in France and Scotland, the filaments are almost exclusively composed of frustules containing the internal cells, and which thence derive a most marked character; while the normal frustules are, as Professor Smith justly remarks, rarely to be detected. It would be a very curious fact if this diatom should prove to be known everywhere in an abnormal condition—and that that condition should be one of increased development. This so-called abnormal structure—which according to my view differs considerably from that exhibited in the figure which illustrates Professor Smith's paper—is very beautiful under the microscope. Each frustule in the figure referred to contains an internal cell, elliptical or linear-elliptical (as the filaments happen to vary in breadth from ·0006″ to ·0015″), converging to a point at each end, and traversed longitudinally by a median line. The following, on the contrary, is the result of my own observations, made, I may add, before I saw Professor Smith's paper. When a frustule becomes abnormal it is divided by an elliptically curved line, the centre of the curve approaching very close to the lateral margin, while the extremities of the line terminate nearly in the middle of each end of the frustule. On each side of the termination of the line are situated the minute nodules which are present in every condition of the diatom. A single frustule is thus subdivided into two cells, as will be more readily perceived by referring to the figures. The same arrangement precisely, takes place in the adjoining frustule, only the direction of the line is reversed; so that when the two frustules are viewed in connexion, the lines form a symmetrical elliptical figure truncated at each end, for they are very far from converging to a point. The median line of the "internal cell," represented by Professor Smith's artist, is in fact the junction of two frustules. A somewhat similar arrangement appears to exist in *Meridion Zinckeni*, Kütz.*, as far as I can judge from the figures given by the author, for I have not had an opportunity of examining specimens myself.

Among the interesting acquisitions made during the excursion, the first place must unquestionably be given to a very minute form discovered in both Glen Callater and Canlochlan, but extremely rare. Judging from the general character of the frustules, Professor Smith was inclined to think that they belonged to a filamentous species, but being unfortunately all in a scattered state, he could not with any certainty assign its place in the system. He therefore, with some doubt, bestowed upon it the provisional name of *Grammatophora* ? *Balfouriana*. Having had occasion to examine this most remarkable diatom minutely in the preparation of this report, I have come to the conclusion

* Professor Gregory informs me that this diatom was pointed out to him by De Brébisson in a gathering made by me last summer at Duddingston Loch. I had not observed it myself, and Dr. Gregory's slide containing it is not at the present moment accessible. Dr. Gregory has since observed it in some Banffshire gatherings.

that Professor Smith is correct in referring it to one of the filamentous groups. My reasons for coinciding in this view are—1. That, apart from the peculiar structure, which of itself is almost sufficient evidence, there is a greater variation in the relative length and breadth of the frustules than would be likely to occur in other diatomaceous groups. In some the length is more than equal to twice the breadth, while others are exactly square, and between these two extremes every gradation may be observed; resembling in this inequality, *Fragilaria, Odontidium, Grammatophora,* and other filamentous genera having plano-compressed frustules. 2. Two nodules exist at each extremity of the frustule, as in *Odontidium, Fragilaria,* &c.

With reference to the genus of this diatom I have ventured to take a more decided course, as it does not appear to me that it can be regarded even doubtfully as a *Grammatophora* without doing violence to that genus. The vittæ in the frustules of *Grammatophora* are, to borrow a portion of Kützing's definition, "medio interruptæ, plus minusve curvatæ;" they are, in fact, with the exception of this interruption, continuous throughout; whereas in the form under consideration they are as much interrupted at each end as they are in the middle, and are besides not in the slightest degree curved. Two internal septa run through the frustule, as in *Grammatophora,* and upon these the so-called vittæ are developed, but which, from the causes above mentioned, are so much abbreviated as to resemble elongated coloured nodules; for in the shorter frustules their form becomes merely oblong or even oval. Unquestionably there is an evident affinity with *Grammatophora*; but upon the whole, seeing that, besides the differences already referred to, all the known species of the last-named genus are marine, I hope it will not be considered as a rash proceeding if I propose to establish a new genus for the reception of this curious fresh-water diatom.

DIATOMELLA, nob.

Frustules quadrangular (forming at first a plano-compressed filament, at length separating). Coloured vittæ two, straight, interrupted in the middle and at each end. Length ·0004″ to ·0010″.

Diatomella Balfouriana. Pl. IV. fig. 10–13.

Grammatophora? Balfouriana, W. Sm. MSS.

The general characters of this minute species are visible without difficulty under a magnifying power of 400 or 500 diameters. The frustule is surrounded by a thickened border, and is divided into three more or less equal parts by two straight internal septa or bars not clearly defined externally, on each of which, at about equal distances between the middle and ends, are situated two dark-coloured short vittæ, while at the ends themselves the septa terminate in minute nodules. In the most elongated frustules the coloured vittæ are linear, but they contract in proportion as the frustules diminish in length, until they lose the character of vittæ, and resemble nodules. The middle portion of the frustule is blank, while the spaces between the septa and the margin are transversely striated, but it requires a power of at least 600 diameters to bring this character out. The frustules of this diatom are not unfrequently seen in the process of self-division, and one of these I have represented in the plate. It will be perceived that a narrow separation has already taken place, and that in each portion the lateral striæ are apparent, while as yet there is only one septum. The next stage in the process would probably be the division of the single septum into two, followed by the development of the blank middle space.

Melosira nivalis, W. Sm.

A new species previously determined by Professor Smith, and which will appear in the forthcoming second volume of his work. I am not aware of the original station. It is scattered through two or three of the Braemar gatherings, and I found it near the Pass of Killiecrankie last summer. Professor Smith is, I believe, under an impression that *Coscinodiscus minor* may turn out to be the sporangial form of this species.

Melosira distans, Kütz.

I was not aware of this diatom having been previously collected in this country, until Professor Gregory recently informed me that he had noticed it in a gathering from Elgin, as well as in some other collections from the north of Scotland, but believing that it was already known as a British species, he had not drawn attention to it. The gathering placed in my hands is remarkably pure, and agrees exactly with slides in my possession from Bilin and Habichtswald, stations given by Kützing. Professor Smith found it also in Auvergne. It is much to be regretted that a note of the precise locality of this diatom was not preserved, as it is the only station for the rare *Odontidium anomalum*, which was found intermixed with it.

Orthosira spinosa, W. Sm. Pl. IV. fig. 14–17.

Orthosira spinosa, W. Sm., Ann. of Nat. Hist. vol. xv. p. 8. pl. 1. fig. 12.

This is another instance of the all but simultaneous discovery of a new species by Professor Smith in France, and Professor Balfour in Scotland. It was collected by the former on Mont Dore, at an elevation of 4236 feet; by the latter in a locality where it would be produced under a corresponding temperature, if we take into consideration the difference of latitude. The structure of this plant is very interesting. The outer wall of the cylindrical filament is continuous, but separates spontaneously at the junction of the valves, where the inner wall contracts in a rounded manner. The valve is here beautifully striated, the striæ being coloured and semi-opake at the junction, but soon becoming colourless, and gradually disappearing in the transparent tissue of the valve. When the orifice of the valve is examined, it is found to be closed by a concave diaphragm marked with radiating striæ, coloured at the circumference and pale and moniliform as they approach the centre, where there are usually three or four minute perforations. The peculiar character of the species lies, according to Professor Smith, in the valves or frustules being furnished at the point of junction with a fringe of spine-like processes; but I confess that I have been unable to make out this character to my satisfaction. I have indeed occasionally thought that I perceived a fringe which reminded me of the peristome of some Mosses, but on a closer inspection it disappeared; and what seemed to be extraordinary, I could not find the spines when I sought for them in the position most favourable for their exhibition, viz. when viewing the valve vertically or in profile. The point then to be ascertained, seems to be the structure at the boundary line, where the valvular striæ terminate at the orifice, and those of the diaphragm commence. And I need not say, that it is with great deference that I venture to take a different view from so high an authority as Professor Smith, and to suggest that the appearance of spines may have been caused by an optical deception. It seems to me, after reiterated examinations with both low and high powers, that the valvular striæ simply curve round towards the edge of the orifice to meet those of the diaphragm. The striæ (or vittæ as they might well be called), being coloured and conspicuous, and the tissue of the valve very pellucid, do present, when viewed in certain lights and in certain directions, the semblance of short processes. In the view I have now given of the structure of the valve at the point of junction, I may however be in error, and I hope that other observers will endeavour to determine the question. The filaments of this species vary in diameter from ·0007″ to ·0015″.

EXPLANATION OF PLATE IV.

Fig. 1. *Eunotia Camelus?* The lower figure represents an unusually depressed form.
Fig. 2. *Eunotia tridentula.*
Fig. 3. *Eunotia quaternaria.*
Fig. 4. *Cymbella æqualis.*
Fig. 5. *Cymbella lunata.*
Fig. 6. *Navicula cocconeiformis.* This and all the above as seen under a power of 600 diameters.
Fig. 7. Portion of a filament of *Odontidium anomalum.*
Fig. 8. Three frustules separated, but otherwise in their relative position Magnified 400 diameters.
Fig. 9. A single frustule more highly magnified.
Fig. 10. Frustules of *Diatomella Balfouriana*; magnified 400 diameters.
Fig. 11. A frustule of the average proportion.
Fig. 12. Frustule in the process of self-division.
Fig. 13. Side view of frustule. Figs. 11–13 as seen under a power of 1000 diameters.
Fig. 14. Portion of filament of *Orthosira spinosa*; magnified 300 diameters.
Fig. 15. Portion of filament showing the character of the striation, &c.
Fig. 16. The diaphragm as seen vertically.
Fig. 17. Orifice of valve with marginal striation, closed by the diaphragm.

IX. *A Comparative View of the more important Stages of Development of some of the higher* Cryptogamia *and the* Phanerogamia. By Charles Jenner.

Read 8th March 1855.

For some time past, the few hours of leisure I have been able to spare from the pressing engagements of business, have been employed in investigating the germination and reproduction of the higher Cryptogamic plants; those Cryptogamic plants in which sexual organs have been recognized, and the reproductive spores of which, at one or other stage of their development, are enclosed in a testa or case. My attention was early directed to the following facts :—

First. That in different orders of these plants, the spores are enclosed in their testæ, and set free from their connexion with the parent plant, at altogether different stages of development. For example,—

The vesicular spore of a Moss is fecundated before it obtains an enveloping case and is set free; whereas the spore of a Fern, when it is detached, consists only of a vegetative axile cell, which developes into a thallus upon which is borne the fecundating organ as well as the archegonial cell. And

Secondly. That very varying stages of development are arrived at, within the enclosure of the spore-case, in the several orders of the higher Cryptogams: thus—

In Ferns, the spore developes only externally to the spore-case the cellular frond which bears the archegonial cells, whereas in the *Selaginella* the analogous cellular expansion is developed within the spore-case.

It thus became apparent to me at the very outset of my investigations, that in considering the question of the entire cycle of an individual life among these plants, we should never lose sight of the fact, that there is no such identity among the spores of the higher Cryptogams, as is supposed to exist among the embryogenic seeds of Phanerogams; and also, that we should err as much in assuming the spore, at the period of its vegetative development, to represent the earliest stage in this cycle, as we should, were we to consider the seed as the first stage of the existence of a Phanerogamous plant, overlooking the origin and development of the embryo, its envelopes and its albumen, and the special relation which these latter bear to the parent plant.

All plants above the lowest possess special cellular structures, within which, as within the ovular envelopes, or in the substance of which, as in the pro-embryo of a Fern, there is produced an embryonal chamber or sac. In the interior of this cell the protoplasm or formative matter is concentrated, from which is evolved the whole after-structure. Thus, in Mosses, in Lycopodals, and in Ferns, as well as in Phanerogamous plants, it is a single cell within which the subsequent development is called forth through the influence of fecundation. This germ-cell is in every case the commencement of the new individual cycle of life.

To enable me to trace, as carefully as I propose, the analogy between the principal organs and stages of development of the higher Cryptogamic plants and the Phanerogamic, I must ask you to dissociate in your minds this germinal vesicle from the structure within which it has its origin. These investing organs are very varied in their form and texture. The most striking differences prevail between them in Gymnospermous plants and Angiospermous plants, and also between them in the orders and even genera of Angiosperms and the several orders of Cryptogams; while, on the other hand, there is an approach to homogeneity in the form, structure, and early general development of the germ-vesicle itself, so that unless we dissever, as it were, this germ-vesicle from those heterogeneous environments (which have only for their purpose the sustentation and preservation of the germ-vesicle), we shall trammel our subject with unnecessary difficulty and fail to attain that clear point of view that is so desirable.

There are thus then certain structures, so intimately associated with the germ-vesicle of all but the lowest plants, though totally independent of it, that we can scarcely investigate the course of the one without to some extent entering upon the consideration of the nature and relation of the other. These structures may be called accessory or investing organs, and as examples of them I may mention, the various coats of the ovule, the pro-embryonic frond of Ferns, and the cellular layer which environs the embryonal germ of a Moss, and which afterwards constitutes the spore-case. I may repeat that these investing organs belong to the organic structure of the parent plant; and they do so belong to it, whether they are maintained in their connexion with it, as are the primine and secundine of the ovule, or whether they are disconnected from it, as is the prothallus of a Fern. The first growth therefore to be recognized as independent development, is the vesicular coat which is formed around the concentration of protoplasmic or germinative matter within the embryo-sac. The contents of this vesicle are the immediate resultant of the parent life, the first formative act of the new existence being the cell-wall enclosing these contents. In the unimpregnated stage of the germinal vesicle, its derived power has become isolated, for its processes of assimilation and the varying disposition of the protoplasm must be considered acts of its separate vitality.

I have further to notice generally, that in all plants the separation of the young plant from the old,—of the newly-derived existence from the parent life, is accompanied by a condition of rest, or rather of the capability of resting; for instance, the Phanerogamous embryo within its testa, the vesicle of a Cryptogam within its spore-case.

This resting stage is always carefully arranged for by the provision of suitable integuments and store of endospermous matter. We have seen that the resting stage is attained at varying epochs of development in different orders of plants, and that a more or less amount of development is attained within the particular receptacle of the parent plant. Special organs are modified to suit the special circumstances of each case. Thus, in Angiospermous Phanerogams, for sustentative and nutritive purposes, the coats of the ovule are maintained in their connexion with the axis by means of a funicular cord; whereas the homologous organ of Filices—a free development subsequent to the resting stage—is cellular fibrillæ or rootlets. These fibrillæ of the prothallus of the Fern are, however, not only homologous with the funiculus of the ovule of Angiospermous Phanerogams, but their function is the same, namely that of affording support and nutriment. The funiculus of the ovule then, and the fibrillæ of the prothallus of the Fern, are, to speak briefly, homologous and analogous organs.

I now proceed to my particular purpose, which is to trace in a general manner the cycle of development of a Moss, a Fern, a Phanerogamous plant, and to trace in outline a few analogies between their more important organs, which, if diverse in appearance and without any very apparent relation, have at least common purposes. Nature is so infinitely varied in her forms of manifestation, and she is so rich in her adaptation of means, yet withal has such a clear and palpable unity of purpose, that on the one hand we need not be surprised at apparent discrepancies, and on the other we need never doubt one common identity.

In the Table (p. 60) I have separated the investing organs from the germinal body, and have shown the relation which I hold the various organs of the plants under review have to each other, and also distinguished the stage of development in each order at which the resting condition is attained; this condition being in every case precursory of detachment from the parent plant. The investing organs may be divided into general and special; the general investing organ being the ovarium in Angiospermous Phanerogams, the theca in Filices, and the archegonium (in its ripened condition the sporangium) in Musci. The special investing organs are those which immediately environ the germinal vesicle; these are, in the Phanerogamia the coats of the ovule, in Filices the pro-embryo, and in Musci the sporular integument which enfolds the nucleal germ, and which finally constitutes the testa of the Moss-spore. The unimpregnated germinal vesicle of the Phanerogamia finds its homologue in the archegonial cell of the pro-embryo of the Fern, and in the embryonal cell within the archegonium of a Moss. The maturation of this cell is only preparative to the fecundative act, or the fertilizing process, whatever that may be, which takes place, in one or other manner not yet determined, in all plants at this stage of progress. The impregnating influence or matter being imparted to this vesicle, embryonal development ensues, and always in the same general manner, varied only by the special varying circumstances of each particular case. The fertilized cell stands on the verge of the active development of an independent vitality. In Ferns the resting stage is passed before impregnation has taken place. The course of growth after impregnation is continuous. The germinal body, by a succession of transverse divisions, obtains the condition of a septate cellular process, longitudinal and radial divisions follow, and a structure is formed which developes an ascending and descending axis, in due course to disengage from the former a bud, the commencement of a new cycle of individual life.

In Phanerogamia, immediately after fertilization, which I need not say takes place within the ovarium, a transverse septum is formed across and within the germinal vesicle; by successive transverse divisions of the superior half of this germ-cell, a confervoid filament is formed, which has received the name of the suspensor. The suspensor varies in length in different families, orders and genera, being longer in some and shorter in others, but in all it is distinctly a septate cellular process. The inferior moiety of the germ-cell, by a series of longitudinal, transverse, and radial divisions, developes into a radicular portion and a cotyledonary expansion, and only when this stage is reached do the outer coats of the investing organs become more or less dense by intra-cellular deposit. Detachment takes place at the hilum, and the embryo enclosed in its case becomes free as a "*seed.*" This is the resting stage in Phanerogamia. In Mosses, the germ being fertilized, its outer envelope or cellular investment becomes dense and firm, and no further development takes place within the general investing organ. The spore has attained the resting stage and is set free. The fertilized vesicle, now the spore, is no sooner placed in circumstances favourable for development, than dehiscence of the outer envelope takes place, the embryonal cell protrudes and elongates, transverse septa are formed, as in the case of the Phanerogamic germ-vesicle, a branched confervoid filament or septate cellular process is developed, which I submit is the homologue of the suspensor, and from a cell of this filament arises the phyllary axis, which bears in its turn the reproductive organ, and thus completes the cycle.

I do not pretend to offer this as a thoroughly proven exposition of the subject. I lay it rather before you somewhat in the shape of an hypothesis. Yet, if, after carefully weighing the subject, I had not felt it to be supported by observation, I should not have occupied the valuable time of this Meeting. No one can be more sensible of the incompleteness of this my first essay than myself. I am too truly a tyro in science to deem that I can teach. I can only venture to hope that I have touched chords of thought, that in abler and more skilful hands may evolve knowledge. Truth is so valuable, and opinion, unless accordant with truth, so worthless, that while I solicit your kind consideration even to the errors of my essay, I invite your free and candid criticism.

COMPARATIVE TABLE.

MUSCI.	PHANEROGAMIA.	FILICES.
Archegonium or Sporangium.	Ovarium.	Sporangium or Theca.
Nucleal Germ.	Placental Bud.	Axile Bud or Spore. RESTING STAGE.
Sporular Envelope.	Ovular Envelopes. = { *Primine.* *Secundine.* *Embryo-sac.*	Pro-Embryo.
Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.
FECUNDATION.	FECUNDATION.	FECUNDATION.
Fertilized Embryonal Cell or Spore. RESTING STAGE.	Fertilized Germinal Vesicle.	Fertilized Archegonial Cell.
Confervoid pro-Embryo.	Confervoid Suspensor.	Septate Cellular Process.
Plumular Bud.	Radicle. Plumule. RESTING STAGE.	Radicle. Plumular Bud.
Phyllary Axis.	Phyllary Axis.	Phyllary Axis.

DESCRIPTIVE TABLE.

	MUSCI.	PHANEROGAMIA.	FILICES.
General Investing Organ.	Archegonium or Sporangium.	Ovarium.	Sporangium or Theca.
Special Investing Organ.	Sporular Membrane.	Ovular Envelopes. Primine. Secundine. Embryo-sac.	Pro-Embryo.
Germinal Body.	Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.

X. *Some Remarks on Vegetable Placentation.* By John Cleland, Esq.

Read 12th April 1855.

The object of the few following remarks is to bring forward some evidence against the axile theory of placentation, and to show that the free central placenta found in many plants is really composed of a second whorl of carpels with everted edges.

My observations are founded entirely on the *Lychnis* and *Primula.* In the latter we have the most perfect example of a free placenta, while the former illustrates most distinctly the theory which I wish to bring forward.

On opening the fruit of the *Lychnis dioica,* its carpels are seen to be united into a perfect circle, and to present no trace of their homology with the leaf except in the venation on their internal surface. When the seeds are removed the funicular cords are seen arranged in five vertical double rows with smooth spaces between. On making a transverse section, these smooth spaces are found to be composed of a pad of white cellular tissue, and alternating with them and with the rows of cords are the five rays of a star-shaped mass of the same white cellular substance occupying the centre. This star seems clearly to indicate the formation of the placenta from five parts, and the position of the cords in five series shows the same thing. But this is not consistent with the axile theory. If ovules are ever equivalent to buds emanating directly from the axis, they must in every such case be more or less under the law of evolution followed by the leaves, and however their arrangement may seem from circumstances to depart from that law, they cannot observe a system of distribution essentially different. We find a whorled arrangement followed by every other homologue of the leaf, and should expect it here too. But in the case before us, the ovules are given off in vertical double rows. The objection may be started, that this appearance may result from the piling of whorls one on another without alternation, just as the stamen is in front of the petal in the Barberry and the Buckthorn, or rows of petals are piled in front of one another in abnormal specimens of the Camellia. But if this explanation be adopted, we have still to account for the rows being double, and for each row being connected by vascular tissue with the one on the other side of the adjoining interspace, while to its fellow it is only joined by interstitial cellular tissue.

On the other hand, if we adopt the ordinary marginal theory, we have staring us in the face the old objection, that there is no trace of any connexion ever existing between the placenta and wall of the ovary; but on the contrary, between the double rows of cords where the carpels are supposed to have turned inwards, we have a smooth pad of cellular substance. Moreover we should expect the rays of the central star to be pointed to the interspaces instead of being in the position we find them in; for by this theory each pair of rows is formed from the margins of one carpel and has nothing to do with the neighbouring pairs, and we should therefore expect to find *a* (fig. 1) connected by vascular tissue, not with *b*, but with *c*.

What I wish to suggest as a better explanation than either of the above is, that this placenta is formed of a second whorl of carpels, distinct from and alternating with the outer carpels, and bearing the ovules on their everted margins. This view accounts for the arrangement of the vascular tissue. The double rows of cords are considered according to it as formed from the margins of two adjoining carpels, and the true fellow of each of the component rows is the one at the other side of the neighbouring interspace, and the bundles of fibres represent the midribs of the leaves. This view was first suggested and seems to be very considerably supported by the monstrosity which I have figured, in which two members of the inner whorl had assumed the foliaceous form (fig. 2). One of them was much contorted on account of its excessive development in a confined space, but the other retained its place in the whorl with its edges everted.

The structures of the Primroses seem also to support the notion of a second carpellary whorl. In their case the common marginal explanation appears to particular disadvantage, and I hope to show that in respect to them too the free central explanation is untenable. The ovules indeed are sessile, and so closely set on the placenta, that it is impossible to say from their position what is their arrangement—whether whorled round an axis or in vertical rows. But other evidence is not wanting.

First, in a well-developed fruit of the Auricula, I have observed a five-rayed star of cellular tissue in the centre (fig. 3).

Secondly, at an early period the placenta of the Primrose is formed of two parts, one in the centre vascular and united to the torus, the other superficial, distinct, and easily removed, cellular and bearing the ovules. If the ovules were buds, the cellular tissue of their first origin could not have this superficial disposition, but would be the ascending axis of the plant, whose true position is central.

Thirdly, if the central part were a continuation of the axis, we should find some at least of the fibrous bundles from the

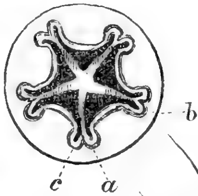


Fig. 1.

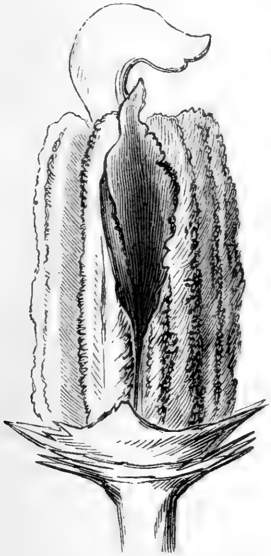


Fig. 2.

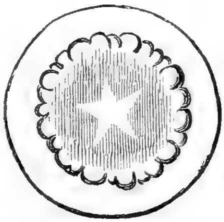


Fig. 3.

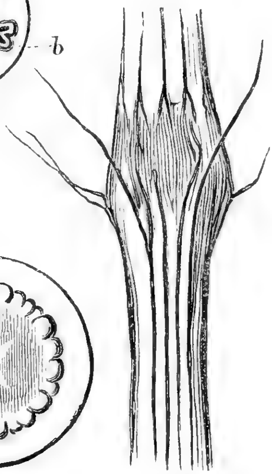


Fig. 4.

stem running directly into it, but instead of that, the fibres are entirely re-arranged at the base of the ovary; a joint is formed at this point by decreased size of the cells of the cellular tissue, and the first appearances of fibres in the placenta are not prolonged upward from the stem, but descend to meet those of the stem (fig. 4).

These facts seem conclusive against the axile theory in the case of the Primroses; and if in them it does not hold, we have a strong argument against its truth in any case. It seems improbable at the outset that the ovule should vary so much in morphological value as to be in one plant equivalent to a bud, and in another perhaps not far removed from it, only a secondary growth from a single leaf. This of itself prejudices one against believing that we have placentation of both the marginal and axile kind; and another circumstance likewise irrespective of arguments drawn from the structure of the pistil in particular species is in favour of the marginal theory, viz. that the pollen-grain, which is the male equivalent of the ovule, is always a mere offshoot from a leaf homologue, and we might not unnaturally expect the ovule to have the same morphological value.

XI. *Note on* Linaria sepium, *Allman*.

By Charles C. Babington, M.A., F.R.S. &c.

Read 8th November 1855.

Early in the summer of 1855 I succeeded in obtaining seeds of this plant from roots growing in the Cambridge Botanical Garden which had been originally sent to it by Dr. Allman from Bandon. These seeds were sown in a pot, and produced many plants which flowered in the August and September following. The produce thus obtained shows that my former idea concerning *L. sepium* is correct, and that it is not a distinct species, but a hybrid between *L. repens* and *L. vulgaris*. Four forms were raised from the seeds of *L. sepium*: (1) *L. sepium*, (2) a plant closely resembling *L. repens*, (3 and 4) slightly differing forms of *L. vulgaris*.

L. repens is growing on the same bed in the garden as the *L. sepium* from which these seeds were obtained, but *L. vulgaris* grows in quite a different part of the garden. Similarly at Bandon, I learn from Dr. Allman that *L. repens* and *L. sepium* grow together, but *L. vulgaris* is not found within a mile of *L. sepium*.

Since the above note was written, I have received from Bandon, through the kindness of Dr. Allman, a series of specimens quite connecting *L. sepium* and *L. repens* which he had gathered in their native place. The result derived from cultivation is thus, to a great extent, confirmed by observation of the wild plants.

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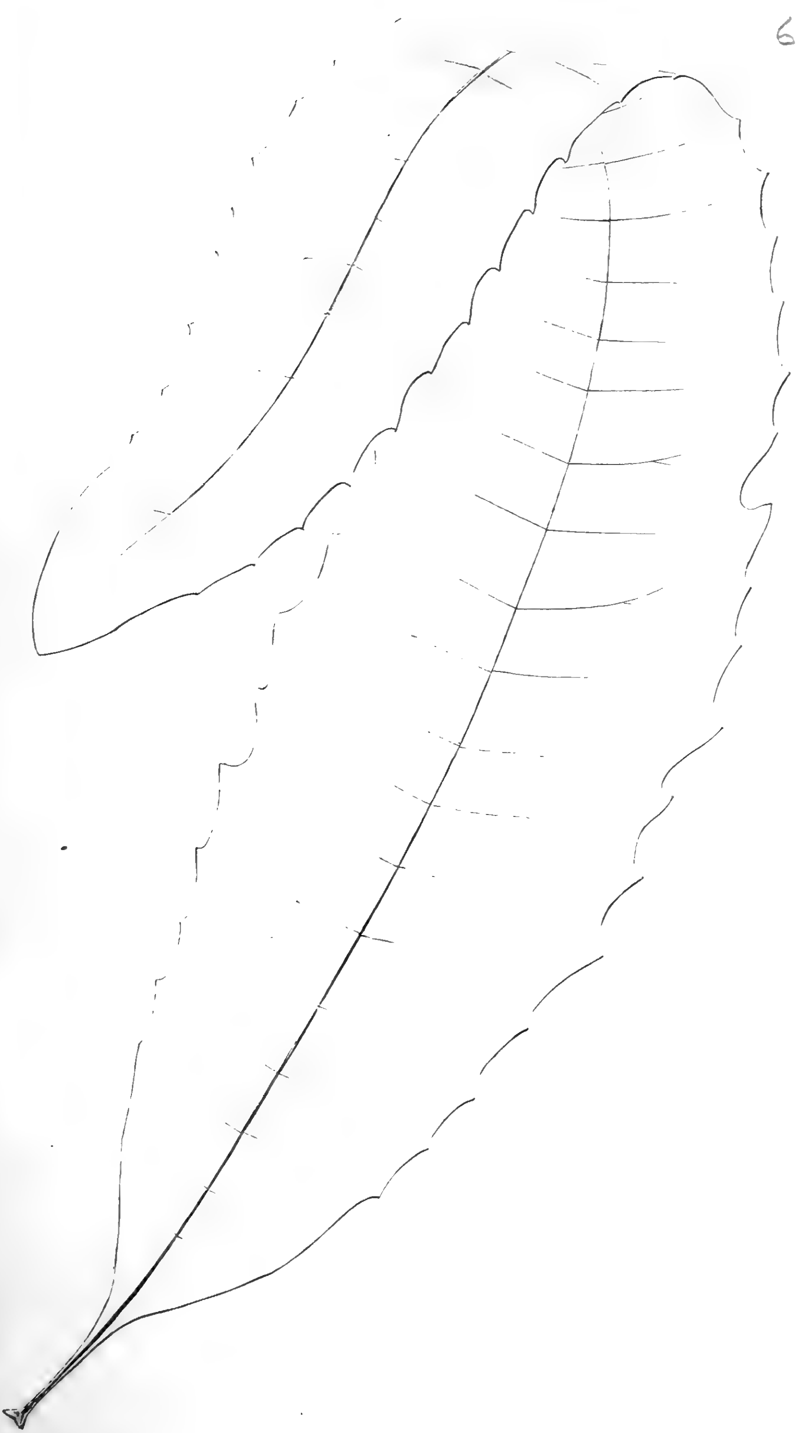

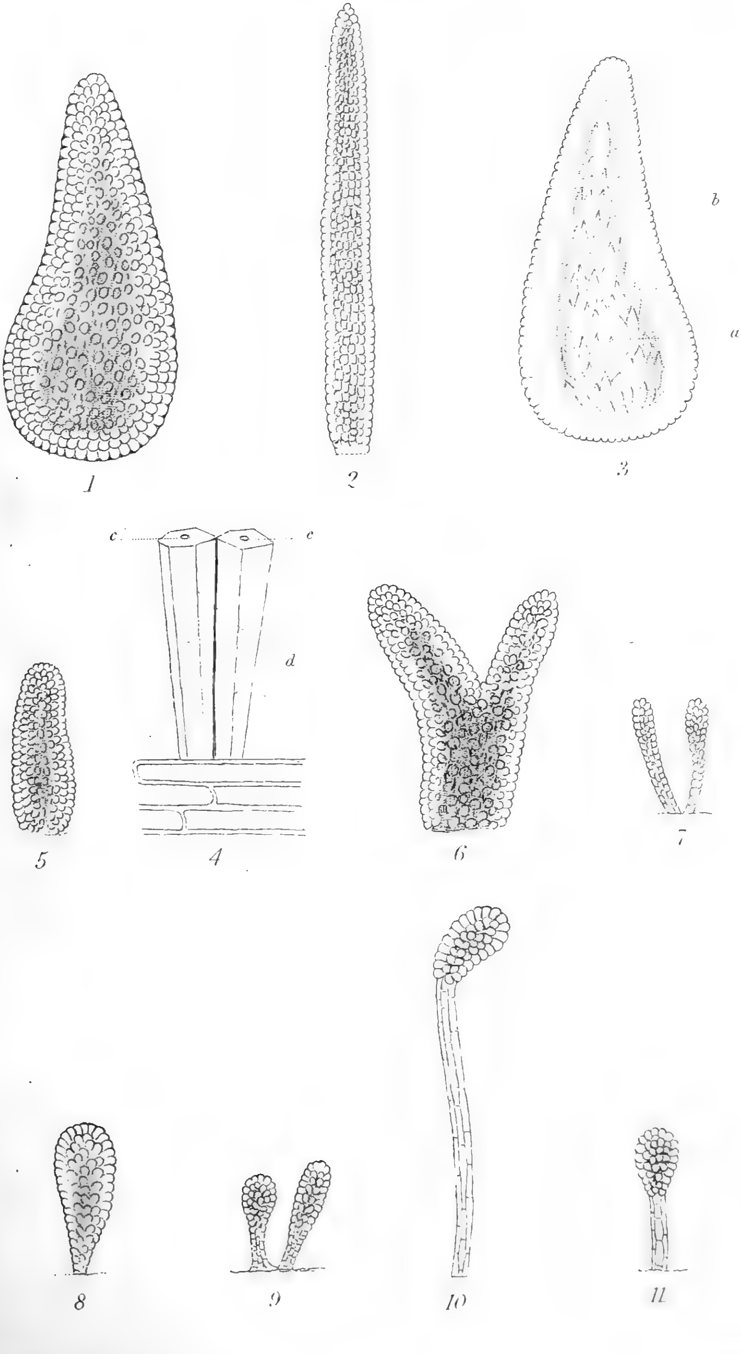

G. Lawson, del.

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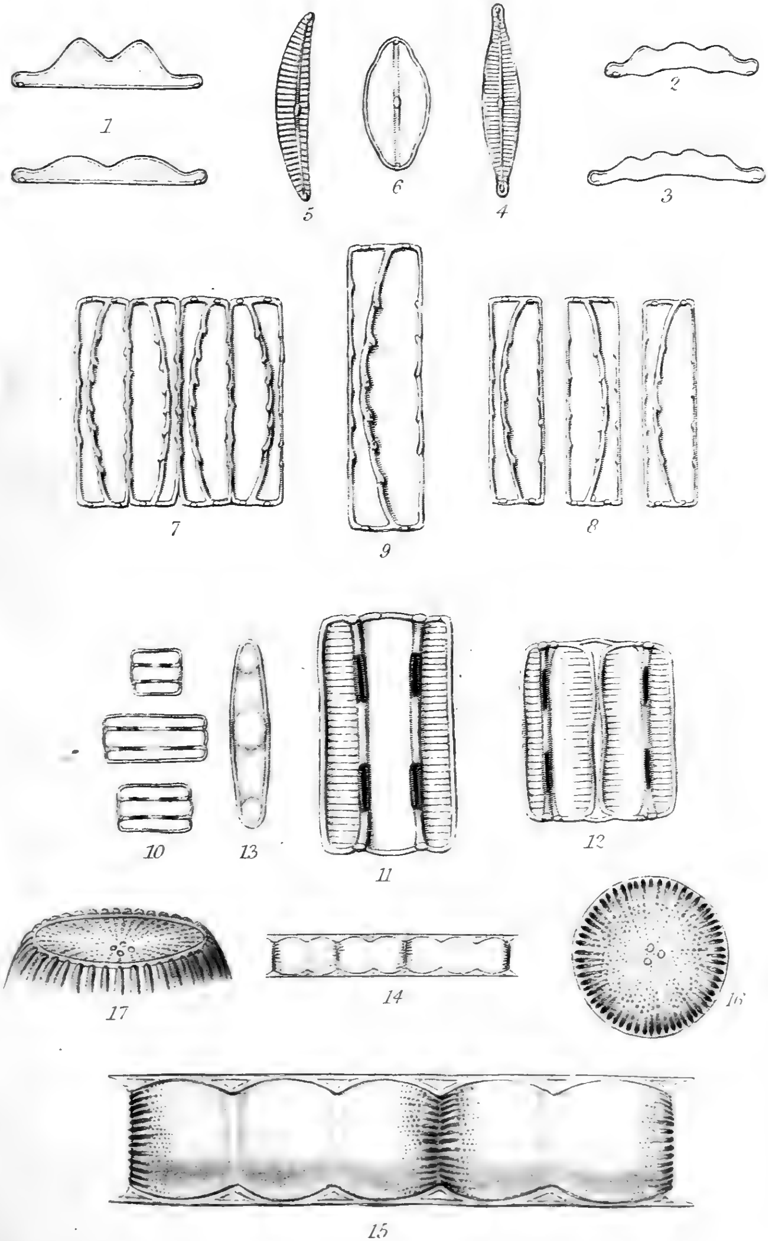

R. K. Greville, del.

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XII. *On the Batrachian* Ranunculi *of Britain.* By CHARLES C. BABINGTON, M.A., F.R.S. &c.

READ 8TH NOVEMBER 1855.

It is with much diffidence that I venture to attempt the elucidation of the Batrachian Ranunculi of Britain, for the great difficulty of the subject necessarily presses heavily upon the mind. Also, it cannot be otherwise than disheartening to feel, that however successful I may be in my own estimation and even in that of my friends, and, that although my endeavours may result in a close approach to the acquaintance with the plants that has been attained in Sweden and France, it is certain that several of the most eminent of the botanists of Britain will consider that I have been wasting my time and retarding rather than advancing science. Had the views of those learned men been generally held by persons of equal scientific rank in other countries, I should have thought it my duty to adopt them; but as several of the most distinguished botanists of continental Europe do not think that they are "idling away their time by catching at shadows," when they expend it upon an earnest endeavour to attain the most accurate possible knowledge of the plants inhabiting their respective countries, I am led to the belief that I am really doing well when trying distantly to follow their example.

It has been justly remarked, that we have no good definition of a species amongst plants, and that it is hard or even impossible to apply those which we possess. Until species can be defined, each botanist is left to judge as best he can of what ought or ought not to be so considered. In the case which is about to be presented to the reader, I have been led, or rather driven to the conclusion that the forms described below are species, by having had most of them under my observation in a growing state for several years, and finding them to continue constant in their characters when raised from seed under varying circumstances through successive generations: also, by remarking that they not only possess permanent definable distinctions, but present such differences at first sight as to enable the practised eye to distinguish them easily. Surely, in such a case, the minuteness or obscurity of the structure upon which the technical character is founded can be no just argument against the claims of the plants to be considered as entitled to specific rank. Neither can we accept as conclusive against them the fact that some eminent botanist, such as Smith (Eng. Flora, iii. 55), has combined them under two names; or, Seringe "long ago recorded his decided opinion, that all were mere varieties of one species." Neither Seringe (Mélanges Botaniques, ii. 8 & 49) nor Schlechtendal (Animadv. Bot. in Ran. 8), who is also used as an authority by those who persuade themselves that all these plants form only one species, appears to have had any knowledge of the characters that are now employed in this group of plants; and I think that no botanist of the present day lays stress upon the hairiness or smoothness of the plant or its capsules; neither would plants be considered as distinct solely on account of the presence or absence of the broad floating leaves. It is nearly certain that several of the species (as I consider them) that are to be described presently (viz. *R. heterophyllus*, *R. Baudotii*, *R. floribundus*) would each afford a series of forms, extending from a state in which there are no capillarly-divided leaves to one consisting solely of them, similar to that recorded by Schlechtendal under the name of *R. aquatilis*. The existence of such series assuredly rather tends to prove that there are several species of *Batrachian Ranunculi* than that they are all of one species. Doubtless it requires a considerable familiarity with the plants to enable a person to refer all these forms to their proper species, and mistakes are very frequently made in attempting to do so. Also innumerable errors and difficulties arise when names are required to be given to scraps, such as are often collected and preserved even by good botanists.

We are told that a series of specimens from all parts of the world proves that there is only one species of *Batrachian Ranunculus*. Doubtless it would be easy to form a series apparently justifying such an opinion, but our success in so doing does not seem necessary to prove the non-existence of several species; for it may, and I believe has, happened in many such cases that the supposed connecting links are single specimens of distinct species, which consist of multitudes of similar individuals in their native districts, although only one or two may have been preserved in the herbarium employed for study. Let the living plants be carefully examined in a country, such as Britain, where they are numerous, and if, after an unprejudiced endeavour to arrive at the truth, they prove undistinguishable, then let them be combined. But if, as my observations lead me to believe, the best known of them are quite constant in their form and habit, it does not seem to be the pursuit of truth that leads to their neglect, but rather the adherence to a preconceived theory. Take as an example the *R. circinatus*: this plant inhabits the most different situations, growing upon a muddy or gravelly bottom, in swift streams or stagnant ditches and pits, in water or on mud, and yet the well-known structure of its leaves is invariable.

Many years since it fell to my lot to attempt to controvert the opinion then prevalent in England, that the *R. aquatilis*, *R. circinatus* and *R. fluitans* formed one species (Ann. Nat. Hist. Ser. 1. vol. iii. p. 225–230), and I showed conclusively, as I venture to think, that the depth, motion, or stagnancy of the water in which they grow has nothing whatever to do with the size, shape or structure of the leaves, nor with the direction of them. Of course certain slight alterations are the result of the circumstances in which the plants are placed, but they are not such as to affect the characters upon which the species are founded. In doing this I was performing little more than restoring to recognition in this country species known to Ray, and defined and named according to the Linnæan method by Sibthorp. On the European continent several eminent men had already adopted them. Since that date my attention has been often turned towards these beautiful plants, and during the last few years I have made them a special subject of study. Within the same period, such men as Fries, Koch, Godron, Cosson and others, have been led to think that the *R. aquatilis* required further subdivision. Accordingly many attempts have been made to do so with greater or less success, and it is a cause of much satisfaction to me to find that, with a single exception, the British species have already been detected and described in other countries. That those botanists should have arrived at different conclusions, and even changed their opinions once or more, is certainly not a valid excuse for neglecting the study in which they have partially failed; for in this, as in all other departments of knowledge, correct results are not usually attained until after many attempts. Let it not be thought from these remarks that I claim to have succeeded; for all that I propose to myself is to make a small step towards success, and to place before those who may follow up the study a few additional facts, or an improved application of those already known.

In this group of plants we are not acquainted with any single character which may safely be stated to be always deserving of confidence; but if a combination of several characters is employed, there will rarely be any serious difficulty in identifying the supposed species, even when the structure of some of the parts has undergone change. The look of the plant is generally distinctive of the species; and the difficulties commence when an attempt is made to draw up technical definitions, or to determine the names from "specific characters." Such is found to be the case in most groups of closely allied species inhabiting the "metropolis," as it has been called, of extensive and difficult genera. We may call the plants varieties or hybrids, but, until they are proved to be such, we are only avoiding a difficulty, not stating a fact in science.

Having made these preliminary observations, I will now endeavour to point out the characters upon which we seem to have the most reason for placing dependence in preparing specific characters for the *Batrachian Ranunculi.*

It has long been known that the absence of hairs from the receptacle, and of any submersed and filiformly-divided leaves, distinguishes *R. hederaceus* and its more recently noticed ally, *R. cœnosus,* from the rest of our native species. It was pointed out by Sibthorp, that the submersed leaves of *R. circinatus* and *R. fluitans* had a different form from those of *R. aquatilis,* under which latter name he included plants which I have failed in reducing to less than eight species. In these latter plants (*i. e.* the *R. aquatilis* of Sibthorp), the submersed leaves are formed of repeatedly-dividing filiform or setaceous parts, which spread in such a manner from their first division, where the leaf trifurcates, as to take the shape of a greater or less segment of a sphere. These three divisions of the leaf are forked at very short or more distant intervals; they are fine or rather thick, rigid or flaccid, and accordingly retain their direction when taken out of the water, or collapse so as to resemble a painter's pencil.

In all the species, the floating or emerged leaves have an outline which is nearly circular, or only forms part of a circle; they are divided more or less deeply into lobes, or quite to the top of their petioles into leaflets; in some cases these leaflets have partial petioles of a considerable length, and then the circular outline of the whole leaf is not apparent. When the leaf is formed of lobes or sessile leaflets, the outer margins of the lateral lobes or leaflets, that is, the outer margins of the leaf, are either straight from their base throughout a considerable part of their extent, or their lower part is much rounded; therefore the leaflets are wedge-shaped or obovate.

In most of the species, the peduncles spring from the same nodes as both the divided and submersed, and the flat and floating leaves; but in the plant called *R. peltatus* in this paper, they are very rarely produced in the former situation; so rarely, as to have caused Fries to denominate the floating leaves "folia necessaria" in that plant. The peduncles either about equal the leaves or much exceed them, and then raise the flowers considerably out of the water. They are either equally thick throughout their length, or narrow more or less gradually towards the flower.

The petals are either broad with many veins, or narrow and usually few-veined. In the former case, the edges of contiguous petals are close together, and often overlap; in the latter, they are usually distant, and give what I have called a star-like appearance to the flower. As the flowers of the broad-petaled species advance towards decay, they acquire a slightly similar look; for the petals, which had originally a rounded form, lengthen so much that their lower part becomes wedge-shaped, and the flower rather star-like.

In two of our species, the stamens are so short as to be exceeded by the pistils, but usually they conspicuously overtop those organs.

Although the stigma varies in shape, it is not easy to apply this difference to the discrimination of the species, for it changes its form as it acquires age.

Not much dependence should be placed upon the position of the style, for apparently it generally forms a continuation of the inner, or nearly straight side of the ovary.

The carpels differ much in shape, but usually form the half of an ovate or obovate figure; the inner or upper edge is usually almost straight, but not always so, and then the carpel is often nearly ovate or obovate. On these latter forms of carpel, the persistent base of the style, or slight apiculus that represents it, nearly terminates the diameter of the carpel; but on the others it usually is connected with the straight side, being placed at its end, but forming an angle with it. The carpels are usually compressed laterally, and their coats closely enclose the seed; but in some cases they are inflated in their upper part, or slightly so throughout. These inflated carpels are, therefore, broadest at the end; but in some of the species where they are not inflated, a narrowing and flattening occurs at the end.

RANUNCULUS, *Linn.*

Section I. *Batrachium.* Fruitstalks arching. Carpels transversely wrinkled. Petals white (with a yellow claw in all our plants).

This section includes all the species which it is now proposed to consider. It constitutes the genus *Batrachium* of Fries; but I must be permitted to think, that there is no valid reason for separating it generically from the other *Ranunculi*. *R. sceleratus*, although a true *Ranunculus*, has several points in common with the *Batrachia*. It has minute seeds traversed by faint transverse wrinkles, and when growing in water its lower leaves float in a similar manner to those of the species of *Batrachia*, and very closely resemble them.

Subsection A. Submersed leaves twice or thrice trifurcate with filiform segments spreading in the form of a section of a sphere, rarely wanting. Receptacle hispid.

1. *R. trichophyllus* (Chaix); *submersed leaves* closely trifurcate, segments short rigid *not collapsing* into a pencil when taken out of the water, *no floating leaves*, peduncles not narrowing upwards about equalling the leaves, flowers small, *pet.* obovate 5–7-*nerved* not contiguous *evanescent*, stigma oblong, receptacle oblong, *carpels* $\frac{1}{2}$-ovate laterally apiculate *compressed.*

R. trichophyllus, *Chaix in Vill. Dauph.* i. 335; *Gren. et Godr. Fl. de Fr.* i. 23.
R. pantothrix, *DC. Syst.* i. 235 (in part); *Bert. Fl. Ital.* v. 575.
R. cæspitosus, *Godr. in Mém. Nancy,* 1839, 30. f. 6 (the terrestrial state).
R. capillaceus, *Lloyd! Fl. de la Loire Inf.* 5; *Godr. Fl. Lor.* i. 15.
R. aquatilis v. pantothrix, *Koch, Syn. Fl. Germ.* ed. 1. 11; *Sturm, Deutschl. Fl.* fasc. 67. t. 11; *Fries! Herb. Norm.* ix. 27 (specimen).
R. heterophyllus var. succulentum, *Fries, H. N.* xi. 33 (specimen)?
Batrachium trichophyllum, *F. Schultz, Fl. Gall. et Germ. exsic.* 805 bis & 1203; *Van den Bosch, Prod. Fl. Batav.* 5.

Stem floating, rooting at the lower joinings, obtuse-angled, hollow. Submersed leaves with filiform segments diverging slightly, and when mature so rigid as not to collapse when removed from the water: middle branch at the first fork the smallest. Petioles plane-convex, short. Upper leaves sessile. When growing upon mud from which the water has retired, the segments of the leaves are very short and thick. Floating leaves always absent. Stipules large, rounded, auricled, $\frac{1}{2}$ or $\frac{2}{3}$rds adnate. Peduncles falling short of, or slightly exceeding the leaves. Buds globular. Flowers small, star-like. Sepals ovate, very blunt, concave, green with a diaphanous margin. Petals distant, white, wedge-shaped, slightly clawed and yellow below, about twice as long as the calyx when full-grown. Nectary round, scarcely at all margined or prominent; but probably this structure is not constant, for I have seen, on what is apparently a plant of this species, a prominent bracket-shaped nectary. Stamens from about 10 to 15, exceeding the pistils. Style prolonging the inner edge of the ovary, short, curved. Stigma at first oblong, afterwards elongating. Carpels blunt, a little hairy, and slightly narrowed at the end. Receptacle nearly globose, as thick as the peduncle. Colour of the plant dark lurid green.

This plant differs from *R. heterophyllus* by its small few-nerved evanescent petals, globular receptacle, dark green dense rigid small submersed leaves; from *R. confusus* and *R. Baudotii* by its short peduncles which are equally thick throughout, its oblong not ligulate stigmas and globose receptacle, deciduous small petals, and in other respects. *R. floribundus* and *R. peltatus* are large-flowered plants that cannot be confounded with it even when the former happens to want the floating leaves. It differs from all the other species of the subsection by never having been observed to have floating leaves, nor to show any tendency to produce them. Its nearest ally is *R. Drouetii.* It is well marked by its stems, which float close to the surface of the water, being furnished with small dense rather closely placed dark green leaves, and small flowers which only just rise out of the water. No species resembles it in these respects.

Flowering in May and June.

R. trichophyllus is plentiful in Cambridgeshire, Norfolk and Suffolk, but is perhaps not very generally distributed throughout the kingdom. *R. Drouetii* is probably often mistaken for it, as is also the wholly submersed state of *R. heterophyllus.*

2. *R. Drouetii* (F. Schultz ?); *submersed leaves* rather closely trifurcate, segments rather rigid but *collapsing,* floating leaves (rare) tripartite with subsessile or stalked wedge-shaped bifid leaflets, peduncles not narrowing and about equalling the leaves, flowers small, petals obovate 5–7-nerved not contiguous evanescent, stigma oblong, receptacle oblong, *carpels* $\frac{1}{2}$-obovate sublaterally apiculate *inflated at the end.*

R. Drouetii, *F. Schultz in Gren. et Godr. Fl. de Fr.* i. 24?
R. Godronii, *Gren. in F. Schultz, Fl. Gall. et Germ. exsic.* No. 1202 (specimen).

Stem floating, rooting from the lower joinings, very bluntly angular, hollow. Submersed leaves with filiform segments which are rather short, diverge greatly at their trifurcations, less so at the bifurcate divisions: middle branch at the first fork the smallest. Petioles plane-convex, short. Upper leaves nearly or quite sessile. Floating leaves very rare, tripartite; divisions stalked, bifid, wedge-shaped, the sides being very nearly straight, except the outer side of the lateral ones, which is slightly but decidedly rounded; middle division much more shortly stalked than the others, or very nearly sessile, usually placed at an angle with the other divisions, and directed downwards, so as to be always submersed. These tripartite leaves soon decay, and the plant produces beyond them a series of filiformly-divided submersed leaves, similar to those that had preceded them. Petioles of the tripartite leaves rather long, nearly cylindrical. Stipules large, rounded, auricled, $\frac{1}{2}$ to $\frac{2}{3}$rds adnate. Peduncles falling short of, or slightly exceeding the leaves, from both kinds of leaves. Buds oblong. Flowers small, star-like. Sepals ovate, very blunt, concave, greenish, dotted with purple, especially towards the edge; the whole margin diaphanous. Petals distant, white, wedge-shaped, yellow below and slightly clawed, about twice as long as the calyx when full-grown. Nectary round, scarcely at all margined or prominent. Stamens fewer than 10, exceeding the pistils. Style prolonging the inner edge of the ovary, short, curved. Carpels blunt, more or less hairy at the end, which is a little inflated so as to have a broad flat edge; base of the style small, rather variable in position, not central nor truly lateral. Receptacle oblong, as thick as the peduncle. Colour of the plant bright green.

This plant agrees in so many respects with the descriptions of *R. Drouetii*, and with specimens of that plant obligingly sent to me by my excellent correspondent M. R. Lenormand, that I am led to consider it as belonging to that species, notwithstanding the occasional presence of floating leaves. When those leaves are absent, the English plant appears to be identical with that described as *R. Drouetii* by Dr. Godron. That botanist places much dependence upon the "style . . . . inséré presque à l'extrémité du long diamètre du pistil:" such is not the case in our plant, nor is the rudiment of the style central upon the carpel of the French specimens, on some carpels of which it somewhat approaches that position, but upon others it is decidedly lateral. There is similar variety in the position of the apiculus on the carpels of the English plant.

The presence of flat floating leaves is an apparent objection to the identification of the plants; but I think that the widening of the divisions of some of the upper leaves, indicating an approach to a floating leaf, such as is occasionally although rarely found upon our plant, may be detected upon M. Lenormand's specimens. Of this, however, I am not quite certain.

I am much indebted to my friend the Rev. W. W. Newbould for directing my attention to the floating leaves of our plant.

The *R. Godronii* (Gren.), specimens of which I have received from Dr. F. Schultz, appears similar to our plant when it is furnished with the floating leaves, but I am unable to see in what other respects it differs from the typical *R. Drouetii*. I cannot find any description of *R. Godronii*.

R. confervoides (Fries, H. N. xiii. 45) is closely allied to this species, but has long slender peduncles. *R. paucistamineus* (Tausch) may be a stronger form of *R. confervoides.*

R. Drouetii can only be confounded with *R. trichophyllus* or *R. heterophyllus.* From the former it is distinguished by its bright green colour, collapsing leaves, inflated and very blunt carpels, and much more lax habit; from the latter by its very peculiar floating leaves, fewer-nerved and evanescent petals, inflated and minutely apiculate carpels, and nearly globose receptacle.

Flowering in May and June.

I have received *R. Drouetii* from several places in Cambridgeshire, Burnham in Norfolk, Byford in Herefordshire, and Hook in Surrey.

3. *R. heterophyllus* (Fries); *submersed leaves* loosely trifurcate, segments long *collapsing,* floating leaves subpeltate tripartite with sessile or stalked wedge-shaped 3–5-lobed leaflets, peduncles not narrowing scarcely exceeding the leaves, flowers large, *petals* broadly obovate-cuneate 7–9-*nerved* not contiguous *persistent,* stigma oblong, *receptacle conical,* carpels ½-ovate laterally pointed.

R. heterophyllus, *Fries, Summa,* 140, & *Herb. Norm.* ii. 32 (specimen).
R. aquatilis α. pseudo-peltatus, *Godr. in Mém. de Nancy,* 1839, p. 25. f. 5 *c* & *g*.
R. aquatilis var. pantothrix, *Fries, Herb. Norm.* ix. 27 (specimen).
R. aquatilis, *Eng. Bot.* t. 101.
Batrachium heterophyllum, *Van den Bosch, Prod. Fl. Batav.* 8.

Stem floating, rooting from the lower joinings, prominently but irregularly angular, hollow. (A plant apparently referable to this species which grew in shallow water has a solid stem. Much stress has been laid upon such a difference, but it seems of little consequence.) Submersed leaves two or three times trifurcate, afterwards bifurcate; segments filiform, rather rigid. At the first fork the branches are divaricate and the middle one is the smallest, at the succeeding forks they are more and more approximate. Petioles semicylindrical, short. Upper submersed leaves sessile. Floating leaves usually flat, with bifid leaflets, each segment deeply lobed; when they rise out of the water, as is frequently the case, they form a nearly or quite circular disk; their outer edge is usually straight from its base, but occasionally is slightly rounded from thence. Stipules broad, adnate nearly throughout. Peduncles from both kinds of leaves. Buds globular, or slightly depressed and obscurely pentagonal. Flowers becoming star-like. Sepals ovate, very blunt, convex, brownish green towards the top with a dark irregular edge, yellowish at the base, the whole margin diaphanous. Petals sometimes with more than nine nerves, white, yellow below, fully twice as long as the calyx. Nectary round, very prominent, bracket-shaped, so as to open nearly at right angles to the plane of the petal. Stamens many, exceeding the pistils. Style prolonging the inner edge of the ovary, curved. Stigma straight. Carpels blunt with a large apiculus, slightly hairy at the end, inner edge nearly straight.

When the floating leaves are not produced, the plant is similar in all other respects. Both states are frequently to be found in the same place.

The differences between this plant and *R. trichophyllus* and *R. Drouetii* have been already pointed out. Its collapsing leaves distinguish it from the four following species. Its uniformly thick and short peduncles separate it from *R. confusus, R. Baudotii* and *R. peltatus*; its wedge-shaped leaflets from *R. confusus, R. floribundus* and *R. peltatus*. In swift streams it sometimes much resembles *R. fluitans*, but has not the structure of that plant.

Flowering from May to July; rarely flowers may be found in April and August.

I have obtained this plant from Cambridgeshire, Leicestershire, Chichester, the River Lea near Hertford, Battersea in Surrey, and Pangbourn in Berkshire. I believe it to be pretty generally distributed.

4. *R. confusus* (Godr.); *submersed leaves* loosely trifurcate, segments long rather rigid *not collapsing, floating leaves* long-stalked subpeltate *subtripartite with sessile obovate* 3–5-lobed *segments*, peduncles slender narrowing gradually exceeding the leaves, flowers large, petals obovate-cuneate 7–9-nerved not contiguous persistent, stigma tongue-shaped, receptacle ovate-conical, carpels $\frac{1}{2}$-ovate compressed and narrowed upwards.

R. confusus, *Godr. in Fl. de Fr.* i. 22.
R. Petiveri, *Koch in Sturm, Deutschl. Fl.* fasc. 82. t. 2.
R. Petiveri *α.* minor, *Koch, Syn.* ed. 2. 13.

Stem floating, rooting at the lower joinings, roundish, hollow; the upper part, when flowering, often rising out of the water. Submersed leaves two or three times trifurcate, afterwards bifurcate; segments rather thick. At the first fork the branches are nearly equal, long and divaricate, at the succeeding ones more and more approximate. Intermediate leaves with fewer, shorter and linear segments. Petioles semicylindrical, short. Floating leaves flat, marked with brownish irregular spots;

segments diverging, slightly combined at the base or sessile, lateral ones much rounded at base externally; outline of the floating or emerged leaves scarcely more than a semicircle. Petioles thick, semicylindrical. Stipules oblong, much adnate. Peduncles very long, rising high out of the water, from both kinds of leaves. Buds globular, but slightly depressed and a little pentagonal. Flowers rather large, star-like. Sepals oblong, blunt, convex, green, with a broad diaphanous margin. Petals elliptic-cuneate or obovate, white, yellow and shortly clawed below, 2 to $2\frac{1}{2}$ times as long as the calyx even when first expanded, their lower half much lengthened afterwards. Nectary shortly oval, strongly margined below, scarcely at all so above, forming an acute angle with the plane of the petal. Stamens about 20, exceeding the pistils. Style rather long, recurved from near its base, prolonging the inner edge of the ovary. Carpels ultimately rather acute, the inner edge nearly straight. Persistent base of the style long and conical, nearly erect. Receptacle as thick as the peduncle. Flowers strongly scented like honey.

Differs from *R. heterophyllus* by its submersed leaves not collapsing, its stem often rising out of the water, its long slender and narrowing peduncles, and ligulate stigma; from *R. Baudotii* by the obovate segments of its floating leaves, slender peduncles, half-ovate carpels compressed and narrowed at the top, and stamens exceeding the pistils.

Flowering from June to September.

I have obtained this plant from near Chichester, Dunster and Weston-super-Mare in Somersetshire, Stackpole and Tenby in Pembrokeshire, and the mouth of the Tees on both sides of the river I believe. It seems to prefer the neighbourhood of the sea, and does not object to slightly brackish water.

5. *R. Baudotii* (Godr.); submersed leaves closely trifurcate, segments rather rigid not collapsing, floating leaves long-stalked tripartite with sessile or stalked *wedge-shaped* 2–4-lobed segments, peduncles thick narrowed at the top exceeding the leaves, flowers moderate, petals 7-nerved not contiguous persistent, *stamens not exceeding the pistils*, stigma tongue-shaped, receptacle elongate-conical, *carpels* $\frac{1}{2}$-obovate *inflated at the end.*

R. Baudotii, *Godr. in Mém. de Nancy*, 1839, p. 21. f. 4, and *Fl. de Lorr.* i. 12, and *Fl. de France*, i. 21; *Koch, Syn.* ed. 2. 434.
Batrachium Baudotii, *Van den Bosch, Prod. Fl. Batav. 7.*

Stem floating, rooting from the lower joinings, very bluntly angular, with a shallow furrow on two sides, hollow. Submersed leaves two or three times trichotomously divided into short filiform segments, forking like those of *R. confusus*. Intermediate leaves with fewer and linear segments. Petioles short or none. Floating leaves flat; divisions wedge-shaped regularly to their base, 3–4-lobed, or often of many linear blunt segments. Outline of the floating or emerged leaves not more than a semicircle. Petioles long. Stipules adnate nearly throughout. Peduncles long, thick, from both kinds of leaves. Buds globular, depressed (?). Flowers rather large, star-like. Sepals like those of *R. confusus* (?). Petals white, yellow below, 2–2½ times as long as the calyx. Nectary shortly oval. Stamens 15–20. Style long, recurved from its middle, prolonging the inner edge of the ovary. Carpels very many (50–100 on each receptacle), forming a globose mass. Inner edge often considerably rounded near the top; apiculus small. Receptacle thicker than the peduncle.

Owing to neglect, the above description is imperfect in a few particulars.

This plant is very nearly allied to *R. confusus*, with which species I long confounded it. *R. confusus* appears to be always a more slender and elongated plant, never to have stalked segments to its floating leaves, nor the deep lobes often replaced by broad linear blunt segments, nor the short stamens, nor the globose clusters of many rather pointed carpels with inflated tops, of this plant. Here also the segments are truly wedge-shaped, the outer margins of the lateral ones appearing to be constantly straight quite to their base. The narrowing long peduncles, tongue-shaped stigmas, many and inflated carpels, and great difference of appearance, separate it from *R. heterophyllus*.

I am much indebted to my liberal friend M. R. Lenormand for authenticated specimens of this plant; and Dr. F. Schultz has identified with it a plant gathered by Mr. Syme at Guillan, near Edinburgh, specimens of which the latter gentleman has kindly given to me.

The *R. marinus* of Fries (Mant. iii. 51; Herb. Norm. ix. 28) is closely allied to *R. Baudotii*; but he is probably correct in believing (Summa, 555) them to be distinct. In some respects it seems more nearly related to *R. confusus*, and I have suspected that they may be identical.

Flowering from May to August; but sometimes flowers may be found in April.

R. Baudotii appears to delight in slightly brackish water. I possess it from Edinburgh, Seaton Carew in the county of Durham, Burnham in Norfolk, near Chepstow in Gloucestershire and Monmouthshire, Shirehampton near Bristol in Gloucestershire, Dunster in Somersetshire, and near Cork (?).

6. *R. floribundus*; submersed leaves closely trifurcate, segments rather rigid divaricate not collapsing, floating leaves long-stalked subpeltate $\frac{1}{2}$-trifid or 3-partite with sessile obovate 3–5-lobed segments, *peduncles not narrowed* scarcely exceeding the leaves, flowers large, *petals* obovate-cuneate 9–*many-nerved not contiguous* persistent, stamens many exceeding the pistils, *stigma tongue-shaped*, receptacle spherical, carpels $\frac{1}{2}$-obovate very blunt.

Stem floating, rooting from the lower joinings, bluntly angular, hollow, often rising out of the water. Submersed leaves dark green, two or three times trifurcate, afterwards bifurcate, segments rather short filiform; intermediate primary subdivision smaller. Petioles short, semiterete. Floating leaves convex, divided more than halfway down; lateral segments bifid, each lobe bicrenate; middle segment 3-crenate; *outer edge of the leaf much rounded at the base.* Outline of the floating or emerged leaves forming about $\frac{2}{3}$rds of a circle, but the rounded outer bases often overlap. Petioles nearly cylindrical. Stipules very broad, with a free rounded end. Peduncles from both kinds of leaves. Buds slightly depressed, slightly pentagonal. Flowers star-like. Sepals ovate, greenish, with a diaphanous margin. Petals at first nearly contiguous, afterwards distant, white, clawed and yellow below, more than twice as long as the calyx. Nectary ovate, its margin thickened all round and slightly prominent below. Stamens 20–30. Style short, recurved, prolonging the inner edge of the ovary. Inner edge of the carpels nearly straight. Receptacle as thick as the peduncle.

I am unable to identify this plant with any described species. It is most nearly allied to *R. peltatus*, with which I was much inclined to have combined it. It differs from *R. peltatus* by its deeply trifid floating leaves, dark green submersed leaves with unequal segments branching at shorter intervals, peduncles not narrowing upwards, nor very long, nor almost solely springing in company with the floating leaves (in *R. floribundus* they spring as frequently with the petioles of the submersed as of the floating leaves), the ovate nectary, and depressed buds. From *R. heterophyllus* it may be known by its submersed leaves not collapsing, its floating leaves (when tripartite) with sessile segments, and not straight-sided, its ovate nectary, and depressed buds; from *R. confusus* by its floating leaves being usually convex, not spotted; peduncles not long, slender, and narrowing upwards; carpels not compressed and narrowed upwards; and by its dark colour; from *R. Baudotii* by the markedly rounded base of the outer margin of its convex leaves, its peduncles not narrowed towards their top, many-nerved petals, long stamens, and much fewer carpels.

A Sicilian specimen from Prof. Gasparrini, which he named *R. aquatilis*, appears to be *R. floribundus*.

Flowering from May to September.

I possess this plant from Hedon near Hull, Denver Common in Norfolk, and a pit by the road-side near Legge's Farm near Hatfield in Hertfordshire.

It is the most beautiful of our species; its large white flowers being so numerous as to cover the places that it inhabits with a sheet of bloom.

7. *R. peltatus* (Fries); submersed leaves loosely trifurcate, segments rather rigid divaricate not collapsing, floating leaves long-stalked subpeltate nearly half-3-5-fid with obovate 3-4-crenate segments, *peduncles narrowing* gradually *from floating leaves* and exceeding them, flowers large, *petals* round becoming obovate-cuneate 9-nerved *contiguous* persistent, stamens many exceeding the pistils, stigma club-shaped, receptacle ovate, carpels ½-obovate very blunt.

R. peltatus, *Fries, Summa*, 141, and *Herb. Norm.* xii. 48 (specimen).
R. aquatilis *α*. peltatus, *Sturm, Deutschl. Fl.* fasc. 67. t. 7.

Stem floating, rooting from the lower joinings, bluntly angular, hollow, often rising out of the water. Submersed leaves light green, 2 or 3 times trifurcate, afterwards bifurcate; segments long, slender, filiform; primary subdivisions about equal. Petioles short, semiterete. Floating leaves convex; *outer edge of the leaf much rounded at the base.* Outline of the floating or emerged leaves forming about ⅔rds of a circle, but the rounded outer bases often overlap. Petioles plane-convex. Stipules adnate nearly throughout, rounded at the end. Peduncles long, rising high out of the water, from the floating leaves; very rarely a peduncle springs with a submersed leaf. Buds globular. Flowers very large, sweet-scented. Sepals ovate, diaphanous except at the centre, where they are slightly green. Petals quite contiguous, ultimately slightly separated by the lengthening of their lower part, white, clawed and yellow below, more than twice as long as the calyx at their first expansion. Nectary oblong, its margin slightly thickened all round and a little prominent below. Stamens about 30. Style curved, short, prolonging the inner edge of the ovary. Carpels not inflated; inner edge nearly straight. Receptacle small; its shape is rather doubtful, owing to the cultivated plant perfecting few carpels, and its shape not having been observed in the wild plant when fresh.

This plant differs from *R. heterophyllus* and all the other species, except perhaps *R. tripartitus*, by its "necessary" floating leaves, for the presence of a flower springing in company with a submersed leaf is extremely rare, with $\frac{1}{2}$-trifid not tripartite nor wedge-shaped lobes, and by their being nearly always convex; by its submersed leaves not collapsing; its long narrowed peduncles; and petals contiguous except when about to fall; from *R. confusus* by its convex not tripartite floating leaves, contiguous petals, $\frac{1}{2}$-obovate and very blunt carpels; from *R. Baudotii* by its convex not tripartite leaves with obovate segments, narrowing peduncles, contiguous petals, long stamens and short receptacle.

Flowering from May to September.

I possess this plant from St. Pierre in Monmouthshire, (where it was first noticed as being a distinct species by the Rev. F. J. A. Hort,) Bream in Gloucestershire, and Hoveton in Norfolk.

Sturm's figure quoted above represents the petals as not being contiguous, but is doubtless intended for this plant. Fries's specimen contained in the *Herb. Normale* is very imperfect, but leaves no doubt upon my mind of the identity of our plant with it. A specimen sent to Fries, with the name of *R. peltatus* attached to it, was stated by him to be correctly so named.

8. *R. tripartitus* (D.C.); "submersed leaves divided into capillary segments collapsing," floating leaves long-stalked subpeltate deeply trifid with cuneate-obovate 2–4-fid segments, *peduncles not narrowing falling short of the leaves,* flowers very small, petals oblong 3-nerved not contiguous, stamens few exceeding the pistils, *stigma small on a long subulate terminal style with a slender base,* receptacle globose, *carpels* unequally *obovate much inflated* with a nearly terminal point.

R. tripartitus, *DeCand. Pl. Gall. Rar.* p. 15. t. 49; *Eng. Bot. Suppl.* t. 2946; *Lloyd, Fl. Loire,* 4!
R. tripartitus α. microphyllus, *DeCand. Syst.* i. 234.

Stem floating or creeping, rooting from the lower joinings, slightly furrowed, rising out of the water. Submersed leaves (which have not yet been observed in Britain) several times trifurcate; segments long, slender, filiform. Floating and emerged leaves deeply trifid, forming about $\frac{3}{4}$ths of a circle; the lateral segments with 3, the central with 2–4 crenatures, the outer edge of the lateral segments rounded in their upper half, but straight below. Upper *stipules free.* Buds globular. Sepals ovate, dark green tinged with purple, the whitish margin diaphanous. Petals very small, slightly exceeding the sepals, rather acute, narrowed into a claw, pinkish-white, yellowish below, with 3 distant nerves. Nectary roundish, its border a little thickened only below. Stamens 5–10. Style straight, placed nearly upon the middle of the end of the ovary. Carpels very blunt, glabrous; inner edge rounded. Receptacle globose.

This plant and *R. ololeucos* (which has not as yet been found in Britain) are distinguished by having very slightly adnate stipules, much inflated carpels having a much rounded inner edge, and minute stigmas. The slender base of the long subulate deciduous style also is a mark of *R. tripartitus.* In *R. ololeucos* the style is persistent, sickle-shaped, and thickened at the base, the petals are much larger and wholly white (in all our species of *Batrachian Ranunculi* they are more or less yellow at the base), and the peduncles much exceed the leaves.

Flowering from May to August.

Mr. H. C. Watson discovered this plant on Esher Common in Surrey. I have found it between Haverfordwest and Robeston in Pembrokeshire.

It is probable that by descending the little streamlets in which this plant has been found until they increase in size and depth, the form producing submersed leaves will be found. My valued friend Mr. Borrer has given to me a specimen grown in deep water in his garden which has loosely twice trifurcate leaves with long narrowly linear segments. Such leaves are found interposed between the capillarly divided and the subpeltate leaves of several of these *Ranunculi,* for instance in *R. Baudotii.* It is scarcely necessary to remind botanists, that the form of the style is not to be seen upon dried specimens, for it shrinks so much as in the dry state to appear as if it were broadest at the base. I possess a specimen, gathered by my friend Mr. F. Townsend near Tunbridge Wells, which probably, but not quite certainly, belongs to *R. tripartitus.* It appears to have grown in rather deep water, but does not now possess any of the submersed leaves. It has no petals remaining, and may be *R. ololeucos.*

Subsection B. Submersed leaves not like those of Subsection A. Receptacle hispid.

9. *R. circinatus* (Sibth.); leaves all submersed and sessile trifurcate with repeatedly and very closely forked *rigid segments all placed in one roundish plane* not collapsing, peduncles narrowing much exceeding the leaves, flowers large, petals obovate many-nerved nearly contiguous persistent, stamens exceeding the pistils, stigma cylindrical, receptacle oblong, carpels $\frac{1}{2}$-ovate compressed rather acute.

R. circinatus, *Sibth. Fl. Oxon.* 175; *Reichenb. Fl. excur.* 719, *et Icon. Fl. Germ.* iii. Ran. t. 2; *Fries, Herb. Norm.* ix. 29 (specimen); *Eng. Bot. Suppl.* t. 2869.

R. divaricatus, "*Schrank,*" *Koch, Deutschl. Fl.* iv. 152, *et Syn. Fl. Germ.* ed. 2. 13 ; *Godr. Fl. Lor.* i. 15, *et Fl. de Fr.* i. 25.
R. stagnatilis, *Wallr. Sched. Crit.* 285.
R. aquaticus albus, circinatis tenuissime divisis foliis, floribus ex alis longis pediculis innixis, *Raii Syn.* ed. 3. 249.

Stem submersed, ascending, branched, angular, furrowed, hollow, rooting from the lower joinings. Leaves small, their capillary brassy-green divisions repeatedly forked, but all lying exactly in one plane, which is placed usually at right angles to the stem and has a round outline. Stipules sheathing, adpressed, not auricled. Buds obovate, depressed. Sepals ovate, blunt, greenish, tinged with purple towards the tip, the margin broadly diaphanous. Petals 2 or 3 times as long as the calyx, about 9-nerved, white with a yellow claw. Nectary roundish, small, rather strongly bordered below. Stamens 15–20. Style prolonging the inner edge of the ovary. Stigma recurved, but straight. Receptacle narrower than the peduncle both in flower and when bearing carpels. Carpels ultimately rather acute, and tipped with the recurved persistent style.

The structure of the leaves is sufficient to distinguish this plant from all known *Ranunculi*.

Flowering from June to August.

This plant is not unfrequent. For its distribution in Britain I may refer to Watson's 'Cybele Britannica.'

From the remark of Messrs. Hooker and Arnott (Brit. Fl. ed. 7. p. 7) that they "cannot believe this to be distinct from the following" (*R. aquatilis,* including the *R. heterophyllus, R. trichophyllus, R. confusus* and *R. Baudotii* of this paper), I am necessarily led to the conclusion that they have no practical acquaintance with it, and perhaps have paid no attention to it except when preserved in an herbarium. As I have on several occasions received specimens of *R. heterophyllus* under the name of *R. circinatus,* when the petioles were shorter than is usual and the leaves small, I presume that it is not so generally known to botanists as its distribution would have rendered probable. It is so constant to its characters, that, even when the water has dried up in its place of growth, it retains its distinctive structure and grows and flowers in the air.

10. *R. fluitans* (Lam.); leaves all submersed about twice trifurcate with very *long linear twice or thrice forked nearly parallel segments,* peduncles narrowing, flowers large, petals broadly obovate many-nerved contiguous persistent, *stamens falling short of the pistils,* stigma cylindrical, receptacle

conical, carpels obovate inflated much rounded at the end laterally apiculate.

R. fluitans, *Lam. Fl. Fr.* iii. 184; *Reichenb. Fl. exsic.* 886 (specimen), *et Icones Fl. Germ.* iii. Ran. t. 2; *Gren. et Godr. Fl. de Fr.* i. 25; *Van den Bosch, Prod. Fl. Batav.* 6.
R. peucedanifolius, *Desf. Atl.* i. 444.
R. fluviatilis, *Sibth. Fl. Oxon.* 176; *Wallr. Sched.* 284.
R. sive Polyanthemo aquatili albo affine Millefolium Maratriphyllum fluitans, *Ray, Syn.* 250.

Stem floating, very long, branched above, nearly round, hollow, wholly submersed. Leaves together with their petioles often a foot in length. Segments thick. Petioles of the upper leaves often short. Stipules broadly lanceolate, strongly auricled, $\frac{1}{2}$-adnate. Sometimes at the end of the stem a few stalked 3-furcate leaves with short broad linear segments are found; in these leaves the middle segment is entire, the lateral ones are simply forked; they do not at all resemble the floating leaves of the other species. When the seedling plant has been deserted by the water, all the leaves are of this form. Bud shortly pyramidal, pentagonal. Peduncles thick, much shorter than the leaves. Flower often semidouble. Sepals ovate, blunt, green, bordered with purplish black and a broad diaphanous edge. Petals 2–3 times longer than the calyx, slightly clawed, 9–15-nerved. Nectary round, bordered slightly below. Stamens many, short. Style prolonging the inner edge of the ovary. Stigma straight, a little inflexed at the top. *Receptacle* conical, *slightly pilose* immediately after the flowers have fallen. Carpels with a small lateral point.

The structure of the long whip-shaped leaves is sufficient to distinguish this plant. It is also remarkable for the tendency of the flowers to produce a second imperfect whorl of petals. It does not change its form even when growing in stagnant water.

Not uncommon in rivers. Watson's 'Cybele' may be referred to for its distribution in Britain.

Flowering in June and July.

The *R. Bachii*, Wirten (Schultz, Archives de Flore, i. 292; Billot, Exsic. No. 1103!), is a form of *R. fluitans*. The form of the petals does not afford a constant character, neither does the length of the peduncle. I have observed it in the River Whiteadder in Berwickshire. It is much smaller in all its parts and more elegant, but I cannot detect any other difference. Mr. J. Lange has sent it to me from Denmark. It has sometimes been mistaken for the *R. marinus* (Fries), with which it has very little in common.

Subsection C. No submersed leaves. Receptacle not hispid.

11. *R. cœnosus* (Guss.); leaves all roundish cordate with 3–5 rather *deeply divided lobes which widen from their base,* petals exceeding the calyx, *style terminal* upon the ovate-conical ovary, carpels unequally obovate with a terminal point.

R. cœnosus, *Guss.* "*Prod. Suppl.* 187," and *Syn.* ii. 39; *Godr. in Fl. de France,* i. 19; *Bab. Man.* ed. 3. 7.
R. Lenormandi, *F. Schultz in Flora oder Bot. Zeit.* 1837, p. 727!; *Walp. Repert.* i. 34; *Bab. Man.* ed. 2. 6; *Eng. Bot. Suppl.* t. 2930.
R. hederaceus β. grandiflorus, *Bab. Man.* ed. 1. 5.

Stem floating or creeping upon mud, branched, nearly round but with slight angles. Leaves not spotted; lobes very blunt and broad at the top, entire or with 1–3 notches. Petioles long, terete-compressed. Stipules ½-adnate, bluntly pointed, the floral ones very broad. Peduncles not narrowed, nearly equalling the leaves. Buds oblong. Flowers large. Sepals obovate, concave, greenish, tinged with purple towards the tip, with a diaphanous margin. Petals about twice as long as the calyx, narrow, obovate, 5-nerved, white with a slight tinge of pink, slightly clawed and yellowish below. Nectary round, bordered below. Stamens 8–10, about equalling or a little exceeding the pistils. Style nearly central upon the ovary (that is, the upper edge of the ovary is nearly as prominent and rounded as the lower edge) which narrows gradually into the style. Style short, thick, and slightly curved outwards. Stigma oblong. Receptacle spherical, naked. Carpels with their inner (upper) edge much rounded towards the top, inflated, tipped with the terminal although not always quite central style.

Flowering from June to August.

I possess this plant from near Coniston Lake in Westmoreland, near Sheffield, Needwood Forest in Staffordshire, Charnwood Forest in Leicestershire, near Aberystwith in Cardiganshire, near Swansea in Glamorganshire, near Haverfordwest in Pembrokeshire, near Llanberis in Caernarvonshire, Esher Common in Surrey, Tunbridge Wells in Kent, Lucott Hill in Somerset, and near Plymouth in Devonshire.

Messrs. Hooker and Arnott indirectly hint (Brit. Fl. ed. 7. p. 8) that near Glasgow this plant may be an altered state of *R. hederaceus,* for "it is principally met with in ditches where the temperature is raised by warm condensed steam," "and where formerly *R. hederaceus* only occurred." This seems to require more proof than a simple statement affords. We want (1) to be rendered quite sure that *R. cœnosus* is the plant that now inhabits those ditches, and (2) that it was the true *R. hederaceus* alone that grew there formerly. I have most frequently found *R. cœnosus* in rather elevated situations, where no source of artificial heat could affect it.

12. *R. hederaceus* (Linn.); leaves all roundish reniform with 3–5 shallow rounded *lobes widening to their base,* petals scarcely exceeding the calyx, *style prolonging the inner edge of the ovary,* carpels $\frac{1}{2}$-oval or $\frac{1}{2}$-obovate with a lateral point.

R. hederaceus, *Linn. Sp. Pl.* 781; *Eng. Bot.* t. 2003; *Reichenb. Icon. Fl. Germ.* iii. Ran. t. 2.

Stem floating or creeping upon mud, branched, nearly round. Leaves usually spotted; lobes separated by shallow notches, widening gradually from their base to a narrow rounded end, often broadly triangular, entire or rarely with a slight notch at the top. Petioles long, semicylindrical. Stipules long, much adnate, blunt, denticulate. Peduncles not narrowed upwards, much falling short of the leaves. Flowers very small. Petals about equalling or a little exceeding the calyx, narrow, 3-nerved. Stamens 6–8. Stigma short, oblong. Receptacle spherical, naked. Carpels compressed below, blunt and inflated above, inner edge nearly straight, laterally tipped with the style or pointless.

Flowering from June to September.

This plant is probably generally distributed, but as *R. cœnosus* is often mistaken for it, I may mention that I know of its existence at Inverarnan at the head of Loch Lomond, near Llanberis in Caernarvonshire, Lanwarne in Herefordshire, Needwood Forest in Staffordshire, Tiptree Heath in Essex, Triplow and other places in Cambridgeshire, near Haverfordwest in Pembrokeshire, Ninham in the Isle of Wight, and Bovey Heathfield in Devonshire.

XIII. *On some species of* Epilobium.

By Charles C. Babington, M.A., F.R.S. &c.

Read 10th January 1856.

Having been led to examine the British species of *Epilobium*, and arrived at the opinion that some of them have not received as much attention as they deserve, and have therefore been misunderstood, it seems desirable to publish the results. My object in so doing is to direct attention tô the plants—not to place before botanists a conclusion satisfactorily attained. There remains much to be done before we can be said well to understand these plants. Those upon which it is proposed to treat have been included under the names of *E. tetragonum* and *E. alpinum*.

Before proceeding to the discussion of the species, it will be well to clear the way by pointing out the characters upon which it is believed that we may depend. This will entail a slight sketch of the arrangement of our *Epilobia*. Leaving out of consideration the group called *Lysimachion* by authors (although there is a newly-discovered species of that section to be noticed before ending this paper), we shall find that, taken in its general sense, the form assumed by the stigmas will separate our plants into two groups: (1) those which have that organ formed of four spreading divisions so as to be cross-like, namely *E. hirsutum*, *E. parviflorum*, *E. montanum*, and *E. lanceolatum*; and (2) the rest of our species, whose stigmas are so placed as to form a club, either by having the four parts soldered together or by their being adpressed to each other. In the latter case, that is, when the stigmas are adpressed, they may sometimes be observed to separate slightly, but never, as I believe, to become cross-like. It is only when taken generally, that the stigma can be safely used as a distinctive character; but if allowance be made for exceptions in the case of individual plants, it does seem to afford valuable help in grouping the species. This is the more desirable from the true biological characters which separate the species being often not noticeable in the flowering state of the plants. The characters referred to are the mode of extension of the plants from year to year. The plants are either *turionate*, *stoloniferous*, or *rosulate*; the stoles are either scaly or leafy, the scales are somewhat inflated or not so. The leaves upon these offsets gradually increase in size from the base to the end of the shoot, and their pairs are all separated by long joints; are all placed close together and form a rosette; or those at the end of the stole are so placed as to form a rosette, the others being distant. Taking these as the primary characters of the divisions, we obtain an arrangement which differs but little from that founded upon the stigma which has usually been employed. The following is the arrangement proposed :—

I. Turionate; that is, producing radical suckers.

1. *E. hirsutum.*

II. Stoles autumnal, rosulate. Stem erect.

† *Stem mostly round. Stigma 4-cleft.*

2. *E. parviflorum.*
3. *E. montanum.*
4. *E. lanceolatum.*

†† *Stem with raised lines. Stigma entire.*

5. *E. roseum.*
6. *E. tetragonum.*

III. Stoles æstival, long-jointed throughout, with small leaves. Primary stem erect. Stigma usually entire.

7. *E. obscurum.*

IV. Stoles æstival, long-jointed, with small leaves, ending in autumnal bulbs which become detached. Base of stem cord-like.

8. *E. palustre.*

V. Stoles æstival, leafy, rosulate.

9. *E. alpinum.*

VI. Stoles æstival, leafy, not rosulate.

10. *E. anagallidifolium.*

VII. Stoles æstival, scale-bearing, not rosulate.

11. *E. alsinifolium.*

In addition to the characters used in this arrangement, the following points deserve notice.

1. The stem in some of the plants rises erect directly from a fibrous root, and usually produces lateral branches from the axils of its lowest leaves so as to take a rather cæspitose form. This primary stem appears always to be erect, but the lateral stems or branches are usually procumbent at their base and fre-

quently produce roots there, although throughout the greater part of their length they are erect or ascending. When the plants grow in water, or in very wet places, these adventitious roots are sometimes produced from the lower joinings of the upright primary stem, and the procumbent part of the branches is very long: if in this case a branch is carelessly pulled up, the plant may easily be supposed to have a cordlike base, when its real structure is very different. Towards the end of the summer, or in the autumn, these cæspitose species usually produce from close to the base of their stem very short flowerless shoots having their joints so much contracted that the leaves lie closely upon each other, and a rosette or rose-shaped tuft is formed. The original plant does not survive the winter, but in the ensuing spring the place which it occupied is more or less surrounded by a cluster of new cæspitose individuals resulting from the rosettes of the preceding autumn; each rosette producing from its terminal bud a new primary stem, and from some of its axils a few lateral stems.

In other plants, thick long stoles with distant leaves take the place of the rosettes. It is only at the end of these stoles that the least trace of the close arrangement of leaves forming the rosettes is to be found, nor is it always seen even there. These long stoles root and live through the winter, and their remains when attached to the base of the stem of the succeeding year may be taken for the chordorhizal structure if the stem fails to produce lateral stems from its lower axils. The character derived from the chordorhizal base is not therefore wholly to be trusted, although Fries has confidence in it.

2. Another habit is that in which there is no trace of the cæspitose mode of growth, but in its place there is a prostrate slender stem producing many adventitious roots, and turning upwards at the end so as to form the upright stem of the plant. If branches are at all produced from the lower part of the stem they are placed at some distance from each other, or in distant pairs, for the joints are long. Most of these species throw out from many of their lower joinings stoles furnished with long joints and pairs of very small leaves, and end in a sort of bulb, the scales of which are rather fleshy with their upper epidermis loose. These bulbs become detached in the winter, by the decay of the stole, together with the stem which has flowered, and from them spring the plants of the following year.

We may now proceed to the consideration of the species which are usually included under the name of *E. tetragonum*. Fries appears to have been the first botanist who attempted their separation by a reference to their development; but that eminent writer has been unfortunate in the specimens distributed in illustration of the plants, as will be seen hereafter. Applying those characters to our native plants, it is found that there are at least two species included under the name of *E. tetragonum*. One of these will retain that name, and another is the *E. obscurum* of Schreber. The former has the cæspitose habit, and produces sessile or subsessile rosettes after the time of flowering: the latter is originally cæspitose, its primary stem being erect from the root and branching from its lowest axils, but these lateral branches are prostrate and rooting to some extent; and in the place of the rosettes of the former it has long rooting stoles. Specimens of this latter plant (*E. obscurum*) are what I have been accustomed to call *E. virgatum* whilst totally in ignorance of the *E. obscurum*. I hope to be able to show that no great error was committed in doing so. For it is my belief that Fries himself made the same mistake, if indeed it is a mistake, and that his *E. virgatum* exists as a distinct plant from *E. obscurum*. He has called various plants by the name of *E. virgatum* at different times. The plant first issued (Herb. Norm. ii. 46) as *E. virgatum* is very nearly related to *E. tetragonum*, although perhaps not exactly that species; for it may be the *E. Lamyi* (F. Schultz), as Koch supposed it to be. These specimens do not accord with the description given in the 'Novitiæ' (ed. 2. p. 113); but a trust in the accuracy of Fries caused them to be accepted as typical of his plant. The original source of the name is the 'Fl. Hallandica' (p. 66), and the description to be found there may help us in determining what was the plant really intended by its author. As the book is perhaps not very common, the characters are extracted. They are as follows:—

"*E. virgatum*; foliis lanceolatis sessilibus dentatis opacis caule tetragono pubescentibus, stigmate indiviso."

To this are added the following remarks:—

"Verum videtur *Chamænerion obscurum*, Schreb.; sed *E. obscurum* omnium fere auctorum ad præcedens [*E. tetragonum*] foliis alternis, ex. gr. Fl. Dan. t. 1267, pertinet. Radix subrepens. Caulis e basi tereti adscendenti erectus, 2–4-pedalis, vage ramosus, 4-angulus, pubescens, deorsum glabratus. Folia distantia, opposita alternave, sessilia, lanceolata, subcoriacea, remote dentata, plus minus pubescentia, constanter opaca. Laciniæ calycinæ villosæ. Siliqua villosa. Flos sequentis [*E. palustris*]."

These descriptions do not agree with the first specimens (H. N. ii. 46), and differ slightly from the description given in the 'Novitiæ;' but they do agree tolerably well with the specimens afterwards stated by Fries to be the true plant (H. N. x.), the leaves of which are subsessile, broad, and rounded at the base, from whence they narrow, with tolerable regularity, to their tip, which is suddenly contracted to an obtuse angle. They are opake, thin, and apparently flaccid, distantly denticulate, slightly hairy. The presence of the word "subcoriacea" in the 'Flora Hallandica' causes some difficulty, for it is hardly possible that the leaves of the plant sent to me in the 'Herb. Normale' (fasc. x.) can ever have been subcoriaceous. That specimen has an upright base, thickening from a slender broken point, and producing 4 or 5 whorls of fibrous roots,—a structure different from what I understand by Fries's term, "chordorhizum." After a careful consideration of the plant and the descriptions, I have arrived at the opinion that the *E. virgatum* (Fries, H. N. x.) is *E. obscurum*, and am inclined to the further opinion, that the *E. virgatum* of the 'Fl. Hall.' is the same plant. The peculiar base of the stem in the specimen probably results from its having grown in a very wet place.

Having thus, as it is hoped, shown the probability of *E. virgatum* being a synonym of *E. obscurum*, we may proceed to the consideration of the characters, &c. of that plant and its ally, *E. tetragonum*. I am indebted to my valued friend Mr. Borrer for directing my attention to these plants, and pointing out their more important differences. Since the original sketch of this paper was written, I have seen a valuable memoir by Dr. Grisebach (Bot. Zeit. 1852, p. 849), and Dr. F. Schultz has very kindly sent to me a copy of his excellent review of it (Arch. de Flore, ii. 41). From the study of Mr. Borrer's manuscript notes and his specimens, and of the writings of these two eminent botanists, I have obtained a tolerably clear idea of the subject.

The following is the mode in which the plants may be characterized:—

E. tetragonum (Linn.); *rosettes subsessile*, stem erect, *leaves strap-shaped much denticulate-serrate*, limb of the intermediate leaves decurrent, buds erect, seeds oblong-obovate tubercular.

E. tetragonum, *Linn. Sp. Pl.* ed. 1. 348; *Curt. Fl. Lond.* i. 66 (131); *Fries, Herb. Norm.* viii. 41 (specimen); *Reichenb. Fl. exsic.* 357 (specimen); *Gren. et Godr. Fl. de Fr.* i. 579; *F. Schultz, Archives de Flore*, ii. 51.

E. adnatum, *Griseb. in Bot. Zeit.* 1852, p. 854.

Stem upright from the root, usually branched from the base, with 2–4 raised decurrent lines from the edges of the leaves. Rosettes usually very nearly sessile, and although they are sometimes shortly stalked when the plant is flooded, they do not even then resemble the stoles of *E. obscurum*. Seeds rounded at both ends, but with a recurved point at the base; that is, if the front of the seed is observed, the base appears to be blunt, but if a lateral view is taken, the small point directed backwards is seen. The intermediate leaves appear to be always decurrent by their limb, as are often many of the others; they do not narrow much until near to their upper end; the little teeth are near together, conspicuous, and often have incurved callous points. The lower leaves are more nearly lanceolate, the lowest obovate.

Dr. Grisebach differs from all other botanists by thinking that this is not the typical plant of Linnæus, and accordingly changes its name to *E. adnatum*, and calls the *E. Lamyi* (F. Schultz) the *E. tetragonum* (Linn.). Dr. Schultz thinks that Grisebach is in error, and restores the Linnæan name to the plant that has usually been so called. In this I quite agree with him. Nevertheless there are difficulties attending the determination of the Linnæan plant that call for a few remarks. It is highly probable that Linnæus included the *E. obscurum* under the name of *E. tetragonum*. In the first edition of the 'Sp. Pl.' (i. 348) he gives the character as follows:—

> "E. foliis lanceolato-linearibus denticulatis: imis oppositis, caule tetragono."

In the second and later editions of the same work it is

> "E. foliis lanceolatis denticulatis: imis oppositis, caule tetragono;"

and the remark is added,

> "Summitas, adhuc tenella, nutans."

Our *E. tetragonum* is very much better described by the former than the latter of these definitions, and the additional observation shows that Linnæus had, when preparing the second edition for the press, fallen into some confusion, for it need scarcely be remarked, that neither *E. tetragonum*, nor *E. obscurum*, nor *E. Lamyi* has a nodding summit. It is a curious fact, that Linnæus does not include *E. tetragonum* in his 'Fl. Suecica,' although it appears not to be a rare plant in Sweden. May we not thence conclude that he had little acquaintance with the plant, and thus account for his altering the character for the worse? This is rendered more probable when it is found that the figure quoted by him from Tabernæmontanus (Icon. p. 854) does not represent *E. tetragonum*, nor agree with the Linnæan description: what it does represent is a more difficult point to decide, and no attempt is now made to do it. There is only one specimen preserved in the Linnæan Herbarium with the name and authenticating marks of *E. tetragonum*. The place where it grew is not stated, and there is no clue to its history. It is not *E. tetragonum*, nor either of its close allies, but appears to be the plant now universally called *E. roseum*. It seems probable that Linnæus was led by this specimen into the mistake of altering the specific character of his plant and adding the erroneous remark. It is scarcely necessary to observe, that these alterations are derived from the peculiarities of *E. roseum*.

E. tetragonum is perhaps a less common plant in Britain than *E. obscurum*. My specimens are from Glen Falloch, Perthshire; Congestone, Leicestershire; Cambridge; Stapleton, near Bristol; Sussex; Sidmouth, Devon; Cork; and the Channel Islands.

E. obscurum (Schreb.); stoles with distant leaves, stem erect, *leaves tapering* from a rounded base sessile *remotely denticulate* faintly decurrent, lower leaves oblong blunt, buds erect, sepals linear lanceolate, seeds obovate-oblong tubercular.

"Chamænerium obscurum, *Schreb. Spic. Fl. Lips.* 147."

Epilobium obscurum, *Reichenb. Iconog.* t. 199. et *Fl. excurs.* p. 634; *Roth, Fl. Germ.* ii. 438. et *En. Pl.* ii. 152; *Fries, Herb. Norm.* viii. 42 (specimen); *Griseb. in Bot. Zeit.* 1852, p. 853; *F. Schultz, Arch. de Flore*, i. 218 et ii. 49.

E. virgatum, *Gren. et Godr. Fl. de Fr.* i. 578; *Sonder, Fl. Hamb.* 217.

Stem ultimately branching from the base as in *E. tetragonum*, and the whole plant closely resembling that species. In wet places the lateral stems are more or less decumbent, and rooting in their lower part. Stoles in dry places rather short and thick; all their leaves in distant pairs, small, successively enlarged, but not forming a rosette: in wet places they are long and sometimes branch; their leaves are oval, but narrowed below. It is only in the spring, when the new stems are commencing from the ends of the stoles, that anything resembling a rosette is found. In plants resulting from the stoles of the preceding year, it is the end of the stole itself that throws out roots, and sends directly upwards a *single erect stem*, which, at about the time of flowering, begins to branch from most of its axils; the lowermost buds producing stoles, the others flowering shoots. Individuals of this kind have therefore usually a short prostrate base, placed often at a right angle to it, and belonging really to the growth of the preceding year. The capsules are much shorter than those of *E. tetragonum*. The seeds of similar form with those of that species.

My British specimens of *E. obscurum* are from Wyken, Warwickshire; Ilfracombe, Devon; Llanthony, Monmouthshire; and Sussex; and I am informed by Mr. Borrer that it is found in Herefordshire by Mr. Purchas.

There is something in the look of this plant that distinguishes it from *E. tetragonum.* Tangible characters are afforded by the leaves. If well-grown specimens of the two plants are contrasted, the difference in the shape of those organs will be found to be rather considerable. The leaf of *E. tetragonum* is very well described as *strap-shaped,* for its sides are nearly parallel throughout the greater part of their length, the widest part being placed at about their middle. In *E. obscurum* the intermediate leaves are sessile, but apparently not at all decurrent by their limb (as is the case in its ally), although there is a slight appearance of decurrence from the sides of the rudimentary petiole; they are broadest close to their rounded base, and taper gradually from thence to their tip. Their teeth are much less conspicuous and much more distant from each other than those of *E. tetragonum,* and there are sometimes a few intermediate much smaller denticulations. The lowest leaves are usually shortly stalked and more oval than the others; and, in rare cases, many of the leaves possess this oval form and are slightly stalked, only those upon the upper part of the specimen having the true form belonging to the species. The leaves of *E. tetragonum* are always shining, those of *E. obscurum* opake, excepting on the stoles. The capsules of *E. tetragonum* are remarkably longer than those of its ally, and afford, as Mr. Borrer observes, a "striking *primâ-facie* distinction in the living plants." The stoles of *E. tetragonum* have their leaves all closely placed so as to form a subsessile rosette; those of *E. obscurum* have long joints, and therefore a rosette is not formed, although the leaves successively become larger. In very dry places, *E. obscurum* forms a kind of loose rosette at the end of a short stole. From the large size of the leaves at the end of the stoles of *E. obscurum,* they may sometimes be carelessly mistaken for a rosette.

E. obscurum is incompletely figured by Reichenbach (Iconog. t. 199), and represented by the specimen (No. 358) of his 'Flora exsiccata.' Unfortunately that specimen had not produced its stoles at the time when it was gathered; and as the plant drawn by Reichenbach was obtained from Leipzig, and Schreber's 'Spicilegium Fl. Lipsiæ' is the original authority for the name, there is the more reason to deplore the fact that so imperfect an illustration is given. In the text of the 'Iconographia,' Reichenbach quotes the *E. virgatum* (Fries, Fl. Hall. 66) as an undoubted synonym of *E. obscurum,* and the remarks already made will show that in my opinion he is correct in quoting it; but he seems to have afterwards suspected that he was in error, for in the 'Fl. excurs.' he leaves that synonym out, and describes another plant as *E. virgatum,* which he supposes to be markedly distinguished from *E. tetragonum* and *E. obscurum* by having a stigma that ultimately becomes quadrifid. Hartmann, as quoted by Koch, expressly states of *E. virgatum,* "stigma semper integrum, nunc inordinate 2–4-fidum, nunquam vero cruciatum vel regulariter quadrifidum." Fries says in the 'Fl. Hall.,' "stigmate indiviso," in the 'Novitiæ' "stigmate demum quadrifido," in the 'Summa' "stigmatibus in clavam coalitis." Petermann (Fl. Lipsiæ, 280) describes *E. obscurum,* which resembles the plant of this paper, as the *Chamænerion obscurum* of Schreber, but adds, "neque vero sec. herbar." Reichenbach makes a similar remark, but neither author tells us what the plant of the Herbarium really is. The extract from Schreber's description given by Reichenbach (Iconog. ii. 89, and Fl. excur. 635), for I have not succeeded in obtaining access to the original work, will apply tolerably well to the plant now called *E. obscurum.* Roth's works (Tentamen Fl. Germ. ii. 438, and Enum. Plant. i. sec. 2. p. 152) contain descriptions of *E. obscurum* agreeing with that of Petermann, and with the plant pointed out to me by Mr. Borrer and already described in this paper. Roth remarks of it, "planta ab *E. tetragono* diversissima est" (En.), and "planta per plures annos in horto . . . . excepta proceritate non mutavit habitum" (Fl.).

Sonder describes a plant as *E. virgatum* (Fl. Hamb. 217), of which he says "stolonibus elongatis, caule ex ascendente basi stricto," and quotes to it the specimen erroneously published by Fries (Herb. Norm. ii. 46) as *E. virgatum,* and now referred by Grisebach to *E. Lamyi* (F. Schultz). Sonder quotes *E. Lamyi* as being the same as his *E. virgatum*; but if his plant has really the elongated stoles and is chordorhizal, as he appears to intimate in the words quoted above, then it cannot be the *E. Lamyi* of F. Schultz, which that botanist states to have "radice perpendiculare," and also to possess "ad caulis basin foliorum rosulam 1 (rarius 2) proferente, stolonibus nullis." I am indebted to my valued friend and correspondent Mr. R. Lenormand of Vire for two specimens of the *E. Lamyi* (F. Schultz), marked as authentic, gathered in La Vendée. They present so much the appearance of *E. lanceolatum,* that we cease to wonder that Koch referred imperfect specimens of the plant to that species. They do not branch in their lower half, do not creep, have no stoles nor rosettes, have narrowly lanceolate rather strongly denticulate leaves with a wedge-shaped base on one of the specimens, and a broad base which is rather narrower than the middle of the leaf on the other. The plant is apparently very scarce, and presents much difficulty. Schultz (Arch. ii. 49) quotes Sonder's *E. virgatum* as a synonym of *E. obscurum,* where also he places the *E. virgatum* of Godron. I am indebted to Mr. Sonder for specimens gathered by himself near Hamburg (at one of the places mentioned in his 'Flora') in 1842, and sent to me with the name of *E. virgatum* (Fries); but I have no doubt that they really belong to *E. obscurum.*

It will be noticed that I have not quoted the *E. virgatum* of Koch (Syn. Fl. Germ.). It is omitted because there can be no doubt that that eminent botanist was unacquainted with the true characters distinguishing these plants; and that, as he tells us himself, he did not know the true *E. virgatum* until the second edition of his work was nearly completed. He states that most of the specimens called *E. virgatum* by him were merely *E. tetragonum,* or rather perhaps his words may mean that they were *E. obscurum,* which he considered as only a slight variety of that species.

Dr. F. Schultz thinks that the *E. virgatum* of Fries's 'Summa' is a hybrid between *E. palustre* and *E. obscurum.* As I have not seen the true plant of Fries (for his published specimens are respectively *E. Lamyi* probably and *E. obscurum*), it is out of my power to form any certain opinion. Schultz and Grisebach both place it in a section characterized by the plants possessing stoles and hybernacula like those of *E. palustre,* whilst Fries says that its stoles are "elongatos sparsifolios," like those of *E. obscurum,* but that its seeds equal those of *E. palustre,* and therefore are twice the size of those of *E. obscurum.* In another place Schultz remarks, that the difference between *E. virgatum* and *E. tetragonum* derived from the form of the seeds is not discoverable. Supposing him to mean *E. obscurum* under the name of *E. virgatum,* as is perhaps the fact, he is quite correct; but if *E. chordorhizum* (Fries) is intended, the size of the seeds must be quite different, as we learn from Fries's definite statement on the subject. Schultz also informs us (Arch. ii. 46) that the *E. Schmidtianum* (Roskov.), noticed by Koch (Syn. 266) under *E. palustre,* is not a broad-leaved state of *E. palustre* as Grisebach supposes, nor a form of *E. virgatum* (*E. obscurum*) as he formerly thought himself, but that it is a hybrid between *E. palustre* and *E. obscurum,* to which he gives the name of *E. obscuro-palustre.* I quite agree with Fries in believing that far too many difficulties are attempted to be removed by supposing the plants to be hybrids; and also, that hybrids are seldom produced naturally except in a few genera, such as *Verbascum,* and that most of the plants that are so called will prove to be extreme states of recognized species (see Fries, Mant. iii. 97). Nevertheless it is possible that there may be natural hybrids in this genus; that the *E. chordorhizum* (Griseb.), *E. palustri-obscurum* (Schultz), is one; and that the plant found by Mr. Baker at Gormire is the first of the two forms of it mentioned by Dr. Schultz (Arch. ii. 46), although the seeds of our plant have not the long base found in *E. palustre,* nor more than a very slight prolongation of the testa at their rounded summit. But I am more inclined to place it, provisionally, with *E. obscurum,* in the hope that Mr. Baker's attention may again be directed towards it. It agrees in most respects with the *E. virgatum* (Fries, Summa), but the top of its stem, when bearing unopened buds, is stated to nod, and its seeds are not smooth. Its stoles resemble those of *E. obscurum,* but are more slender. In a series of specimens I find no trace of the bulb-like hybernacula formed by *E. palustre, E. chordorhizum* (Griseb.) and *E. Schmidtianum,* which last plant Schultz states to have "les stolons de l'*E. palustre.*" It should be added, that its seeds are twice as large as those of *E. obscurum.*

If attention is paid to the stoles, there is no probability of *E. obscurum* being confounded with any of the other species, although those of *E. palustre* are somewhat similar in description. The latter plant has very slender stoles, each terminating in an autumnal hybernaculum which is already described, a long rooting base to its stem, very narrow leaves with a wedge-shaped base, nodding buds, and subfusiform seeds which are acute at the base and narrowed at the top where there is a prolongation of the testa into a kind of beak bearing the beard. It is nevertheless often difficult to distinguish bad or incomplete specimens of *E. obscurum* from *E. palustre,* for the lowest lateral branches of the former being usually prostrate and rooting for some distance, have, when torn off from the plant, much outward resemblance to the chordorhizal plants of *E. palustre.* Indeed it has already been stated, that there is much reason to fear that Fries himself has been deceived by such fragments*.

In the 'Cybele Britannica' (iii. 350) Mr. Watson mentions a plant or plants under the joint title of *E. virgatum* and *E. Lamyi,* and refers especially to specimens gathered by Mr. T. Moore in Kent, which were guessed by me to be possibly *E. Lamyi,* but which I now am certain are not the plant rightly so named. Mr. Moore's plant was found in company apparently with *E. palustre,* of which, although it presents some difficulties, I am inclined to the opinion that it is not a state, but think that it may be referred to *E. obscurum.* I am informed that specimens of it were sent to Dr. Grenier, and that he called it the *E. tetragonum* of the 'Flore de France.' In that determination he was assuredly in error, for the plant can belong to no other species described in that admirable work than *E. palustre* or *E. virgatum* (the *E. obscurum* of this paper). In obtaining

* My specimens of *E. palustre* are from the following places:—Clova, Forfarshire; Isle of Skye; Teesdale, Durham; Keswick, Cumberland; Llanberis, Caernarvonshire; Llanthony, Monmouthshire; Sandwich, Kent; Ma'am, Galway; Ventry, Kerry.

and quoting the opinion of either of the authors of that 'Flora,' it should be remembered that, although the work is a joint production, each portion has its own individual and declared author. Dr. Godron is the author of the account of the genus *Epilobium*. In such cases as this, Dr. Grenier may know no more than the inquirer about the subject upon which he is consulted.

We will now turn our attention to the species allied to *E. alpinum*, which present some difficulty, from there being probably two plants which pass by that name. Of this Dr. Godron was well aware when preparing the account of this genus for the 'Flore de France.' He observes, "L'*E. alpinum* (Fries, Nov. Mant. ii. 20) est, sans aucun doute, une espèce distincte de celle de France et de Suisse. Car la plante de Fries . . . . porte à la base de ses tiges, au lieu de stolons filiformes, des rosettes sessiles de feuilles fasciculées, qu'il compare aux rosettes de l'*E. tetragonum*." (Fl. de Fr. i. 578.) It is a cause of surprise to me that, knowing so much, he did not inquire further into the subject, but has left the French plant in possession of the name of *E. alpinum*, which belongs to that of Lapland. It was the intention of Linnæus to include under that name the plant of the Alps; but it is clear, from his quoting Scheuchzer's work with doubt, that he was not quite satisfied of their identity. In his later writings he has removed the mark of doubt from that reference, and added other synonyms belonging to the alpine plant and also to *E. alsinifolium*. The *E. alpinum* therefore of the 'Species Plantarum' included three plants: namely (1) *E. alpinum* of Fries, which must be accepted as the type of the Linnæan species; (2) *E. alsinifolium* of Villars; and (3) *E. anagallidifolium* of Lamarck, which is the *E. alpinum* of Godron.

Botanists appear to be now pretty unanimous in distinguishing Nos. 1 and 2, but seem to have known nothing concerning the *E. alpinum* of France and the Alps until Godron published the remark that has just been quoted. Had not that accurate and observant botanist directed attention to the subject, it is probable that we might long have continued to be ignorant of the fact that the *E. alpinum* of the north differs materially from that of the south of Europe. It will have been seen from the quotation from the 'Flore de France,' that the chief difference between them is, according to Godron, to be found in the presence or absence of stoles or rosettes. If such a difference of habit really exists, it is probable that botanists will not see much reason for refusing to adopt Dr. Godron's opinion. That this southern plant, if distinguished, ought to bear the name given to it by Lamarck cannot admit of question; for there seems to be no reason for doubting that he had it in view when he published the description and figure of his *E. anagallidifolium*. He states that it is closely allied to the *E. alpinum* of Linnæus, but doubts their identity*.

After stating what I believe to be the characters of the three plants, a few observations will be made upon them.

E. anagallidifolium (Lam.); *joints of the barren stems all long* with small obovate leaves, flowering stem erect from a long rooting base, leaves oblong blunt narrowed below not acuminate stalked, upper leaves lanceolate, buds nodding, *sepals oblong blunt*, seeds obovate pointed below apiculate.

E. anagallidifolium, *Lam. Dict.* ii. 376. t. 278. f. 3; *Griseb. l. c.* 853.

E. alpinum, *Gren. et Godr. Fl. de Fr.* i. 577; *Reichenb. Fl. exsicc.* 1061.

Stem filiform, mostly simple, with two slightly raised lines, usually 3–4 inches long; or prostrate, branched, densely leafy, rooting. Leaves resembling those of *E. alpinum*, glabrous or downy. Flowers pale reddish. Capsules like those of *E. alpinum*, glabrous or downy. Seeds brown, rounded at the top, but with a minute point formed by a slight prolongation of the testa: there appears to be a furrow down the middle of the flat side.

It inhabits the lofty mountains of Scotland. My specimens are from Morne and Lochnagar, Aberdeenshire; Clova, Forfarshire; Ben Vorlich, Dumbartonshire. In Smith's Herbarium there are specimens from Ben Lomond, Stirlingshire; Craig Chailliach and Ben Lawers, Perthshire.

E. alpinum (Linn.); *barren stems short their upper leaves closely placed*, flowering stem erect from a short rooting base, leaves oval or oblong blunt narrowed below not acuminate, upper leaves lanceolate, buds nodding, *sepals linear-lanceolate acute*, seeds lanceolate-obovate pointed below apiculate.

E. alpinum, *Linn. Sp. Pl.* ed. 1. 348; *Eng. Bot.* 2001; *Fries, Herb. Norm.* viii. 44.

Stem filiform, simple, with two slightly raised lines, usually 3–4 inches long. Leaves pale green. Flowers pale. Capsules relatively smaller than those of *E. alsinifolium*, but resembling them. Seeds rather pale, bluntly rounded at the top, but with a minute central point formed by a slight prolongation of the testa, with a keel along the middle of the flat side; but the keel in this plant and the furrow in *E. anagallidifolium* is not ascertained.

It inhabits the lofty mountains of Scotland. All the British specimens that I have seen belong to the smaller of the two forms distributed by Fries; they are from Ben Wyvis, Ross-

* In the paper already noticed, Dr. Grisebach has arrived at conclusions concerning the allies of *E. alpinum* similar to those independently formed by me, and Dr. Schultz appears to adopt them in his review of it.

shire; Drumouchter, Inverness-shire; Ben na Buird, Aberdeenshire; Clova, Forfarshire; Ben Lawers, Perthshire.

E. alsinifolium (Vill.); stoles (yellowish) with small roundish distant scales, stem erect from a long rooting base, *leaves ovate-acuminate repand-dentate* shortly stalked, buds nodding, *sepals linear-oblong, seeds subfusiform.*

E. alsinifolium, *Vill. Dauph.* ii. 511; *Deakin's Florig. Brit.* f. 626.
E. origanifolium, *Reichenb. Fl. exsicc.* 775.
E. alpinum, *Fries, Herb. Norm.* v. 41.

Stem usually simple, rather thick, with two raised lines, 3–12 inches long. Leaves shining, subpellucid, glabrous. Lowest leaves blunt. Flowers large, purplish, few. Capsules very long, upright, long-stalked. Seeds narrowed at both ends, and continued gradually into a great prolongation of the testa at the top, causing the beard (pappus) to appear to be stalked.

It inhabits the lofty mountains of Scotland; the Great Cheviot in Northumberland; Cronkley Fell, Teesdale, Yorkshire; Fairfield, Westmoreland; at and above Aber Waterfall, Caernarvonshire.

It is not easy to describe the great difference in appearance that exists between *E. alpinum* and *E. anagallidifolium*, and therefore they will doubtless seem to the reader to be far more alike than is really the case. I have never seen in *E. alpinum* the remarkable prostrate rooting flowerless shoots which are characteristic of *E. anagallidifolium*, and which are as different from the rather loose rosettes of *E. alpinum* as they are from the stoles of *E. palustre*. The short leafy stems forming the loose rosettes of *E. alpinum* do not become creeping stems nor true stoles. The sepals may perhaps afford a certain distinction between them.

It must be added, that I have no acquaintance with the supposed differences between *E. alpinum* and *E. anagallidifolium* as they appear in the living plant, and that it is often difficult to tell accurately to which of them dried specimens ought to be referred. Well-developed and complete specimens are so very different, that there is little ground for hesitation in admitting two plants as natives of the Scottish mountains which have such markedly different modes of growth as to render it highly probable that they are distinct species. The identification of these plants with the *E. alpinum* of Scandinavia and of the Alps, respectively, does not, I think, admit of doubt. Botanists will do well if they direct their attention to the interesting question of their specific distinctness.

Scottish botanists should look carefully for the *E. lineare* (Mühl.) which is found on the mountains of Scandinavia, and may very probably inhabit those of Scotland. It closely resembles both *E. alpinum* and *E. palustre*. From the former, to which it appears to be the most nearly allied, it may be distinguished by its linear obtuse denticulate leaves; its sepals, although of the same shape, are apparently blunt; its flowers are "white," or "cream-coloured." From *E. palustre* it is at once known by "vegetatio cæspitosa ob rosulas ad basin sessiles," and the total want of the slender stoles of that species.

It is hardly necessary to expend many words upon the differences of *E. alsinifolium* from the two plants above mentioned, for its very differently shaped seeds afford a good distinction, and the appearance of its foliage is very dissimilar. But it is necessary to direct attention to the singular fact, that the plate devoted to the illustration of this species in 'English Botany' represents another plant. Mr. Borrer has kindly favoured me with the use of authentic specimens, named *E. alsinifolium* by the late Mr. Winch, and stated to have been gathered by him on Cheviot. One of them was communicated by the late Mr. Sowerby as the plant figured by him in 'English Botany' (t. 2000); another is stated to be Mr. Winch's plant by the lamented Mr. Edward Forster; and a third is similarly ticketed by Mr. D. Turner. These three specimens all accord well with the plate (Eng. Bot. 2000); but neither they nor it have, as I believe, any claim to the name of *E. alsinifolium*. They are probably only small states of *E. montanum*; indeed, the cultivated specimen from Mr. Turner can scarcely be called small. Mr. Turner was well acquainted with this rather singular fact, for in the 'Botanist's Guide' (ii. 470) he states, under the heading of *E. alpinum*, the name originally applied to the plant by Winch, that he, in common with other botanists, believed the specimens sent to him to be "only a starved state of *E. montanum*." I am inclined to agree with Mr. Turner; but Mr. Borrer, than whom there is no person better qualified to give an opinion on such a subject, thinks that "the clubbed stigma and the angles of the stem tend to a contrary conclusion. These angles are still visible on the specimens, as lines at least, even on the large garden fragment." One thing is clear to both Mr. Borrer and myself, viz. that the specimen sent to Sowerby, and figured by him, was not *E. alsinifolium*. In Winch's Herbarium there is a "small mountain variety of *E. montanum*," which has faint decurrent lines upon its lower joints. The Cheviot plant appears to be chordorhizal, judging from one of the specimens preserved in that Herbarium; and the plate in 'English Botany' represents an underground stole similar to those of *E. alsinifolium*. If we are obliged to allow that hybrids are easily produced between *Epilobia* in a wild state, then we might probably escape from the difficulty by supposing this plant to be one; viz. between *E. alsinifolium* and *E. montanum,* both of which are, I believe, to be found upon the same part of that mountain. On that supposition, the habit and the leaves would result from the latter plant; and the stole, the slight angles upon the stem, and the club-shaped stigma, from the former. Nevertheless there is great reason to think that Winch did gather the true *E. alsinifolium* on Cheviot, for his description of the plant found there, when in cultivation, accords well with that species. His words are, "In winter it is not deciduous, but forms wide-spreading, matted tufts of small leaves, among which the fibrous roots shoot out, as in proliferous plants. The flower-stems are partially decumbent, cylindrical, at first simple, *afterwards much branched,* and furnished with numerous elliptical, slightly toothed, soft leaves; the flowers are few, and the style undivided." (Bot. Guide to Northumb. and Durham, ii. p. v.) One or two points in this description, such as that which I have italicized, refer to the plant which Winch had by some mischance mixed with the true *E. alsinifolium*; but I think, for the most part, it cannot have been taken for that plant. I also think that the *Lysimachia siliquosa glabra minor latifolia* of Ray is really *E. alsinifolium.* It is most unfortunate that the wrong plant should have been figured in 'English Botany,' as that error has probably tended to encourage those who desired to disprove the specific distinctness of *E. alsinifolium*; and it is wonderful how botanists who have had occasion to quote figures of that species, myself amongst the number, have continued to refer to 'Eng. Bot. tab. 2000' as representing it. Dr. Deakin describes and figures the true *E. alsinifolium* (Florig. Brit. ii. 549. f. 626); but part of his remarks seems to have resulted from an inspection of 'English Botany,' for they do not accord with the description that precedes them. The lamented Dr. G. Johnston stated (Bot. of East. Borders, 81), that he found *E. alsinifolium* in the Dunsdale Ravine on the Great Cheviot; and as he most liberally presented his specimens to me, I am enabled to confirm his determination of the plant, thus proving that that species really does inhabit those hills. The specimens more nearly resemble those which I gathered upon Cronkley Fell in Yorkshire than the plant usually found in Scotland, and seem to be what Fries mentions under the name of *E. anceps* as a variety of this species (Mant. ii. 20). I am inclined to refer the specimen gathered and named *E. alpinum* by Dr. Douglas (see Bot. E. Bord. 82) to a small state of *E. alsinifolium,* but its imperfect state renders this determination doubtful.

In the valuable and recently published 'Supplement to the

Flora of Yorkshire' (p. 67), Mr. J. G. Baker notices a plant which he found on the "south bank of the Swale near Topcliffe," and describes it as having "subsessile leaves narrowing gradually below . . . . a bisulcate stem, erect buds and dark purple flowers," and states his belief that it is probably the *E. purpureum* of Fries. If his description is correct, and I have no reason to think it otherwise, it seems highly probable that his determination of its name is also right. Mr. Baker kindly presented me with specimens of it, but unfortunately they are only lateral branches of what seems to have been a much-branched plant; they accord well with the descriptions given by Fries (Mant. iii. 185, and Summa, 178). Mr. Baker's plant appears to have had a hollow "bisulcate" stem (but I do not know that the furrows descend from the dorsal ribs of the leaves, as Fries states to be the case in his plant), much branched and clothed with fine scattered hairs; leaves ovate-lanceolate, suddenly narrowed below into a very short winged petiole, finely and distantly denticulate; lower leaves probably opposite; floral leaves large and more or less alternate; flowers apparently rather large, "dark purple," constantly erect; sepals hairy, broad, oblong, acute or perhaps cuspidate; capsules very long, thick, hairy when young, rising conspicuously above the top of the stem. I have thought it right to introduce this short notice of the suspected *E. purpureum* into the present paper from its appearing to deserve the attention of botanists.

Before closing this communication, it is proper to bring more prominently forwards than has been done by its discoverer, the fact that the *E. rosmarinifolium* (Haenke) is a native of Scotland. Mr. John Robertson, a very intelligent gardener and botanist, has had a 'Flora of Perthshire' in preparation for some years, and would have published it before this time if he had succeeded in obtaining sufficient subscribers to cover the expense*. With the prospectus of this book he circulated in 1852 a "few scraps from the work" itself, and amongst them there is the announcement of his having found this plant upon almost "inaccessible rocks that overhang the Tarf, a mountain-stream in Glen Tilt." He adds, that "it may be readily overlooked from the frequent nibbling of sheep and other animals. . . . . It has also been observed in one or two situations by the Tay, where doubtless it has been carried . . . by the impetuosity of the mountain torrents." The characters for distinguishing it from *E. angustifolium* are—

E. rosmarinifolium (Haenke); stem erect round, *leaves linear not*

* Subscribers' names are received by Messrs. A. and C. Black, publishers, Edinburgh. Price 10*s.* 6*d.*

veined, petals elliptic-oblong not clawed, style equalling the stamens.

E. rosmarinifolium, "*Haenke in*" *Jacq. collect.* ii. 50.

E. Dodonæi, *Sturm, Deutsch. Fl.* fasc. 72. t. 5.

Creeping moderately. Stem often decumbent below. Leaves shortly attenuate at both ends, entire or denticulate, with revolute margins. Flowers rose-coloured or white.

This is a very interesting addition to the flora of Britain, for, as far as I can learn, it had not with certainty been ascertained to grow further north than the Cevennes. Messrs. Hooker and Arnott seem to throw some doubts upon its having been found in Glen Tilt, but do not state the cause of them. My inquiries and those of Mr. Borrer lead us to believe the statement of Mr. Robertson.

In the 'Botanist's Guide' there are two stations given for a plant there called *E. angustissimum,* both of which rest upon the high authority of the late Mr. J. W. Griffith. These places are, "Rocks near Twll dû in Cwm Idwel," and "Rocks of Arran Pen Llyn." It has been generally taken for granted that the plants noticed by Mr. Griffith were small states of *E. angustifolium,* but no botanist has, I believe, recorded his having recently met with the plant of the latter station, and we have therefore no means of knowing what it is. In the autumn of 1855 I gathered what seems to be a small form of *E. angustifolium* upon the rocks rising from the lake called Llyn y Cwn, which is close to Twll dû. It had not flowered, nor did it show any buds, and grows in the narrow crevices of the rock in such a manner that I was unable to obtain a root for cultivation. It should be remembered that the station called "Rocks near Twll dû in Cwm Idwel" by Griffith, is stated by him (Bot. Guide, i. 82) to be the spot named "Hysvae" by Richardson in the 3rd edition of Ray's 'Synopsis' (310), where he found the *Lysimachia Chamenærium dicta, flore Delphini* of Parkinson, and that there is every reason to suppose that Richardson, Griffith and myself have successively gathered the same plant in the same or closely contiguous spots. It is curious that Smith should have taken no notice of these mountain stations.

The true name of the plant found by Mr. Robertson is rather difficult to determine, not from any doubt concerning the species to which it belongs, but on account of some confusion which has happened in the use of the several names of the allied plants. The Perthshire plant is—

E. Dodonæi, Villars (in part), Allioni, Gaudin (in part), Koch;

E. rosmarinifolium, Haenke, Reichenbach, Godron;

E. angustissimum, Willdenow (in part), Bertoloni (not Curtis nor Aiton), Waldstein and Kitaibel.

Bertoloni and Godron appear to be justified by the description given by Villars (Fl. Dauph. iii. 507) in considering that he included under the name of *E. Dodonæi* both the small species which are allied to *E. angustifolium*, and therefore have probably exercised a sound judgement in rejecting that name. But the former author seems to me to have fallen into an error in thinking that the plant now under consideration is the *E. angustissimum* of Aiton (Hort. Kew. ed. 1. ii. 5), and of Curtis (Bot. Mag. 76), for the figure given by the latter author seems to fix that name upon the other species, to which also Reichenbach applies it. If therefore we think it proper to drop Villars's name, the next in antiquity is *E. rosmarinifolium* given by Haenke in 1788. Mr. Borrer has pointed out to me that Dodoens does not deserve the honour of being commemorated in connexion with this plant, the figure of which in his work (Pempt. 85) is only a reprint of L'Obel's cut (Stirp. Hist. 226), and all that he says about it is contained in a single sentence which conveys no valuable information. It is probable that he never saw the plant. It cannot therefore be said that we are depriving him of any credit, justly due to him, when we neglect a name of only partial applicability to our plant and adopt another which belongs to it alone.

P.S.—The time which has elapsed since the communication of this paper to the Botanical Society has allowed plants raised from seeds of *E. Lamyi*, taken from the specimens sent by M. Lenormand, to develope their winter form. The seeds were sown in a pot in the early part of the summer of 1855; they flowered in the autumn, and the flowering stems are now (Feb. 22, 1856) quite dead. Around the base of the old stems there is now a dense mass of rosettes, exactly resembling in all respects those of *E. tetragonum*. [They are now, June 5, 1856, not distinguishable from *E. tetragonum*.] The plants have not been defended from the frost, but nevertheless the rosettes are in a healthy condition. Dr. Schultz remarks of the rosettes, that "si la plante n'est pas garantie contre le froid dans une chambre chauffée" (Arch. ii. 53), they perish in the winter; but that if so defended they produce plants that flower, but do not develope any more rosettes. It remains to be seen if such will be the case with the plants in the Cambridge Botanic Garden.

Mr. Borrer informs me that "a plant of *E. Lamyi*, raised from seed sent by Schultz, is (Feb. 9, 1856) showing tufts of leaves as strong as, and (as far as I can see) scarcely distinguishable from, those of *E. tetragonum*, at this time in a north border in my garden, where it must have borne 24 degrees of frost [8° Fahr.]." These facts tend to the conclusion that *E. Lamyi* is not distinct from *E. tetragonum*.

XIV. *On the British Species of* Arctium.

By CHARLES C. BABINGTON, M.A., F.R.S. &c.

READ 13TH MARCH 1856.

IN a former paper (Ann. Nat. Hist. Ser. 1. iv. 253) I endeavoured to show that there were two well-marked species of *Arctium* inhabiting Britain, and then expressed an opinion that neither of them accorded well with the plants figured in 'English Botany.' The names applied to them in that paper were *A. Lappa* and *A. Bardana,* used in the belief that my plants corresponded with those so called by Linnæus and Willdenow. Since that period my attention has at intervals been directed to the genus, and specimens have been often seen that did not well accord with either of those species. A few years since I was favoured by my friend M. J. Lange of Copenhagen with a specimen of a plant called by him *A. intermedium,* and which he believes to be distinct from the described species. On the supposition that this accorded with a plant observed in Britain, and that it was nearly allied to what I had formerly named *A. Bardana,* it is placed in the 3rd edition of my 'Manual' as *A. minus β. intermedium,* and the *A. Bardana* of Smith is incorrectly referred to it. A careful re-examination of the plants has led me to the conclusion that throughout the whole of these researches I have been in error, and that the following remarks present a more correct view of the subject.

We appear to possess five well-marked species of *Arctium* in this country, namely *A. tomentosum, A. majus, A. intermedium, A. minus,* and *A. pubens,* the characters of which I now purpose endeavouring to point out. But before describing the plants it is desirable to direct attention to the points upon which it seems probable that stress may be best laid. (1.) The arrangement of the heads presents an easy mode of separating two of the species from the others. This character must be used cautiously, for it is only the top of the central stem of the plant that is to be trusted: it and the branches often have the heads arranged in the same manner, but frequently the central stem bears a corymb and the branches racemes of heads. (2.) The form of the heads is of much value, and their size must not be neglected. (3.) Although the shape of the phyllaries is nearly the same in all the plants, their direction is a little different and the appearance of the heads is thereby changed. The inner row has not this uniformity of shape, but differs considerably in the several plants. These inner phyllaries are always bordered by a broadish membrane which sometimes increases in width towards the top, but in other cases narrows gradually to a rigid point. (4.) The florets consist of two parts, the upper of which is tubular nearly throughout. That part which is below the commencement of the free filaments is slender in all the species; the upper part is always much thicker, varies considerably in form, and its length bears different proportions to that of the lower part. (5.) The phyllaries either fall short of the florets or equal them. In the latter case the corolla alone is to be taken into account, for the anthers and styles are always much protruded.

It is proper to state here the reasons which have led me to retain the name of *Arctium* for this genus instead of following DeCandolle in employing it for the *A. lanuginosum* (Lam.). Linnæus in his first work (Syst. Nat. published in 1731) gave the name of *Arctium* to the plant called *Lappa* by Tournefort, and characterized it as early as the year 1737 (Gen. Pl.). In 1778 Lamarck transferred the name, under the form of *Arction*, to his *A. lanuginosum* without paying the least attention to its previous use by Linnæus, and applied the term *Lappa* to the Linnæan genus. It is doubtless true that the ante-Linnæan botanists did use *Lappa* as a generic name, but it has been well remarked by the Committee of the 'British Association for the Advancement of Science' appointed to consider the nomenclature of zoology, that "Linnæus was the first to attach a definite value to genera, and to give them a systematic character by means of exact definitions; and therefore, although the names used by previous authors may often be applied with propriety to modern genera, yet in such cases they acquire a new meaning and should be quoted on the authority of the first person who used them in this secondary sense" (Report Brit. Assoc. Manchester, 1842, p. 110). Applying this excellent rule, which is just as true in botany as in zoology, to the present case, we find that the Linnæan name has a priority of many years over that which Lamarck adopted from the ante-Linnæan Tournefort. That this was the view taken at the time is shown by the remarks of Villars (Pl. des Dauph. iii. 27) when continuing to use the name of *Berardia*, which he had given in his 'Prospectus' to the *A. lanuginosum* of Lamarck. There does not seem to be any reason for breaking the rule in this instance, for if it should be said that Tournefort's genera are well defined and therefore should not be rejected, then many more of his names ought to have been adopted in preference to those given by Linnæus.

1. *A. tomentosum* (Pers.); *heads subcorymbose long-stalked spherical* and closed in fruit much webbed (purplish), phyllaries falling short of the florets subulate, inner row longest and broad, *inflated upper part of florets* a little shorter than the lower part.

A. tomentosum, *Pers. Syn.* ii. 383 (1807); *Schkuhr, Handb.* iii. 29. t. 227.

A. Bardana, *Willd. Sp. Pl.* iii. 1632 (1800); *Eng. Bot.* t. 2478; *Fries, Nov. Fl. Suec.* ed. 2. 263.

A. Lappa β, *Linn. Fl. Suec.* ed. 2. 278, teste *Fries, l. c.*

A. Lappa, *Sven. Bot.* t. 63; *Fl. Dan.* t. 642.

Lappa tomentosa, *Lam. Dict.* i. 377 (1783); *All. Fl. Ped.* i. 144 (1785); *Gray, Brit. Pl.* ii. 434; *Lindl. Syn.* ed. 1. 154; *DeCand. Prod.* vi. 661; *Koch, Syn.* ed. 2. 463; *Gren. et Godr. Fl. Fr.* ii. 281; *Reichenb. Icon. Fl. Germ.* xv. t. 811; *Fl. Dan.* t. 2423.

Lappa major montana, capitulis tomentosis sive Arctium Dioscoridis, *Raii Syn.* ed. 3. 197. 4; *Pet. Brit. Pl.* t. 23. 6.

Stem and petioles slightly mealy and floccose. Stem 3 to 5 feet high. Leaves cordate-ovate; lowermost very large. Erect central stem and usually most of the branches ending in irregular corymbs of heads; but sometimes many of the branches have fewer heads with a racemose arrangement. Peduncles very long, but rarely a few of the lower heads have only short stalks. Heads large, usually covered with much cobweb-like hair; occasionally a plant with almost glabrous heads is found. Phyllaries purplish-green or greenish-purple, each with a small strongly hooked purplish-yellow rigid point; inner row broad and membranous even near to the end which is purple often quite blunt truncate or emarginate with a straight rigid excurrent nerve or rarely shortly subulate. Florets broadest just above the origin of the free filaments at which point they suddenly enlarge from a slender tube, become inflated and then narrow upwards, very persistent with the ripening fruit when they close the small space left between the ends of the converging phyllaries. Fruit dark brown with blackish blotches, nearly smooth.

It is probable that the long delay that has attended the acknowledgement by name of this plant by English botanists, although it was figured by Sowerby, may have been caused by its inhabiting the eastern districts of England, and being rarely, if ever, to be found in other parts of the country. Experience must prove or disprove this idea. The plant really represented in 'English Botany' not having been seen, any woolly-headed *Arctium* was called *A. Bardana*. The *A. minus*, which possesses many of the characters of *A. tomentosum*, being figured in the same work under the name of *A. Lappa*, the conclusion was arrived at that *A. Lappa* and *A. Bardana* formed only one species. For if tab. 2478 is a representation of the plant commonly called *A. Bardana* in England, then its difference from the specimens generally found and so named would show that there is so great a range of variation in the species as to render it highly probable that the *A. Lappa* of tab. 1228 is another of its states. If the true *A. Lappa* of Willdenow had been figured in that valuable work, no such idea would probably have arisen.

In most respects Sowerby's figure is an excellent representation of *A. tomentosum*, but the drawing was probably taken from a lateral branch, and the relative length of the phyllaries and florets (as shown in the dissected figure) does not appear to be correct. The inflated form of the floret is excellently shown.

The *A. Lappa* (Willd.) not being presented to the notice of our botanists, but that name given by Smith to *A. minus*, caused the erroneous conclusions that only a single variable species existed in Britain, and also, that there were no more species upon the European continent.

Although Fries informs us that the *A. minus* (Schkuhr) is the true *A. Lappa α.* of Linnæus, a statement confirmed by the specimen in his herbarium, still the var. β. (Linn.), which we know on the same excellent authority is the plant called *A. tomentosum* by Persoon and *A. Bardana* by Willdenow, is figured in the 'Svensk Botanik' (tab. 63) and 'Flora Danica' (tab. 643) as *A. Lappa*.

It is proper to direct attention to the fact that Gray (*l. c.*) and Lindley (*l. c.*) correctly identified the plant of Sowerby as *A. tomentosum*, but neither of them seems to have known that there are two other woolly-headed species in this country.

I have not observed this plant out of Cambridgeshire, but it is probably much more extensively distributed.

Flowering in August.

2. *A. majus* (Schkuhr); *heads* subcorymbose long-stalked *hemispherical* and open in fruit *glabrous* (green), phyllaries equalling or exceeding the florets subulate, inner row shorter than the others, *subcylindrical upper part of florets* more than half as long as the lower part.

A. majus, *Schkuhr, Handb.* iii. 49; *Fries, Nov.* 264; *Wimm. et Grab. Fl. Siles.* iii. 105; *Bab. Man.* ed. 2. 182, ed. 3. 179.

A. Lappa, *Willd. Sp. Pl.* iii. 1631; *Bab. in Ann. Nat. Hist.* Ser. 1. iv. 254; *Man.* ed. 1. 171.

Lappa major, *DeCand. Prod.* vi. 661; *Koch, Syn.* 463; *Gren. et Godr.* ii. 280.

L. officinalis, *All. Fl. Ped.* i. 145; *Reichenb. Icon. Fl. Germ.* xv. 54. t. 812.

L. major Arcium Dioscoridis, *Raii Syn.* ed. 3. 197. 2.

L. major capitulo glabro maximo, *Dill. in Raii Syn.* ed. 3. 196. 1.

Burdock, *Pet. Engl. Pl.* t. 23. 1.

Stem and petioles finely mealy and rather floccose. Stem 3–4 feet high. Leaves cordate-ovate; lowermost very large. Central stem and usually most of the branches ending in irregular corymbs of heads; but sometimes many of the branches have fewer heads and a racemose arrangement of them. Peduncles very long, but occasionally a few of the lower heads are only shortly stalked. Heads very large, quite glabrous or with a very little cobweb-like hair in their youngest state; after the florets have fallen, which they seem to do at an early stage of the growth of the fruit, the head is quite flat and open at the top, often an inch across, and the involucre is almost exactly hemispherical with the outer phyllaries deflexed, the middle ones patent and the inner ones nearly erect. Phyllaries usually all green and subulate; their hooked points yellowish; inner row paler, less gradually subulate than the others but narrowing upwards until near to the point where it narrows quickly, scarcely converging over the fruit: the heads therefore do not appear to be constricted near the top as is the case in the other species. Florets very nearly cylindrical in their enlarged part, rather widening than contracting above the sudden enlargement, deciduous. Fruit yellowish, irregularly rugose.

This is usually not nearly so large a plant as *A. tomentosum*, although it often attains a very considerable size. It is conspicuous on account of its long branches and large heads, which latter much exceed in magnitude those of either of the other species.

The very long peduncles and corymbose heads distinguish it and the preceding from the three other species, but in estimating these characters attention should be paid to the heads forming the termination of the upright central stem of the plant; it has been already remarked that the branches do not always present the same arrangement of the heads. Difficulties may occur when neither *A. majus* nor *A. tomentosum* is known, or when only the lateral branches are examined, but when an intimate acquaintance has been obtained with either of them, it is nearly impossible that any doubt of the distinctness of those species can continue to exist.

The remarks to be found under *A. tomentosum* have shown how differently the name *A. Lappa* has been applied by botanical writers; three out of our five species having been so called. It is therefore desirable that the use of it should cease. It also appears from the remarks of Fries (Nov. 263), that the *A. majus* was certainly not the typical *A. Lappa* of Linnæus; the name therefore cannot be properly employed to designate this plant.

The figure given by Tournefort to illustrate his genus *Lappa* rather represents a head of the *A. tomentosum* than of *A. majus* of this paper. The head named *L. major* by Gaertner is more like my *A. minus.*

A. majus is probably generally distributed in Britain, flowering in August.

My specimens are from Grosmont, Monmouthshire; Mordiford, Herefordshire; Bluntisham, Hunts; Clonakilty, Cork. I have seen it in several other places, but unfortunately my notes concerning them have been lost.

3. *A. intermedium* (Lange); *heads racemose subsessile ovate* closed in fruit slightly webbed, phyllaries equalling or exceeding the florets subulate, inner row lanceolate shorter than the others, subcylindrical upper part of the florets equalling the lower part.

A. intermedium, *Lange, MS. in Herb. Bab. et litt.*; '*Flora of Denmark*;' *Reichenb. fil. in Icon. Fl. Germ.* xv. 54. t. 812.

Stem and petioles floccose. Stem 3–4 feet high. Leaves roundish-cordate, lowermost large. Central stem usually (?) nodding and as well as the branches furnished with many nearly sessile heads arranged in a racemose manner; ending in three heads placed close together. Heads moderately large, narrower than those of *A. majus*, but appearing long from the ascending direction of most of the phyllaries, usually slightly webbed. Phyllaries purplish-green and subulate; their hooked points purplish-yellow; inner row purple at the end, lanceolate acute. Florets cylindrical in their upper half, much resembling those of *A. majus* but with different proportions, apparently persistent. I have not seen the fruit.

This plant may be known from all the others by having its heads nearly sessile; *each branch usually ending in a cluster of three heads.* Its leaves are apparently shorter in proportion to their width. It is distinguished from the following plant by possessing much larger ovate (not spherical and stalked) heads; from *A. pubens* by its closed and nearly sessile heads; from the two preceding by the racemose arrangement of the heads even at the top of the primary stem.

Its distribution is unknown to me, with the exception that I have gathered it near Berwick-upon-Tweed, and Mr. Newbould at Hope in Derbyshire. Mr. Baker states (Suppl. to the Fl. of Yorkshire, 85) that he finds it frequently in Yorkshire, but I have not seen any specimens of his plant.

It flowers in August, but, like all the other species, may sometimes be found in that state in July.

As I do not know that M. Lange has published the characters of his plant, it appears to be desirable to insert the following extract from his letter, dated March 1849:—

"*A. intermedium* calath.: adultis ovatis, squamis exterioribus subulatis viridibus apice stramineis interioribus lanceolatis apice purpureis. It is the highest of all the species. Plant fresh green. Stem and head purple brown tinged, the heads doubly greater than the little form (*A. minus*). It grows principally in woods.

"*A. minus* calath.: adultis depresso-globosis, squamis omnibus subulatis cano-viridibus exterioribus apice stramineis. The plant low, pale and grayish green. Open ground."

It is probable that similar characters to the above are to be found in that botanist's 'Danish Flora,' which I have not seen, and which is written in the language of Denmark.

4. *A. minus* (Schkuhr); *heads racemose* shortly stalked *spherical* slightly contracted at the mouth in fruit slightly webbed (greenish), *phyllaries* falling *short of the florets* subulate, inner row equalling the others, *subcylindrical upper part of the florets* about equalling the lower part.

A. minus, *Schk. Handb.* iii. 49; *Fries, Nov.* 263.
A. Lappa α, *Linn. Fl. Suec.* ed. 2. 277, teste *Fries.*
A. Lappa, *Curt. Fl. Lond.* ii. 173; *Eng. Bot.* t. 1228.
Lappa minor, *DeCand. Fl. Fr.* iv. 77; *Koch, Syn.* 463; *Gren. et Godr. Fl. Fr.* ii. 280; *Reichenb. Icon. Fl. Germ.* xv. 53. t. 811.
Lappa major capitulis parvis glabris, *Dill. in Raii Syn.* 197. 3.
Lappa major montana, capitulis minoribus, rotundioribus et magis tomentosis, *Raii Syn.* 197. 5.
Small-headed Burdock, *Pet.* 23. 3.
Small woolly-headed Burdock, *Pet.* 23. 4.

Stem and petioles finely mealy. A smaller plant than either of the preceding. Central stem usually nodding and as well as the branches producing scattered shortly stalked heads forming an irregular raceme, on the lower or later branches the heads are often nearly sessile; the terminal head solitary. Heads about half the size of those of the preceding species and greener than in it; the amount of web very variable. Phyllaries green, sometimes slightly tinged with purple; the hooked points yellow; inner row purple at the end, gradually narrowed into a rigid subulate point but not hooked, alone converging over the fruit; the others mostly patent or a few of the outer ones deflexed. Fruit fuscous with black blotches, rugose towards the top.

The small spherical heads of this plant, about the size of a hazel-nut, readily distinguish it from *A. intermedium*; as do their size, their short stalks, and their racemose arrangement even upon the central inclined stem, from *A. tomentosum.* The very large corymbosely arranged heads of *A. majus* clearly point out that plant as distinct from *A. minus.* The much larger hemispherical and long-stalked heads separate *A. pubens* from it.

Although the typical state of *A. minus* is very different from

A. tomentosum, it is difficult to find any character by which they may be at all times certainly distinguished. There is a difference in the shape of the florets: those of *A. minus* although thick in their upper part do not enlarge so suddenly as those of *A. tomentosum,* nor do they contract upwards as in it. It is probable that *A. minus* never has corymbosely arranged heads; that they are always small and shortly stalked; that the florets are deciduous so as to leave the tops of the fruits uncovered: that *A. tomentosum* always has its central stem erect and corymbose, although the branches have the heads arranged in racemes; that the heads are usually large and those in the corymb have long stalks; that the florets are usually so persistent as to hide the ripening fruit; that the phyllaries of the innermost row are usually almost wholly membranous and blunt with an excurrent midrib.

A. minus is probably common, but the distribution of all the species requires to be carefully determined.

My specimens are from Madingley, Cambridgeshire; Stoneleigh, Warwickshire; Mordiford, Herefordshire; St. Aubin's, Jersey; and I have ascertained that it grows near Saffron Walden, Essex; Bluntisham, Hunts; Buntingford, Herts; and Swansea, Glamorgan.

Note.—The *A. Bardana* of my former paper (Ann. Nat. Hist. Ser. 1. iv. 255) includes *A. tomentosum* and *A. minus.*

5. *A. pubens*; *heads subracemose stalked hemispherical* and open in fruit much webbed (green); phyllaries equalling the florets subulate, *inner row equalling the others* and gradually *subulate,* subcylindrical upper part of the florets equalling the lower part.

Stem and petioles thickly clothed with short jointed hairs which shrink into a coarse mealiness. Stem 3 feet high. Leaves large, ovate, lowermost cordate-ovate. The central stem erect, and the branches, ending in irregular racemes of heads. Peduncles rather long, those of the lower heads the longest. Heads as large as those of *A. tomentosum,* much webbed when young but losing much of the web (as is usually the case with the other webbed species) as they advance towards fruit, ultimately appearing to be nearly naked. Phyllaries green, each with a purple-yellow hook; inner row narrowing upwards but rather membranous, purple at the end. Florets very nearly cylindrical in the enlarged part, persistent but not closing the large space between the nearly upright inner phyllaries. Fruit dark brown, very rugose and with a few paler spots towards the top.

I am unable to place this plant satisfactorily under any of the published species, and think that it is distinct from them. It differs from *A. tomentosum* by its subracemose heads with shorter stalks of which *the lower are the longest,* heads hemispherical and open in fruit, inner phyllaries equalling the others and not widened upwards, upper part of the florets not inflated nor broadest at the base: from *A. majus* by its subracemose much webbed heads, inner phyllaries equalling the others, upper part equalling the lower part of the florets: from *A. intermedium* by its hemispherical open heads of fruit upon rather long stalks and the inner phyllaries equalling the others: from *A. minus* by its heads being twice as large, hemispherical and on longish stalks, and the phyllaries equalling the florets.

It is more pubescent than either of the others from having much more numerous and longer jointed hairs upon its stem and leaf-stalks.

The plant is probably not uncommon. I find it in several places in Cambridgeshire, am indebted to Mr. Kirk for specimens found by him at Fillingley and Kenilworth in Warwickshire, to the Rev. W. W. Newbould for some gathered by him at Ecclesall near Sheffield, and observed it myself in the valley of Llanberis in North Wales in August 1855.

Flowering in August.

XV. *On an Abnormality in the Flowers of* Salix Andersoniana. By John Lowe, Esq.

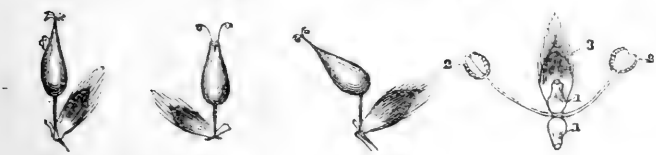
Read 10th July 1856.

In the year 1841, the Rev. J. E. Leefe communicated to this Society a paper, entitled "Remarks on some curious Metamorphoses of the Pistil of *Salix Caprea.*" A short time since, I observed a corresponding set of changes occurring in the male flowers of *Salix Andersoniana.* These, as forming, with those of Mr. Leefe, a complete series of morphological changes, may not be unworthy the Society's notice. The changes observed by Mr. Leefe in *Salix Caprea* consist of a gradual conversion of the pistilline into staminal organs, each step in the process being clearly explained by the plate which is given with his paper in the 1st volume of the Society's 'Transactions.'

In the present specimens we have just the opposite, viz. the stamens becoming converted into ovaries, and this by every conceivable gradation.

The plant from which these were taken grows about half a mile below Cramond Bridge near Edinburgh; it is to all appearance strong and healthy, and in the majority of its flowers there was no observable alteration.

1 2 3 4 5



7 6 8 9

Fig. 1. is a floret whose filaments are partially united at the base; in other respects it is perfectly normal. The scales and glands in this as in the other florets present nothing unusual.

Fig. 2. The stamens still further united, giving the filament a forked appearance.

Fig. 3. represents one of the stamens of the last figure converted into an ovary which bears a pollen-mass on its inner edge; the other stamen is unaltered.

Fig. 4. A still more advanced condition. The ovary has no vestige of pollen-cells, but at the base is the remaining anther, sessile.

Fig. 5. shows each stamen converted into a carpel and bearing an antherine mass. The styles have each but one stigma.

Fig. 6. The two ovaries are here nearly united, but have a fissure superiorly in which are the remains of the anthers. The styles are distinct and monostigmatous.

Fig. 7. The fissure seen in last figure has disappeared by the union of the styles; a pollen-mass still remains on the side of the united ovaries.

Fig. 8. A complete and well-formed ovary.

I ought to remark here that these figures are not intended to represent the progressive development of the ovary as shown by any individual floret, but simply the different stages which may be traced in a number of florets and which may be reasonably regarded as successive.

We may now consider the cause of these phænomena and the laws which govern formations of this nature.

The generally received opinion regarding the production of diœcious flowers is that each flower is rendered unisexual by the suppression of the other sexual whorl, and though this may be mainly true of many diœcious plants, it does not appear to express the whole truth with respect to diœcious Amentiferæ.

Dr. Braun in his 'Rejuvenescence of Nature,' states that both kinds of sexual organs are derived from the same leaf, or as he expresses it, "the same leaves appear in the male as stamens and in the female as carpels." In other words, the leaf which fails to produce a male will give rise to a female organ, and *vice versâ*. Hence, though it is perfectly correct to say, that there is an arrest of development when stamens are alone produced, it is otherwise with respect to female organs, since there is here not an arrest but an exaltation of development.

These specimens illustrate also the parts of the leaf which give origin to the different parts of the essential organs; thus, the anther gradually merging into the carpel shows that it is derived from the lamina of the leaf (the fact of the carpel being formed by the lamina of the leaf being ascertained by morphological changes in other plants). The pollen observed on the edge of the ovary in fig. 5, would encourage the idea that pollen is merely a gemmiferous condition of the lamina of the leaf. And, lastly, we may allude to the gland, which, although not presenting any peculiarity in the present specimens, I have nevertheless found in others assuming a very interesting form. I am not aware that the question has been mooted as to what is its real morphological value. It might be assumed to represent an abortive stamen, but that we find it present in those Salices which may be regarded as having their staminal whorl complete, *Salix pentandra* for instance. Moreover it is found to be placed opposite the interval in flowers which have only two stamens, thus having an alternate arrangement. I have little doubt, especially since meeting with the specimen shown in fig. 9, where there are two glands alternating with the stamens, that they represent the corolla. Regarding the scale as the calyx, we have thus the various whorls of the flower complete.

XVI. *Elucidation of some Plants mentioned in Dr. Francis Hamilton's Account of the Kingdom of Nepál.* By Lieut.-Col. Madden, F.R.S.E., President of the Botanical Society of Edinburgh*.

Read 12th June 1856.

The possession by the University of Edinburgh of the duplicate herbarium (unfortunately incomplete) and the valuable MS. Catalogue of the Plants collected in Nepál and other parts of India by the late Dr. Francis Hamilton (formerly Buchanan), has recently afforded me the opportunity of comparing them with some which he has introduced into his 'Account of Nepál,' only, or chiefly, by their vernacular designations, which are of no assistance to the English reader. Of the result of this examination I purpose to submit a short statement to the Botanical Society, to the Members of which it may prove the more interesting from the fact that, in several cases, the scientific names have not hitherto been given in any, even the latest, works on Indian Botany which have fallen under my notice, although the plants are well known and of general utility in India. Nor will it be considered inconsistent with the object of our meetings, to dedicate a brief space to an inquiry into the botany of a district which engaged the interest and employed the time of this accomplished naturalist†,

* The death of the author having occurred since this paper was read before the Society, it has been printed without the benefit of his corrections.

† The genus *Hamiltonia*, of the order Cinchonaceæ, was devoted by Roxburgh to the memory of this "illustrious peregrinator," as he is called by D. Don. *H. suaveolens* is a shrub of the Rájmáhal and other hills of Behar; and a very beautiful azure-blue variety abounds all along the base of the Himálaya, the *H. azurea* of Wallich, *scabra* of D. Don, *propinqua* of Jacquemont. The flowers are sweetly fragrant till bruised, when they exhale a most fœtid odour, from which the plant derives its Kumáon name of *Padéra*. Dr. Hamilton himself remarks thus on the specific name at No. 694 of the Catalogue:—

"*Hamiltonia suaveolens.* Habitat in sylvis Anggæ et Mithilæ.

"Nomen specificum haud aptum, cum flores, licet aliquando suaveolentes, sæpius, ut in *Pæderia* et *Serissa* affinibus, odorem stercoraceum gravissimum spirant, quod in cæteris ejusdem generis speciebus quoque evenit."

whose late residence, Leny, near Callander, must be familiar to many of our explorers of the romantic scenery of the Trosachs. Dr. Hamilton was, I believe, the first to investigate the botany of Nepál and the adjacent countries, in which he has been zealously succeeded by Wallich, Griffith, and Hooker. I have not myself had the good fortune to visit these regions, and political jealousy has almost sealed Nepál, especially its alpine tracts, to us; but I have traversed its western frontier, and was for several years associated with its military tribes in the service of the East India Company, and have thus been enabled to acquire the popular names of several of the plants in question. I shall not altogether limit myself to those occurring in the 'Account of Nepál,' but shall extend my remarks also to a few of those enumerated in the Catalogue, with respect to which there is reason to think any additional information will be acceptable, or any errors remain to be rectified. Many points must continue undetermined, and will furnish a field of inquiry to future botanists. Dr. Royle has been the most successful investigator of the various sources of the many articles of the Indian Materia Medica, in his valuable 'Illustrations of the Botany of the Himálayan Mountains'; but the origin of many of those contained in his list, published in the 'Journal of the Asiatic Society of Bengal' for October 1832, is still to be made out. With reference to the object before us, the most advantageous plan, perhaps, will be to quote the several passages from Dr. Hamilton's work as they occur, with some regard to the natural sequence of the orders as understood by Dr. Lindley; appending such notices as may be supplied by the Catalogue, and concluding with my own comments.

As Dr. Hamilton always makes use in his Catalogue of the classical names for the various provinces, it may be well to premise that

Magadha	is the modern	Behar.
Mithila	"	Tirhut.
Cosala	"	Oude and Gorakhpur.
Camroop	"	Rangpur and Assam.
Angga	"	North-western Bengal.
Banga	"	Western and Southern Bengal.
Matsya	"	the district of Dinájpur.

"Pháphar, said by some to be a species of *Amaranthus*, called Amardáná in the low country; but others say that this is a mistake.

"Uyá, which I presume is rye, the natives saying that it is neither barley nor wheat, but has a resemblance to both."

The chief grains of Kullu, a hill province north of the Sutlej river, now a British possession, were reported to Dr. Hamilton to be Pháphar, Chuyá, and Uyá: "The Chuyá, from the description given, would seem to be the *Holcus Sorghum,* although the coldness of the situation renders this doubtful" (pp. 274, 275, 315).

The Uyá is the *Hordeum cœleste,* well known to the residents of Simla as the Uá jáo, or Uá barley, being in high estimation in the preparation of cakes.

Pháphar or Pháphra is the *Fagopyrum rotundatum,* Bab. (*emarginatum,* No. 1688, Wall.), near *F. tataricum*; it is known as Bitter Buckwheat, and is very generally cultivated in the higher and colder sites of the Himálaya; *Fagopyrum vulgare* (or *esculentum*), No. 1687, Wallich, being common lower down, and known as Ogal or Ogla, and Kotu (not Kultu); distinguished from the last as Sweet Buckwheat*. Chuyá and Anárdáná are one and the same: *Amaranthus anardana,* No. 2028 of the Catalogue (exclude synonym *Amaranthus frumentaceus,* Hort. Beng. 67 ?). "Anárdáná Hindice. Colitur in arvis Cosalæ et Nepalæ;" and at Bhágalpur on the Ganges, according to Moquin in DeCandolle. Anárdáná implies the supposed resemblance of the grains to the carpels of the Pomegranate. I never met any one who used the name, and incline to think Amardáná, as Dr. Hamilton once writes it, may be the true one, meaning 'immortal grain,' and therefore nearly identical with *Amaranthus*: nothing can better answer to the appellation than this species, which is grown all over the Himálaya, and is also known as Marsá and Báthu. It rises six to eight feet high, and is either of a brilliant crimson or a rich yellow. The effect of a mountain-side, terrace above terrace, covered with distinct fields of these colours, and glowing under the rays of the afternoon sun, is gorgeous indeed; but as an article of food, it must be confessed the reality falls far below the promise of the eye. *Amaranthus caudatus* is occasionally cultivated for the same purpose, and is, in Garhwál, called Rámdáná, 'the grain of God.'

Cynosurus corocanus: Maruya of Nepál: now *Eleusine corocana,* everywhere cultivated in the British Himálaya as Manduá or Maruá. *E. stricta* is also grown in Garhwál.

Holcus Sorghum. Kaungunì, Muccai, or Muruli,—the first being the Newar name (*i. e.* of the aboriginal Mongolian population), the last two those of their Parbatiya or Hindoo conquerors,

* There is considerable discrepancy in the description of the Himálayan Buckwheats given by Don (Prod. Fl. Nep. pp. 73, 74. Nos. 21, 22, 23), Babington (Linn. Trans. xviii. 93 *seq.*), and Meisner (Pl. As. Rar. vol. iii.). I am only acquainted with two cultivated species, the Ogal and the Pháphar, as noticed in the text.

also a mountain race. Generally, however, Kanganí is *Panicum italicum,* and Muccai (Makkai) *Zea Mays*: it is probably a term of Indian origin, but the Mohammedans suppose it to be so termed because Maize came to them from Mecca; of this fact it is but a very slender corroboration that the French call the same corn 'Blé de Turquie.' *Sorghum vulgare* is little cultivated in the mountains, but *Sorghum saccharatum* is occasionally seen about Almorah.

Panicum colonum. Tangni, Tangri, or Kakun, p. 231.

Sabe, referred to *Ischæmum,* a grass of the Nepál Tarai, growing in great quantities, and exported to the British territories for the manufacture of ropes (p. 64).

No. 2324. *Ischæmum Sabe.* Sabe, Hindice. Habitat in Mithilæ campis ubi legitur ad ligamina foliis nectanda. (Specimen from Náthpur.)

No. 2325. *Ischæmum sparteum.* Sabe, Hindice. Habitat in Magadhæ montosis. Ad usum eundem cum præcedente inservit. (Specimen from Ghoramára.) These two plants are identical; *Spodiopogon laniger,* No. 8845 B. of Wallich's Catalogue, Nepál, 1821, being there referred to a new genus, "*Eriantho* affine." In 1850 I found it stacked in large quantities on the bank of the Ganges at Bhojpur and Monger in Behar, where the owners called it Sába, Sáma, and Sábar, and informed me that it was brought down from the Rájmáhal Hills, south, and from those of Tirhut, north—the localities specified by Dr. Hamilton. Dr. Royle (Illustrations, p. 416) states that *Spodiopogon laniger* is "one of the grasses found in the northern as in the southern parts of India." In Kumáon it occurs as far in the mountains as Almorah, and up to an elevation of 5000 feet, flowering in April. Mr. Edgeworth informs me that it is abundant in the *ráos* or hill water-courses of the Sewálik and lower ranges of the Himálaya in the Pinjor Dun, below Simla, up to 3000 feet; there, as throughout Northern India, it is termed Bán (a word which in Shakespeare's Hindustani Dictionary is erroneously identified with Munj), and is well known as a common material for making rope, which is much used, especially for the bottoms of beds and similar purposes. Dr. Royle adds that *Eragrostis* (*Poa*) *cynosuroides* is employed for rope-making: under the names Darbh (Dabh) and Kusa, it plays an important part in the religious ceremonies of the Bráhmans, and, when young, it is a favourite food of cattle; but any other destination has not fallen under my observation. *Eriophorum* (*Trichophorum*) *comosum,* Wall., *cannabinum,* Royle, called Bábar and Baib, and *Saccharum* (*Erianthus*) *Munja,* also yield excellent material for cordage (the latter requiring the preliminary process of being pounded); but we are indebted to Dr. Hamilton for having indicated the importance of *Spodiopogon laniger* as supplying one of the textile articles of Indian produce.

Kshir Kangkri, or Titi Pírálú; a *Lilium* or *Pancratium* (p. 86).

No. 855. *Pancratium sylvestre.* Titi Piralu montanorum, Hindice. Habitat in sylvis Nepalæ inferioris. (Marked in the margin *Allium cumaria.*) From Chatera, April 1810. There is no specimen in the Herbarium, but Wallich believed it to be his No. 8974, *P. verecundum.* Dr. Hooker met "a very sweet-scented *Crinum*" in the Sikkim Tarai, perhaps identical with this.

Dr. Royle (Illustr. p. 374) has a *Crinum* (*C. Himalense*) from Mansár, in the interior of the Himálaya; and the late Dr. M'Gregor assured me that he had found one wild in the valleys near Sabáthu.

Dr. Hamilton, however, states that the true Titipirálu (which signifies the bitter bulb or *Colocasia*) consisted of the dried scales of a tuberous root, having every appearance of being a species of *Lilium.* Of this genus, as well as of *Fritillaria,* many species inhabit Nepál, and among them *L. japonicum,* sometimes called *L. Wallichianum,* known in Kumáon as Findora, a corruption of Pindálu. "The bulb-scales of *Lilium japonicum* dried are said to be employed in China, like salep, in pectoral complaints." (Royle, Illustr. 388. Figured, Wight's Icones, t. 2035.)

According to some of his informants, the Kshir Kangkri is one of the *Cucurbitaceæ*; this is borne out by the signification 'juice of the cucumber;' perhaps *C. Hardwickii,* which is called Air-álu in Kumáon, and Pahári Indráyan, Hill Colocynth, in Garhwál, from its bitterness. Royle, t. 47. f. 3.

Amomum: Desi Eláchi, large Nepal Cardamom, with membranous angles (pp. 74, 75).

No. 13. *Amomum? aromaticum,* Hort. Beng. 1; Roxb. Fl. Ind. i. 44. Alaichi montanorum in Nepala. Colitur inter montes Nepalæ. (To this is added at a subsequent date),—To this probably belonged the specimen received from Surat, which Linnæus considered as the true *Cardamomum.* (Linn. Trans. x. 252.)

There is no specimen in the Herbarium. In Dr. Christison's valuable collection of Materia Medica, this species is named "Java Cardamom, Pereira, ed. iii. p. 1135. From *Amomum maximum,* Roxb. Java and Bengal." I observed it exposed for sale in considerable quantities at Barmdée, a mart on the western frontier of Nepál, where it was said to come from Dotî, a province bordering Kumáon to the east. Roxburgh (*l. c.*) describes *Amomum aromaticum,* Morang Elachi, as a native of the valleys on the eastern frontier of Bengal, with an ovate capsule, the size of a large nutmeg; those of Dotî are much smaller.

"Sínggíya Bikh or Bish (of the lower mountains and hills,

p. 98), much celebrated among the mountaineers. The plant was brought to me in flower, but was entirely male; nor did I see the fruit, which is said to be a berry. So far as I can judge from these circumstances, I suppose that it is a species of *Smilax* with ternate leaves. To pass over several of its qualities that are marvellous, the root, which resembles a yam, is said to be a violent poison. The berries also are said to be deleterious, but when applied externally are considered as a cure for the goître," p. 87.

No. 2219. *Smilax? virosa.* Sínggíya Bish vel Bikh montanorum, Hindice. Habitat in Nepalæ montibus. Identified by Wallich with No. 5099 of his Catalogue, *Dioscorea virosa,* which Dr. Royle informs us occurs also in Garhwál and Sirmur under the name of Rámberee (the divine Zizyphus). It is remarkable in this genus from having its stems furnished with aculei; and Dr. Royle calls our attention to the fact that this species, with *D. triphylla, pentaphylla,* and *dæmona,* all with compound leaves, are distinguished by the acridity of their tubers*. Sínggíya a Bikh, signifying 'horned poison,' alludes to their curved form in *D. virosa*†.

No. 220. *Smilax? narcotica.* Bharbang montanorum, Hindice. Habitat in Nepala inferiore ad montium radices.

This is identified by Wallich with the preceding.

Pinus Picea, W. Common Spruce Fir. Hingwál Ka Ch'hota Saral, *i. e.* Small Alpine Pine, pp. 83–96.

No. 2064. *Pinus striata* : *Pinus Picea,* Hamilton's Nepal, 83, 96. Hingwál Ka Ch'hota Saral (Alpium parva Pinus), Hindice.

* Roxburgh (iii. 806) and Graham (Cat. of Bombay Plants, p. 218) agree that the tubers of *D. pentaphylla* are wholesome, and used as an esculent. Graham tells us that the root of *D. triphylla,* "intoxicating and intensely bitter," is often sliced and infused in toddy to render it more potent. It occurs in Kumáon as high as 6000 feet; *D. dæmona,* with equally nauseous tubers, only reaches to 3000.

The root Charmaghás, so often mentioned in the Sanscrit dictionaries, has not been identified. I found it sold at Barmdee by the Nepalese traders; but my specimens were destroyed by the 'Fish insect,' *Lepisma saccharina,* the scourge of our Indian libraries and herbaria. It may be the Shám, or root of *Chærophyllum esculentum,* mentioned in Royle's 'Illustrations,' which is probably the Chamaas, "a wild edible root used as a relish" by the people of Rol, near the Shátul Pass, Basehar (Lloyd and Gerard, i. 293). The *S. nálika* implies a plant with a tubular stem: *saptalá,* having seven leaves.

† The vernacular Síng, 'a horn,' softened from the Sanscrit Sringa, gives the origin of the Arabic and Persian word for ginger, Zinjabíl, from which the Greek Zingíberis is derived. The common source of all is the Sanscrit Sringavéram, signifying 'antler-shaped;' and it is remarkable that this classical name, as well as that (Nalada) from which the ancients formed their term (Nardos) for spikenard, is no longer used in the Indian dialects, being superseded by some of the many synonyms.

Habitat in Nepalæ alpibus. On the label, "leaves very odorous." This is *Picea Webbiana*, and is identified by Wallich, No. 5058 (for 6058), *Pinus Webbiana*: *P. striata*, Ham.

Neither Wallich nor Hamilton has the Himálayan Spruce (*Abies Smithiana*, or *Morinda*) from Nepál; it is also absent from Kumáon, but is common both east and west of these provinces.

P. excelsa is figured by Wall. Pl. As. Rar. iii. t. 201; but t. 246, *P. Smithiana*, errs in exhibiting the cones *erect*.

Catalogue, No. 2063. *Pinus Strobus*. Gobiya Saral montanorum, Hindice. Habitat in Nepalæ alpibus. (The native name belongs to the last.) Weymouth Pine, p. 83. *Pinus excelsa*, which is very near to *P. Strobus*. In Lambert's 'Description of the genus *Pinus*,' it is characterized as follows:—"This species approaches so near in habit and in the figure of its cones to *P. Strobus*, that were it not for the simple round membranous crest of the anthers, it would be almost impossible to distinguish their limits as distinct species. The leaves of this species are considerably longer than those of *P. Strobus*, and the cones larger." *P. Strobus* has "antherarum crista omnium minima è setis duabus erectis brevissimis." Mr. D. Moore of Glasnevin informed me that it is, in Ireland, less hardy than *P. excelsa*. A variety of this in our Horticultural Society's Garden, with short leaves, removes one of the differences on which Lambert relies. Colonel Markham (Shooting in the Himálaya, 213, 214) says that, in Kunáwar, "torches are made from the Cheel Pine, which, being full of turpentine, burns beautifully, and gives a capital light. . . . . . The gum of the Cheel is held in great estimation for its healing qualities throughout the hills." So Hooker, Journals, ii. 45.

The Salla of Dr. Hamilton is *Pinus longifolia*, also called Chír, a species occasionally introduced into our Pineta, but quite unfitted to endure the severity of our winters, being a semi-tropical plant.

It is observable that Dr. Hamilton nowhere mentions the Deodár, which he could scarcely have failed to procure had it been indigenous to Nepál. When in India, with very scanty materials for an opinion, I came to the conclusion that we have no evidence of its existence till we come to Garhwál, though it is usually quoted as a native of Nepál: a reference to Dr. Wallich's Catalogue establishes the correctness of this conclusion, for under his No. 5060 (for 6050?) we have "*Pinus Deodara*, Roxb. a Kamaon, R. B. (Robert Blinkworth). ? β. ex horto quodam ad Pátan in Nepalia, 1821." But even in Kumáon, where fine groves occur, the tree is clearly introduced.

Juniperus: Dhupi. Alpine Nepal. No. 2280. *Juniperus* *squamosa.* Dhupi montanorum, Hindice. Hamilton's Nepal, 96. Habitat ad Emodi nives: labelled, "Thibet Hills." So Wallich, No. 6043. *J. squamosa,* Ham. Gosainthán, Chur. The common species of the Himálaya, with considerable diversity as found in the dry or the rainy districts. The description of the Dhupi in the 'Account of Nepal,' p. 96, can, however, only agree with *Juniperus excelsa*: "A very large tree." "Its wood has a beautiful grain, a fine mahogany colour, and a remarkably pleasant scent, a good deal resembling that of the pencil Cedar, but stronger, and I think more agreeable. Planks of this are sent to Thibet, from whence they are probably carried to China." Dhup signifies 'incense.'

Juniperus: a low bush; Thumuríya Dhupi. "Branches and leaves have an agreeable smell, and are used in fumigations," p. 96.

No. 2279. *Juniperus? incurva.* Thumuriya Dhupi montanorum, Hindice. Hamilton's Nepal, 96. Habitat ad Emodi nives. No. 6042, Wallich. *Juniperus recurva,* Ham., identified with his *J. recurva.* Gosainthán. Dr. Hamilton's specimen quite resembles some of the north-western forms of *J. squamosa,* and has neither the hue nor the pendulous branchlets of the *J. recurva* of our collections, which is certainly not a native of the British Himálaya. Dr. Hooker (Journals, ii. 28, 45) calls it the weeping Blue Juniper, and figures it as a tree 30 feet high, in Upper Sikkim, but comparatively scarce.

Catalogue, No. 2067. *Cupressus sempervirens.* Bhairopati, Hamilton's Nepal, 97. Habitat in Nepalæ alpibus. Labelled, "Brought from the alps of Thibet: said to be a shrub." ("Its dried leaves have a disagreeable sulphureous smell," p. 97.) The name is here given, 'Bhaingropati;' and in p. 97, Bhairopati (*i. e.* Siva's leaf) is said to be a *Rhododendron.* Wallich (No. 6041) identifies Dr. Hamilton's specimen with *Juniperus excelsa*; and has *Cupressus torulosa* (No. 6046) only from Nítí in Garhwál. I have stated elsewhere, on the authority of the late Mr. J. E. Winterbottom, that he had obtained it from Gosainthán in Nepál; but he subsequently discovered that his specimens were those of a Juniper. Dr. Hamilton's plant has the branches four-sided, agreeing with Don's "quadrifariam imbricatis" of *C. torulosa* (Prod. Fl. Nep. 55) and with my own observation. Lambert says, "ramulis teretibus," perhaps from a young state of the plant.

Hingwál Ka bará Saral: the Yew, according to Dr. Hamilton, confirmed by his specimen No. 2281. *Taxus baccata falcata.* Yew-tree, Anglorum. Híngwál Ka bara Saral montanorum, Hind. Hamilton's Nepal, 83, 96, 117. Habitat in Nepalæ alpibus. The name signifies 'great Alpine Pine,' and is certainly misapplied, probably by the carelessness of the collectors; as 'small Alpine Pine' cannot belong to *Picea Webbiana*. They have most likely been interchanged.

Zuccarini* constitutes a distinct species (*Taxus Wallichiana*) for the Himálayan Yew; but though the leaves are more curved, and the berries smaller than in our European tree, the difference is so trifling, that, with our knowledge of such a marked variety as the Irish Yew generally reproducing the common form, a new species seems uncalled for. Dr. Hooker (Journals, ii. 25) holds that the Himálayan, the North American, and several connecting links, all belong to *Taxus baccata*; he tells us (i. 186) that the red bark is used as a dye, and for staining the foreheads of the Bráhmans in Nepál. The timber found by Layard in the palaces of Nineveh, and pronounced by him to be Cedar, is in reality Yew.

Dr. Wallich (No. 6054, and Tent. Flor. Nep. t. 44. p. 57) identifies *Taxus baccata falcata* of Nepál with *Taxus nucifera* of Kaempfer from Japan, an oversight which has been set right by Zuccarini, as well as by the fact that no one has hitherto detected that plant or other *Taxus* in any part of the Himálaya. Dr. Wallich has indeed, in "No. 6056, *Taxus? Lambertiana*, Wall. Pini spec. Wall. Herb. 1824. Himálaya, Webb, Govan, Kamroop." No specimen exists in the collection here; but from Lambert's genus Pinus iii. t. 67, we know it to be *Pinus* (*Picea*) *Pindrow*. "Dr. Wallich, who had seen neither flowers nor fruit, supposing it to be a *Taxus*, has doubtfully referred it to that genus under the name of *Taxus Lambertiana*, in the Catalogue of his Herbarium. It does not appear to have been found in Nepál, but is frequent in the countries to the westward, having been observed in Kumáon by Captain W. S. Webb, and in Sirmore and Garhwál by Drs. Govan and Royle." Dr. Thomson (Western Himálaya and Tibet, p. 86) considers it one species with *Picea Webbiana*: "The long green-leaved state is that of the moist Himálaya; in the driest regions the very short glaucous-leaved form occurs." The Himálayan chain from Kumáon to Baséhar on the Indian face is annually drenched with rain; and still more the various detached outliers, Dudutoli, Chur, &c., rising above 11,000 feet. Everywhere in this tract, so far as my observation extends, the Pindrow alone will be found up to about that elevation, when in a few hundred feet it yields to *P. Webbiana*. Owing to this lofty habitat, *P. Webbiana* is stimulated into premature growth by our early springs, and often cut down by subsequent frosts;

* Morphology of the Coniferæ, 52, 53, in Reports and Papers on Botany, printed for the Ray Society, London, 1846.

the Pindrow, though from a lower zone, is not liable to this accident.

The preparation of a kind of tea from the Yew-tree is, I think, peculiar to the Himálaya, and it is remarkable that so dangerous a plant should have been selected. Col. Markham (Shooting in the Himálaya, p. 115) thus describes its use in Kashmir: "There is a capital substitute for tea, in the inner bark of the Yew-tree, dried and prepared like tea. The colour is perfect; but I never could find much taste in the infusion, although one of my friends once said that he liked it better than tea." It is for this reason that, in Kunáwar, *Taxus baccata* is called Sang-chá = Sang *tea*, perhaps connected with the name of the mountain Sung-lo in Kiangnan, "famous in China as being the place where the green tea shrub was first discovered, and where green tea was first manufactured*."

Of the popular idea of the great age attained by this tree, I met with a curious illustration in 1851, when an Irish gardener repeated the following as being an ancient composition taught him by old people. Three years being the age assigned to the unit, the total comes to 2187 :—

Tri saoghail muic, saoghal con ;
Tri saoghail con, saoghal eich ;
Tri saoghail eich, saoghal aufhir ;
Tri saoghail aufhir, saoghal seade ;
Tri saoghail seade, saoghal iolair ;
Tri saoghail iolair, saoghal au iur.

In English.

Three lives of a pig = life of a dog ;
Three lives of a dog = life of a horse ;
Three lives of a horse = life of a man ;
Three lives of a man = life of a path (or furrow) ;
Three lives of a path = life of an eagle ;
Three lives of an eagle = life of a yew.

Bhurya patra, or Bhurjapatra, p. 97. *Betula bhojpatra*, Wall. "This bark (of a fine chestnut colour) is imported into the low country in considerable quantity, and is used both in the religious ceremonies of the Hindus, and for constructing the flexible tubes with which the natives (*and Europeans also*) smoke tobacco." Both in India and in Persia this bark was anciently substituted for paper (called Tús in Persia); hence a Sanscrit name of the Birch, Vidhádal, 'leaf of knowledge.'

* Fortune's Tea Countries of China, 86.

The blocks used in Thibet for stereotype printing are formed of its wood. The Sanscrit Bhurjja, 'firm or hardy in the earth,' seems the origin of our term Birch, Russian Beréza, &c. The Bhárangí bark from Almorah (Royle, J. A. S. B. for October 1832, No. 110) is explained to be *Betula bhojpatra*,—Illustrated Cat. of Great Exhib. of 1851, vol. ii.

Káephal (not Karphal), p. 85. *Myrica sapida*. Káyaphal, from the Sanscrit Katphal, signifies both acid and stony fruit. It is scarcely worth eating; but the bark is sent down to the plains in large quantities, and is used, I think, in dyeing.

Lálchandan, "a timber tree, the foliage and appearance of which have some resemblance to the Laurels" (p. 85). No specimen or reference seems to exist in the Catalogue; but the plant is probably *Goughia Himalensis*, Bentham (a new genus of Euphorbiaceæ, near to *Sarcococca*), which is not uncommon in moist valleys in outer Kumáon and other provinces of the Himálaya as far N.W. as Dharmsála near Kotkángra, at 5000–7000 feet. The Kumáon name, Rakt Chandan, is of the same import as that given by Dr. Hamilton, and signifies 'Red Sandal-wood;' the heart-wood being used for the sectarial mark which the Hindus daub on their foreheads.

The genus *Goughia* is described and figured in Wight's Icones, v. 22. t. 1878–79.

Catalogue, specimen No. 1486. *Sinapis Gorræa*. Ghor ráyi, Hindice. Colitur rarius in Indiæ Gangeticæ arvis ob semina acria. In fr. Surjaghorri, 27 March, 1811. Identified by Wallich (No. 4790) with *Sinapis erysimoides*, Roxburgh, Fl. Ind. iii. 123, from Wynaad, a district of Malabar.

Ten years since, I noticed this plant under cultivation at Almorah, with the names Makara ráí, Asl ráí, Tarantula and True Mustard. I referred it doubtfully to *S. erysimoides* or *nigra*. On a voyage down the Ganges in 1850, I found the plant commonly grown from Mirzápur as far down as Bar in Behar, but in the greatest abundance about Benares, being cultivated (like the rest of the genus) in the cold season, on the rich clay banks of the river. The leaves are used as cress, the seed for the same purposes as with us; as well as in horse and camel medicines: hence the name Ghor-ráí, Horse Mustard. On arriving in Europe that year, it was at once recognized as *Sinapis nigra*.

The cultivation of *Sinapis nigra* in India does not appear in our works on its agricultural resources. Dr. Royle enters *Sinapis nigra*? (No. 219) among the Indian articles of Materia Medica (Journal As. Soc. Bengal, Oct. 1832); and in the Liverpool Collection of Imports, Class 29. No. 270. of the Exhibition of 1851, is "Mustard Seed, Brown: *Sinapis nigra*, from Bombay. Import, 1100 quarters in 1850." In the Illustrated Catalogue,

ii. 879, is a similar entry,—"Annaloo Noonæ (*Sinapis nigra*) from Tanjore;" and "Khardal rai, *Sinapis nigra*." (871.)

It appears from Ainslie's 'Materia Indica,' i. 231, that the plant was cultivated long since in the Calcutta Botanic Garden from seeds "brought from England by Colonel Garstin."

Malayagiri, p. 84, "a pale yellow wood, with a very agreeable scent."

1262. *Michelia Zila.* Ham. Nepal, 217. Zila champa. Habitat in sylvis Nepalæ. This is apparently *M. Kisopa. Michelia Doltsopa* is described by Don (Prod. Flor. Nep. 226) as "arbor vasta ligno odorato gaudens, ad ædes ædificandas omnium arborum Nepaliæ optima." *Magnolia* (*Michelia*) *excelsa*, Wall. (Tentamen Fl. Nep.), yields a valuable timber, of a fine texture, at first greenish, but soon changing into pale yellow. This is probably the *champa* of Darjîling, described as "an excellent yellow timber." One of these I suppose to be the Malayagiri, a term implying 'mountain Sandal-wood.' Dr. Hooker mentions the *Cupressus funebris*, Chandan, as "valued only for the odour of its wood" (*l. c.* ii. 45), which is probably yellow. *Ligustrum nepalense, Buxus Himalensis, Symplocos cratægoides*, have all yellow wood, but without odour. *Camphora glandulifera*, the Nepal Camphor-tree, however, has pale yellow wood, while fresh smelling strongly of camphor, and may be the Malayagiri.

"Bish, Bikh, and Kodoya Bish or Bikh; nor am I certain whether the Mitha ought to be referred to it, or to the foregoing kind," Bishma.

"I have only seen the flower and fruit of one. This is called Bishma or Bikhma, and seems to me to differ little in botanical characters from the *Caltha* of Europe," p. 99.

Catalogue, No. 1247. *Caltha? Bismia.* Bishma vel Bikhma, Hamilton's Nepal, 99. Habitat inter nives Emodi.

1248. *Caltha? Nirbisia.* Nirbishi vel Nirbikhi. Ham. Nepal, 99. Habitat cum præcedente. Montanorum unus hanc pro radice indica toxicaria ostendebat, alter autem sequentem afferebat. Flores non vidi.

1249. *Caltha? Codoa.* (No specimen.) Kodoya Bish vel Bikh, Hamilton's Nepal, 99. Habitat cum duabus præcedentibus. Credo hanc esse reveram Toxicariam Indorum radicem. Flores non vidi.

In Brewster's Edinburgh Journal of Science, i. 249–251, "On the Herba Toxicaria," Dr. Hamilton informs us that his specimens were collected in July 1810, near the sources of the Kosi River, and therefore necessarily quite immature; still it is surprising that he should have referred them, even doubtfully, to *Caltha*, to which they bear no resemblance. In the very short account in the Journal last mentioned, founded probably on the specimens before us, he says of *Caltha Bismia*, "The Bikhma is used in medicine, and is a strong bitter, very powerful in the cure of fevers*." *Caltha Nirbisia* "has no deleterious qualities," while *Caltha Codoa* includes Bish and Kodoya Bish. Dr. Wallich† showed that all these specimens belong to *Aconitum*: his 4723, *A. palmatum*, being *Caltha*? *Bishma*, H. Ham.; and 4721, *A. ferox*, including *Caltha*? *Nirbisia* and *C.*? *Codoa*, H. Ham.

It would be impossible to unravel this complication without a visit to Nepál; but perhaps some additional light may be thrown on the subject by eliminating the known from the unknown, and rejecting the specimens as misnamed. Dr. Hamilton (p. 98) expressly says there are "four different plants." We know that the Bish‡ proper is *Aconitum ferox*. Kodoya Bikh may be *A. palmatum*, or Dr. Hooker's new species from Upper Sikkim, *A. luridum*, reported to be as virulent as *A. ferox* (Journals, i. 168; ii. 108). *A. ferox* is found all over the alpine Himálaya; on the Shátúl Pass, in Basehar, it is well known as Bikh; also Maur, Máúr, and Máhur, of the same import. Vatsanába, 'calf-destroyer,' is the original of the Bachnag§, mentioned by Dr. Royle from the Makhzanul Adwiyyah. In order to ascertain whether it were justly called Mitha, 'sweet,' I masticated a very small slice, and found it was so; but this was soon succeeded by the most distressing burning all over the mouth and fauces, though nothing was swallowed.

Plants of other genera are also known as Bikh and Máhúr: the root of *Meconopsis Wallichii* is reported in Sikkim to be very poisonous (H. and Th. Flor. Indica, 254); and the root of a

* So in the Account of Nepal, p. 99.

† He left occasion for additional criticism. The description of *A. ferox* in the 'Pl. As. Rar.' is full and interesting, pp. 35–39; but the plate (t. 41) and specimen 4721 A. belong to *A. dissectum*, Don's Prod. 197. *A. ferox* flourishes at from 11,000 to 13,000 feet; it has beautiful deep-blue flowers in August and September, and is described and figured by Dr. Balfour and Mr. M'Nab in the Ed. New Phil. Journal, October 1849, plate 5, from plants which first flowered that autumn in our Horticultural Garden. *A. multifidum* is abundant at from 12,000 to 14,500 feet; *A. palmatum* grows at Nagkhanda near Simla in forests at 8500 to 9500 feet, and flowers from May to July; *A. heterophyllum* at from 8500 to 13,000 feet.

‡ The term *vish*, Sanscrit, denotes 'poison' simply, and is from the same root as *vishnu*, 'penetrating, pervading.' In the mountains and the north-west provinces it is pronounced Bikh; in Behar and Bengal, Bish; but there is no difference in the original word. Narbishi means 'not poisonous,' a term from which Don (General System of Gardening, i. 63) forms his genus *Nirbisia* to include two deadly Aconites and an innocent *Delphinium*,—as uncalled-for therefore in botany as it is false in etymology.

§ Bachnag, according to Graham's 'Bombay Plants,' is *Gloriosa superba*; its root is a virulent poison.

Convallaria with verticillated leaves is considered a very virulent poison (Hooker's Journals, i. 168)*. Dr. Royle (Illustr. 382) says that "*Polygonatum verticillatum*, L., called Mitha-dúdhya in Sirmore, and *Smilacina pallida*, called Dúdhya-mohura, are both accounted poisonous in the Himálayas." On Mahásu, near Simla, I observed people gathering the young shoots of *P. verticillatum* or *cirrhifolium*, to induce intoxication; and the poisonous root Máhura was useful, they said, in cases of ringworm.

Nirbishi denotes some plant, "not *Aconitum ferox*," but resembling it. Dr. Royle observes that he was struck with the resemblance of some *Delphinium* roots from the Himálayas to those sold as Narbisi; and both at Pindri in Kumaon and Bhojgara, on the south side of the Kowárí Pass in Garhwál, at 11,000 to 14,000 feet above the sea, I found the beautiful *Delphinium Kashmerianum*, Royle, p. 55. t. 12 (*Jacquemontianum*, Cambassedes, Voyage aux Indes, viii. t. 7), with cylindrical tuberous roots, absolutely identical in form with the ordinary Nirbisi, and, I doubt not, its true source. No one, however, could previously supply me with the least information as to the province which produced it: the Nepalese said it came from the west; the Tibetans told Major H. Strachey it came from the east. Dr. Royle (J. A. S. B. October 1832) got the root (No. 49) from Amritsir. Its properties seem to be unknown; he describes it as having a pure bitter taste†.

The Bishma of Dr. Hamilton is expressly stated to be a *bitter*, which precludes the idea of its being *Aconitum ferox*, of which the taste is sweet; and Colonel Kirkpatrick, in his 'Account of Nepál,' p. 182, *note*, long since supposed it might be a kind of Gentian. Dr. Royle conjectures that it may be *Aconitum heterophyllum* (excellently figured, 'Illustr.' t. 13), the root of which,

* In the Journ. As. Soc. of Bengal for May 1849, page 438, Dr. Hooker states that "another far more powerful Bikh is yielded by a plant of the order *Compositæ*, which I have gathered abundantly at 10,000 and 9000 feet; and it requires care to distinguish its root from that of the Aconites; when mixed, the Bhotiyás could not separate them." Dr. Hooker informs me that the plant in question is a *Cacalia*, allied to *C. aconitifolia*; and that the reputed qualities having never been confirmed in any shape, he does not doubt that they are altogether due to the similarity of its foliage to the Aconite.

† Dr. Royle distinguishes this Amritsir and Basehar drug from the common sort: according to him it is fusiform, externally black, somewhat flattened and wrinkled, and in some respects resembling the Bikh itself, with a slight degree of bitterness and acrimony (Illustr. p. 49). This would agree well with the roots of Wallich's fig. of *Aconitum ferox* (*A. dissectum*), and with Colonel Munro's fact of a Kunáwar species being used as a tonic. It appears, on the authority of Linnæus, that in certain cold climates the root of *A. Napellus* is eaten with impunity.

called Atís, Patís, and Mahaushadham, 'the great drug,' is in much estimation for its medicinal qualities. Atís is a vernacular corruption of the Sanscrit Atívísha, 'overcoming poison,—antidote,' (erroneously rendered *summum venenum* by Wallich,) with the synonyms Upavish, 'reverse of poison,' and Prativishá, 'against poison, an antidote'*; the last is the origin of the vernacular Patís. This plant, however, is not quoted as indigenous to the east of Kumáon; and we may therefore substitute *Gentiana Kurroo,* Royle, which is much used in the N.W. mountains, or *Aconitum multifidum,* a very abundant species in the alpine Himálaya, "planta *A. Anthoræ* affinis," Royle; of this or *A. dissectum,* Colonel Munro states (Hooker and Thomson's Fl. Indica, p. 58) that "the roots are eaten in Kunáwar as a pleasant tonic." Dr. Royle's *A. multifidum* is from that district. *A. Lycoctonum* (*læve,* Royle) is as common in the Himálaya as in Alpine Europe; and its roots, which are, I believe, harmless, may also be so employed†.

Jumne-mundroo, p. 85. *Berberis* (*Mahonia*) *nepalensis*; properly Jámani mándru.

Chootraphul, *i. e.* fruit of the Chotra, a Barberry. Catalogue, No. 841. *Berberis asiatica,* Hort. Beng. 25; DC. i. 107. Habitat in dumetis Nepalæ. The specimen is wanting, and Chotra, Chutro, is the proper name of *B. aristata*; but Wallich has, No. 44, *B. asiatica,* Roxb., from Nepál and Kumáon.

Catalogue, No. 1082. *Rhododendron puniceum.* Potasar: Gorangs: montanorum Hind. The common *R. arboreum.*

"Sanpati: a small *Rhododendron,* like *Myrica Gale*; the leaves

* It is the Jadwár or Zedoary of the Arabs and Persians. "Ideoque dixit Avicenna nihil esse ea præstantius ad ebibitum Napellum" (Royle, Illustr. 50). In all probability this is purely an imaginary virtue.

† Griffith (Journals of Travels, ix. 37, 57) says, "I hope before my return to have seen *Coptis Teeta* in flower, and to have proved that the Beese is different from that of Nepál." The Coptis, called Mishimí *Tita,* or *Bitter,* from being indigenous to the Mishimí Mountains, a branch of the Himalaya, bounding Assam to the east, is, like the best Chiretta, of a yellow colour, "a pure intense bitter of some permanence, but without aroma." He calls it a "valuable drug." It may be one of the Bikhmas. In Hindustani, Bikhmán is explained by Shakespeare, "name of a medicine or poison," perhaps from the Sanscr. *vishama,* uneven. Bee or Bih is merely the Assamese form of Bish: thus we have Koni-bih (*Croton Tiglium*), Naga-bih (*Gordonia integrifolia*). Mr. Griffith (J. A. Soc. Beng. 1837, 331–335) mentions "the celebrated poison, Bee," of the *Ranunculaceæ* (and says it is "in very great request") as one of the three staple articles of the Mishims. Masters (J. Agri. and Hort. Soc. Calc. iv. 200) tells us that "the juice of this fruit (*Dillenia speciosa*) is mixed with the Mishimi *Bih* to prepare the poison for arrows." And Wilcox (As. Res. xvii. 456) mentions two kinds of poison from the mountains north of Assam,—the Bor Bis (great poison) and Sengumuri Bis; all no doubt to be included in the above-mentioned species of *Aconitum.*

are very odorous, and even when dried retain their fragrance. It is used in fumigations, and sent to the low countries," p. 97.

Catalogue, No. 1083. *Rhododendron.* Son Pati. Hamilton's Nepal, p. 97. The specimen is imperfect, but seems to belong to *Rhododendron anthopogon* or *pendulum*; the leaves of the first are very aromatic, and are burned as incense.

Bhairopati. *Rhododendron.* "Its qualities are similar to those of the former, but it is less fragrant," p. 97.

Catalogue, No. 1084. *Rhododendron Bhairopatium.* Bhairopati v. Bhaingropati. This specimen is also without flowers or fruit, but belongs to *R. lepidotum*, or one of the varieties or allied species discovered by Dr. Hooker.

Catalogue, No. 1062. *Melia Azederach.*

a. Enc. Method. i. 341; Willd. Sp. Pl. ii. 558. Colitur ad urbes Indiæ rarius, habitat in Nepála. In flower, Calcutta Botanic Garden, 4th January 1814.

No. 1063. *M. Azederach.*

β. Enc. Method. i. 341. *Melia sempervirens,* Willd. Sp. Pl. ii. 559. Habitat ad Indiæ pagos. In flower, Jolpigorry, 31st March 1809.

Wallich's Cat. 1251. *M. sempervirens.*

Nepál and Kumáon.

Ibid. 1250. *M. Azederach,* L. H. B. C.

Dr. Hamilton's first No. has oval-lanceolate leaflets; in 1062 they are somewhat broader and less arcuate; the difference, however, is certainly not more than is usual in specimens from the same tree; and hence Dr. Hamilton finds *M. Azederach* in Nepál, where Dr. Wallich finds *M. sempervirens*; and *M. sempervirens* in the Indian villages, which Dr. Wallich has only from the Calcutta Botanic Garden. I am satisfied that the Himálayan plant is identical with that of the Gangetic plains; in the hills it is called Dek or Jek and Betain; in the plains, Bakáyan, a name which is applied to *M. sempervirens,* As. Res. xi. 170. No specific name could be more inappropriate, since it is completely leafless during the winter months; and this appears to be true also, to a somewhat less extent, of the West Indian *M. sempervirens,* Swartz, which is said to vary from a small bush to a tree. Seemann (Kew Journal of Botany, October 1851) informs us that this is a native of Panamá, and known as 'Jasinto.' DeCandolle (i. 621) mentions Jamaica as its habitat, and says, "priore minor, florens jam biennis, folia tardius autumno deponens, et tepidarium per hyemem in nostris hortis requirens." Roxburgh (ii. 395) adds to the difficulty: he says *M. sempervirens* is "a native of Persia, now common throughout India...... It blossoms the greater part of the year in our gardens, and is perfectly distinct from *Azedarak,* which is a robust, deciduous timber tree, and this is a small delicate evergreen, of short duration compared with the other." He gives Bakarja as the Hindustáni name,—evidently the Bengáli name, Bakarjan, of *M. Azederach*. This last he calls a native of China. Graham (Cat. of Bombay Plants, p. 30) says it is common "about villages" in the Concan and Deccan, S. India. Jacquemont (Voyage dans l'Inde, iii. 147) finds it under the same circumstances in the Punjáb, but scarcely indigenous, nor has it the least claim to be so considered anywhere in Northern India. Its Sanscrit names, Mahátikta, 'the great Bitter,' and Mahanímb, therefore, go for nothing, and are not in the Amera Kosha. The Persian Azád-i-darakht, 'the spreading tree,' which gives it the specific name, with its popular one, 'Indian or Persian Lilac,' is compatible with its importation from America by the Portuguese, who, like other Roman Catholic people, use the berries in rosaries (Bead-tree); once introduced, its "very great beauty," and flowers like the Lilac, sweetly fragrant (Roxburgh), would speedily cause its general diffusion. Wight and Arnott (Prodromus, p. 117) found Roxburgh's own specimens of *M. Azedarach* and *sempervirens* so much alike as to appear as if cut from the same tree; and the figure of the latter in the Botanical Register, t. 643, may very well be *M. Azedarach* in a young state, and forced in a stove. In Dr. Royle's List, No. 191, Bakain is entered as *M. sempervirens*; and in February 1850 I saw this last in the Calcutta Botanic Garden in full flower, a tree 30 feet high, called Mohá ním by the Bengáli gardeners, and quite the same with the Bakáyan of Northern India.

Timmuc (for Timmur) or Taigbul: a mountain shrub; and an arboreous species on the lower hills (p. 84). The first, well known for its aromatic capsules, and for the thick prickly clubs used by fakírs (mendicants), is the *Xanthoxylon hastile* of Royle (*X. alatum* of Roxb. iii. 768, and *X. acanthopodium*, DC.), called Tímúr and Zejbal, the last expressive of its strong pungency. It seems to be the Jwarántika, 'fever-ender,' of the Sanscrit. It is (perhaps erroneously) referred to *X. aromaticum*, a West Indian species, in the Illustrated Catalogue of the Great Exhibition of 1851, ii. 895. There is a new species flourishing in shadier and loftier sites in Kumáon, which Mr. Edgeworth proposes to call *X. tomentosum*; of this the native name is Símur; it has similar properties. The arboreous species mentioned by Dr. Hamilton may be *X. Budrunga* of Roxburgh, of which the capsules are of a warm spicy nature, with the fragrance of lemon-peel. *Toddalia floribunda*, Wall., and another species of *Xanthoxylon* are natives of Nepál; and *Tetrodium cymosum* and *fraxinifolium* (Royle, 157) may be from Lower Nepál.

Padam chhál "is a plant with a thick cylindrical root that is used in medicine, and brought to the low country for that purpose. The specimen that I procured had one large heart-shaped rough leaf, and had somewhat the appearance of an Anemone" (p. 100). The name signifies 'bark of the Lotus,' and, according to my Nepalese authority, belongs to some species of *Rheum*, probably *R. Emodi*, or *Webbianum*, or both, the roots of which have "a spongy texture" (Royle) resembling the Lotus.

Sied burrooa: *Daphne papyrifera*, Ham. pp. 85, 232; properly written Seta-baruwa, *i. e.* White Baruwá. The shrub abounds in the temperate districts of the Himalaya; and the paper made from its bark, though coarse, is not touched by insects. "The bark is exceedingly strong and pliable, and seems to be the same with certain tape-like bandages employed by the Chinese in tying many of their parcels."

Sinkauri, Silkauli: the leaves, Tejpát. "Both its bark and leaves have a fine aromatic smell and taste, and this quality in the leaves is strengthened by drying" (p. 84). *Cinnamomum albiflorum*; *Laurus Soncaurium*, Ham., Linn. Trans. xiii. 557; *C. Cassida*, Don, Prod. 67. Another Sinkauri is distinguished by its aromatic quality residing in the bark of the roots. Dr. Hamilton received it from the mountains of Morang, the tract between the rivers Kosi and Tista. In the Trans. Linn. Soc. xiii. 558, he describes this plant as *Laurus Sailyana*: "vis aromatica tota in radicis cortice posita. Hic autem cortex lævis, colore lateritius, odoratissimus, sapore grato aromaticus. Cortex ramorum et folia insipida, inodora." Nees von Esenbeck (in Wall. Pl. As. Rar. ii. 73–75) identifies it as *Cinnamomum albiflorum β*, very near *C. Tamála*, 'Taj' Bengalensium, cultivated in the gardens of Cámrup.

Machilus odoratissimus (*Laurus Champa et bombycina*, Herb. Ham.), a fine tree of all the warmer valleys of the Himalaya, is known in Kumáon as the Kaula, which term enters into Hamilton's Nepalese names. Dr. Hooker found *Cinnamomum* in Sikkim, up to 8500 feet (i. 162).

"The Seta and Cálá Bhot más of the Parbatiyas (Hindoo mountaineers) are called Musa and Gya by the Newars (the Mongolian aborigines of Nepál). They are two varieties of the *Dolichos Soja*, the one of which has yellow flowers and white seeds, and the other has black seeds and purplish flowers. The former is ripe about the 1st of November, the latter about the 1st of September" (p. 228).

Catalogue, 1778. *Dolichos Soja*. *Soja hispida*, DC. Garo Kolai, Bengalensium. Bhot mas, Montanorum Hindice. Colitur in Camrupæ orientalis et Nepalæ montosis.

Thence abundantly up to Kumáon, where the Soy Bean plants are called Bhat. "Bhut. *Soja hispida*, Kumaon." Illustrated

Cat. of G. E. of 1851, ii. 871. No mention of it, however, in this respect occurs in our botanical or agricultural works on India. Soy pulse is reckoned rather unwholesome, and much of the sickness which assailed the divisions operating against Nepál in 1813–14 was popularly attributed to its use.

Catalogue, 1690. *Hedysarum Alhagi.* Habitat in ripis Gangis et Jomanis arenosis. Labelled, "Monger, 17th June, 1811."

This is the common Jawásá or Camel Thorn of the plains of Northern India, and is here introduced as an example of the way in which species are unnecessarily formed, on the supposition that a new locality (though erroneous) requires a new species. The plant extends from the extreme north of India down to Behar, where I have seen it in the neighbourhood of Monger, near the well-known hot spring of *Sitákund.* It is Dr. Wallich's No. 5760. *Alhagi Maurorum, Hedysarum Alhagi,* H. Ham. e Monger; and neither of these botanists gives any intimation of the genus being found in Nepál, nor is there any known Sitákund in that country. Yet, on the supposition that it is from that country, *Alhagi Nepaulensium* forthwith appears in our books:—Don, System of Gardening, ii. 310, "Native of Nepaul, near Sitaucund." DeCandolle, Prod. ii. 352. Syn. *Genista Juasi,* Ham. *Hedysarum Hamiltonii,* Sprengel, Syst. iii. 316; and *Manna Nepaulensis,* D. Don, Prod. Fl. Nep. 247. Habitat in Nepalia, prope Sitaucund, Ham., in which DC. follows.

In the same manner D. Don has (Prod. 101) *Heliotropium obovatum.* Hab. versus ripas fluminis (Bhagirathi) infra Morshídabad, Ham. (it is *H. europæum,* L.), to which DC. prefixes, "*In Nepalia* versus," &c., the locality being *Bengal.* A *Melianthus Himalayanus* is constituted (Linn. Trans. xx. 417) from a garden specimen of *M. major* grown at Háwalbágh, near Almorah, the only individual of the genus in Kumáon. In short, if we take as criteria the genera *Viburnum, Lonicera**, *Cirsium,* and others in DeCandolle's Prodromus, one-fourth of his Himalayan species have no reality independent of the different names imposed by different botanists, and adopted as species without examination.

Alhagi Maurorum is interesting as the shrub which yields the 'Manna' of N. Persia, Bokhara, and Samarkand, called Tarangabín or Taranjabín; the plant itself being Khár-i-Shutar and Ushtar-Khar, *i. e.* Camel Thorn. The Manna of Mount Sinai, a product of *Tamarix gallica,* is also formed in Louristán

* *Lonicera quinquelocularis* of Hardwick and Roxburgh (DC. iv. 338. no. 50) is *L. diversifolia,* Wall. (no. 24, 334), as I ascertained on the spot where the General discovered it. Exclude "ramis volubilibus."

and Irák, where it is called Gazángabín or Gazánjabín. The names are all *Persian*.

Saxifraga ligulata, Wall.

S. Pacumbis, Ham. MSS. in Don, Prod. 209. Dr. Hamilton's specific name, I doubt not, is a misprint for Páshán-bhéd, its Sanscrit designation (pronounced Pakhán-bhédin in the mountains), still preserved as Pákhán-bhéd in Nepál and Garhwál: so Royle, J. A. S. B. Oct. 1832, No. 121. H. H. Wilson erroneously explains the Sanscrit term by *Plectranthus scutellarioides*. It signifies 'Rock-splitter'; and it is the more interesting that the name should in this remote district be applied to a species of our genus *Saxifraga*, since Pliny (H. N. xxii. 30) refers *Saxifragum* to *Asplenium Trichomanes*, or *Adiantum Capillus-Veneris*: "calculos e corpore mire pellit frangitque, utique nigrum. Qua de caussa potius, quam quod in saxis nasceretur, a nostris saxifragum adpellatum crediderim."

Catalogue, 771. *Calotropis procera*. Habitat in arenosis Mithilæ, Magadhæ, et Cosalæ.

The distribution of this plant (*C. Hamiltonii*, Wight, Contrib. 53) is ill understood. Abundant in the south of Syria (Beid-el-osshar), Northern Africa, and all the warmer regions of Asia, I traced it down the Ganges to Nadiyá in Bengal, where it apparently ceases. It appears to have escaped the observation of Roxburgh, and is not mentioned in his 'Flora Indica.' The allied species, *C. gigantea*, is unknown in Northern India, except at the base of the Himálaya below Nainí Tál in Kumáon, where for some miles it occurs in profusion: thence southward I met with it wild till ten or fifteen miles below Rajmáhal, from which to Nadiya both species are intermingled, *C. gigantea* reaching Calcutta. The name Madár* applies to both: the term Ak, also often applied, is from Sans. Arka, 'the sun,' to which the flowers always turn; hence, where the two occur, *C. gigantea* is called Bará ákand; *C. procera*, Chhota ákand; great and small Calotropis.

Griffith (Itinerary Notes, p. 207) has nearly the same distribution as above: "*Calotropis Hamiltonii*; very common throughout the sandy plains of India, on the N. side of the Rajmahal hills, to the complete exclusion of *C. gigantea*. In appearance there is scarcely any difference, and, as far as foliage goes, perhaps none; the flowers are smaller, and invariably the leaflets much smaller and bilobed at the apex." Dr. Hamilton (Linn. Trans. xiv. 246–248) explains the differences excellently. Dr.

* Madarine, the active principle of *C. gigantea*, "possesses the property of coagulating by heat, and becoming again fluid on exposure to cold."

Hooker (Notes of a Tour in the Plains of India, P. ii. p. 78) notices nearly the same distribution as Griffith: "The species look very different, but when gathered, there is extreme difficulty in recognizing them." He adds, that "there is considerable discrepancy of opinion as to their comparative efficacy, the votes being in favour of *C. gigantea*."

Catalogue, No. 781. *Swertia Chirata*. Bará Chiráta.

No. 782. *Gentiana Cherayti*. Chhota Chiráta.

Dr. Hamilton informs us (p. 85) that of these two species the smaller (782) is the one most in request. It is the *Agathotes Cherayta* of D. Don (Linn. Trans. xvii. 522); *Gentiana floribunda* (Prod. 127); *G. Chirata*, Wall. (P. A. R. iii. 34. t. 252, where the flowers are of far too intense a yellow). Dr. Hamilton truly describes it as a perennial; it has *yellow* roots, hence the Arabic Kasb-al-zarīrach, 'yellow stem or twig' (Royle, 278); it brings twice the price of the other kinds: "sapore intense amaro," Wall., who also notes its "radix perennis." It flourishes in woods and shady places, with Plantago-like leaves, and is the largest plant of the whole, reaching 4½ feet high; so that the native appellation, given by Dr. Hamilton, does not apply.

No. 781 is probably *Ophelia angustifolia*, from which much of the Chiráyitá of commerce is obtained*; but several other species, *alata*, *cordata*, *fasciculata*, *purpurascens*, are equally esteemed or collected. These are annuals, and abound in open sites, at various zones from 4000 to 12,000 feet above the sea. *Ophelia angustifolia* and *paniculata* are figured in Wallich's Pl. As. Rar. iii. t. 204–5.

"The Kutki is another officinal plant, with a woody root, and a stem containing many alternate leaves, toothed on the edges and shaped like a spathula. It has much the appearance of a Saxifrage. The roots are brought for sale" (p. 100). *Picrorhiza Kurrooa*, Royle, Illustr. t. 71. f. 2, a bitter for which he tells us that *Gentiana Kurroo* is frequently substituted. *Nima quassioides*, occurring in the valleys of Basehar and Upper Garhwal at 5500 to 8000 feet, is also called Karwí, from its exceedingly bitter bark and wood.

Picrorhiza Kurrooa is abundant in the Alpine Himalaya, on

* D. Don (Linn. Trans. *l. c.* 524) says it is "more bitter than the last," the *Agathotes*. Wallich, on the contrary (Pl. As. Rar. iii. 2), says that it and *paniculata* "possess only a slight degree of bitter taste." Don is here most correct, according to my experience.

The large and handsome Swertias of the Alpine Himálaya do not appear to be imported to the plains.

Chiráyitá derives its name from the Kirátas, a people of Eastern Nepál, the *Cirrhadæ* of Arrian: hence the Sanscrit Kiráta-tikta; but the mountaineers call it simply Kánda Títa, 'bitter stem.'

the open downs above the limit of forest, 12,000 to 14,000 feet. There is a second species in Kumáon, discovered by Major R. Strachey, at similar heights.

Jatámángsi, p. 97: the Nard or Spikenard of the ancients; Hebrew Neredde, from the Sans. Nalada, *i.e.* 'giving fragrance.' *Nardostachys Jatámánsi*, Royle, Illustr. t. 54. f. 2. *Patrinia Jatamasi*, Don, Prod. 159, 160. The Indian women consider the smell very agreeable, and most of them that can afford it use oil impregnated with this root for perfuming their hair. "All I can say is," adds Dr. Hamilton, "that if this root was the Spikenard of the Roman ladies, their lovers must have had a very different taste from the youth of modern Europe." Cant. i. 12. There is, however, a larger species, *N. grandiflora* (DC. Prod. iv. 624), in Kumáon, flourishing at similar elevations (13,000 to 14,000 feet) to *N. Jatámánsi**, and with a similar root; "but it is much larger, and its smell is more agreeable" (Wall. P. A. R. iii. 40); and Lambert (Genus Cinchona, 1821, p. 179) says, it "may be considered as possessing the most agreeable odour of any" of the Valerians. His figure (p. 180) evidently represents this species, not *N. Jatámánsi*; and the description, anticipated from Don's Prodromus, proves that the latter also, unless made from Nepál specimens, belongs to it. The perfume and properties of the genus are, in fact, very nearly those of *Valeriana Celtica* and *Phu*; and it is curious enough that the radical leaves of the last two species (the roots of which are substituted in Western Asia for the Spikenard) are simple, and bear a considerable resemblance to those of *Nardostachys*. The name Jatámánsi signifies 'locks of hair,' sometimes simply Mási; and the vernacular Bálchhar denotes 'hairy staff,' all with reference to the root, which has been compared to the tail of an ermine, "on account of its withered stalks and ribs of leaves, cohering in a bundle of yellowish-brown capillary fibres." Pliny's description accords (N. H. xii. 26): "Cacumina in aristas se spargunt: ideo gemina dote nardi spicas ac folia celebrant." *Spica* is a translation of the Arabic Sumbul, Hindí Bal, 'an ear of corn.' Sir W. Jones, in As. Res. ii. 405–10, iv. 109, where the figure (copied, except the root, by Roxburgh, *ib.* iv. 435) with cordate radical leaves, is, as Lambert truly observes (*l. c.* p. 179), that of *Valeriana Hardwickii* (Pl. As. Rar. iii. t. 263). The roots of this very common species have the same smell as those of *V. officinalis*, are also used medicinally, and were substituted by Sir William Jones's collectors without

* It is strange that DeCandolle (iv. 624) should assign Mándu and Chitor in Central India as stations for this plant, which cannot live at Almorah, 5500 feet, beyond a few months.

any very glaring imposture. In Pliny's time also, adulteration took place by Pseudo-nard, "crassiore atque *latiore* folio." They are called Shameo in Nepál and Kumáon, the Sanscrit Shami, from Sham, 'to calm'; proving how widespread is the antispasmodic energy attributed to them.

The aromatic-rooted Grass, *Andropogon Jwaráncusa* (*i. e.* the 'fever-goad,' also Jwaranásaka, 'fever-destroyer'), at first taken for the Spikenard*, is abundant all along the base of the Himalaya, and in the valleys of Kumáon up to 4000 feet. At a lower level in the valley of the Alakananda in Garhwál, the still more fragrant species, *A. Calamus-aromaticus*, Royle, t. 97, *nardoides*, Nees, from which the celebrated Rusa, or Grass-oil of Nimmár, is distilled, is not uncommon. Dr. Royle only traces it north to Delhi.

"The Manjít, or Indian Madder, seems to be of two kinds: the *Rubia cordata* of Willdenow, and a species of *Rubia* not described in the common systems of Botany. Both seem to be equally fit for the purpose, and grow in the same manner. It is cultivated exactly as cotton is among the hills" (p. 74).

Catalogue, No. 354. *Rubia cordifolia.*

Catalogue, No. 355. *Rubia Chaya.* From Bhotan.

The first is *Rubia Manjistha*, Roxb. i. 374, the *R. cordata* of Thunberg, from Japan; differing by its pentandrous flowers from *R. cordifolia*, L., from Siberia. But this test is not satisfactory, as remarked by Wight and Arnott, whose statement is perfectly correct, that the flowers of *R. Manjisthá* are frequently tetrandrous. DeCandolle (iv. 588) describes them as all pentandrous, and those of *R. cordifolia* both tetrandrous and pentandrous, agreeing with *R. Javana* (*R. cordifolia*, Blume), which he considers a medial form. Wight and Arnott (Prod. 442), Wight (Icones, i. t. 187; Illustr. ii. t. 128 *bis*), and Don (Prod. 133) all identify them. *R. Manjistha* is very abundant in the Himálaya, from 4000 to 9500 feet, with black fruit, and deep red flowers, not yellow, as represented in Archer's Popular Economic Botany, P. xv. f. 78.

The second species, which Dr. Hamilton considers new, is by Dr. Wallich (No. 6069) identified with *R. cordifolia*, L. Our Edinburgh specimen, however, though imperfect, seems to be an undescribed species, which I found in the glen of the Sarju River in Eastern Kumáon, in two localities, Rámesar and Gangoli, at 3000 to 4000 feet elevation above the sea. Mr. Edgeworth proposes to name it *R. nervosa*. Griffith (Itinerary Notes) probably found it in Bhotan; his No. 11 is *Rubia Manjistha*,

* "The root of *Andropogon muricatum*" is given as a secondary meaning of *Nalada*, Spikenard.

Dewangiri, in woods. No. 116. *Rubia cordifolia*; alt. 2800 ped. in sylvis. No. 367. *Rubia cordifolia.* Khegumpa. Yields Manjistha (Madder). No. 1021. *Rubiæ sp.* Scandens, hirsuta, certe distincta a *R. cordifolia*; towards Panga, in woods, 6500 to 7500 feet. In the Journals of Travels, p. 203, he writes at Dewangiri, elevated 2000 feet: "I find that large quantities of Manjistha or Madder are sent to the plains from this, where the plant is very common." At p. 292 we have *Rubia hispida,* at 8700 feet; and at p. 296, *Rubia hirsuta,* at 5500 feet. At p. 209 he says, "Madder is furnished by both *Rubia Manjistha* and *R. cordifolia*; these species are quite distinct, the latter affecting greater elevations than the former, scarcely descending below 4000 feet." The plant becomes shorter and stouter at high elevations; and in a matured Report, published in the Journ. As. Soc. Bengal for April 1839, p. 281, he modifies this view, and identifies these two supposed species, adding that "Bhotan has *two* species. The two species used in Bhotan are very distinct, and very general constituents of other mountainous floras; one of them has leaves without stalks." This is perhaps Dr. Hamilton's plant from Bhotan. His specific name *Chaya* appears to vindicate a practice condemned by Mr. Archer (*l. c.* 212): "Munjeet is often called Chay-root; but this is a mistake, the latter being the produce of a totally different plant," *Hedyotis umbellata,* in Tamul Saya. In Bengal, Cháyá is *Ærua lanata.* Wallich (Roxb. Fl. Ind. i. 384) has *Rubia alata,* from Nepál, which Don reduces to *R. cordifolia*; and Major Strachey has a *Rubia* from Nítí in Garhwál, with greenish flowers, which he considers to be *R. Manjisthá* of Roxburgh. *Rubia purpurea,* figured and described by Decaisne in Jacquemont's 'Voyage aux Indes,' is merely *R. cordifolia,* one of the many instances in that valuable work of needless synonyms, owing to the want of ordinary precaution as to what previous botanists had already named.

"Umbelliferous plant with root resembling *Athamanta Meum,* and when fresh, an uncommonly fragrant smell" (p. 98). Very probably the well-known *Chora, Angelica glauca* of Mr. Edgeworth, abundant at 9000 to 10,000 feet (and which I take to be the aromatic Gertheon or Certheana of Assam, a compound of *Valeriana* and *Pastinaca,* Griffith, Journals, 37, 57; and J. A. Soc. Beng. 1837, 331, 335). Two thousand feet higher flourishes the Hushiál, also very aromatic, which I believe to be *Hymenolæna angelicoides,* DC. Prod. iv. 245; as well as *Hymenidium Brunonis,* Nesir or Lesir* of the mountaineers, a very fragrant plant.

* Dr. Hoffmeister has pointed out the resemblance of this name and plant to the *Laserpitium* (Lesir-pati) of the Romans, the *Silphium* of the

Bhutkes: Bhutkesar, pp. 86, 98. "A thick woody root, on the top of which were many stiff bristles, and from among these the young leaves were shooting." These Dr. Hamilton thought belonged to *Thalictrum*, and Dr. Royle (Illustr. p. 69) refers Bhutkes to *Corydalis Govaniana*; but it is actually the root of *Oreocome filicifolia* and *elata* of Mr. Edgeworth (Linn. Trans. 1845), especially the former. This is probably identical with *Selinum Candollii* (*Peucedanum Wallichianum*, DC. Prod. iv. 181; *Selinum tenuifolium*, Wall.) and *Pleurospermum cicutarium*, Royle, Illustr. Don's three species of *Athamanta*, Prod. 184–5, described in accordance with the signification of Bhutkes, seem to belong to *Oreocome*. Both the above plants, and one or two species of *Cortia*, growing at great elevations (14,000 to 15,000 feet), are well known all over the Himalaya by Dr. Hamilton's names, which signify 'hair of the spectre,' against which they are worn as charms. They are often called simply Kés, 'hair,' for the same reason as the Jatámánsi. With the medicinal root Bhutkes, Dr. Hamilton mentions another, called Jainti, which he refers to an Orchid growing among moss on large stones, on the higher mountains. *Cœlogyne præcox* is so described on his authority in Don's Prodromus, p. 37. "Brim" (p. 100) is another orchideous root used in medicine; but neither of this nor of the Bariyalbhera seeds (p. 285) from Chhináchhin in Yumila, a province east of Kumáon, have I any identification to bring forward.

Greeks, which the historians of Alexander inform us that his army found in Afghánistan. The Greeks of Cyrenaica represented the plant (*Thapsia Silphium* of Viviani, Flor. Lib., or *Thapsia garganica*, Desfontaines) on their coins still extant; and Pliny (N. H. xix. 15; xxii. 49) paints in high colours the virtues of its gum-resin, *Laser Cyrenaicum*, as a medicine and perfume. The celebrated drug, *Asa dulcis* of Cyrene, recalls the Assafœtida of Persia, as well as a kind of incense from the Himálaya, called Asá purí (*i. e.* 'the fulfiller of hope'), of which the Nepalese told me wonderful virtues.

11th December 1856.—Professor BALFOUR, Vice-President, in the Chair.

The following Candidates were balloted for and duly elected:—

As Ordinary Resident Fellows.

1. THOMAS FULLER, Esq., 65 York Place.
2. JOHN M'CLELLAND, Esq., F.L.S., Surgeon H.E.I.C.S., 13 Brunswick Street, Hillside.
3. CHARLES HOPE, Esq., 14 Saxe Coburg Place.
4. Dr JOHN CLELAND, 5 Pitt Street.

As Associate.

Mr JOHN WRIGHT BROWN, 39 George Square.

Office-Bearers for the ensuing year were elected as follows:—

President.

Professor FLEMING.

Vice-Presidents.

Professor BALFOUR.
Professor ALLMAN.
Dr W. H. LOWE.
WILLIAM IVORY, W.S.

Council.

Professor SIMPSON.
Professor GREGORY.
Dr SELLER.
ANDREW MURRAY, W.S.
JAMES M'NAB.
HENRY PAUL.
Dr JOHN KIRK.
P. NEILL FRASER.
C. J. BURNETT.
Dr W. NICHOL.

Honorary Secretary.......................... Dr GREVILLE.
Foreign Secretary.......................... Dr DOUGLAS MACLAGAN.
Auditor.......................... WM. BRAND, W.S.
Treasurer.......................... WM. W. EVANS.
Artist.......................... NEIL STEWART.
Curator of Museum.......................... Dr JOHN LOWE.
Assistant Secretary.......................... Dr G. LAWSON.

Professor Balfour stated that Dr John Kirk had presented plants from Ida and Olympus to the University Herbarium.

The following papers were read:—

I. *Description of a Method of Preserving Plants of their Natural Form and Colour.* By THOMAS R. MARSHALL.

The plant to be operated on should be placed in a box, in such a manner as to preserve the natural disposition of its parts. The fine sawdust (perfectly dry) of box, or other hard wood, is then to be carefully sprinkled over it, taking care not to shift the position of the leaves. Every part of the plant must be completely covered with the dust. Several plants may be dried in one box—avoiding contact, however. The plants to be preserved ought to be quite fresh when put into the box; if they be lax, place the stems in water till the tissues again distend and recover their natural firmness. About a fortnight in the dust is sufficient to dry the plants in summer (in a natural heat); succulent plants require longer. To assist in freeing the plants from the saw dust, the box may be made with a wire grate and sliding bottom; slightly shake the plant to free it from the dust, what still adheres may be brushed off with a soft hair pencil.

II. *On the species of Pine called in Moffat* "Dr Walker's Pouch Fir." By Professor Fleming.

Dr Fleming remarked that, in the latter portion of the last century and the first quarter of the present, the pursuits of the naturalist were lightly esteemed and usually treated with ridicule. Indeed, "naturalist" and "natural" were too frequently employed as synonymous terms. A striking instance of this occurred at Moffat. Dr Walker, who long occupied with distinction the chair of Natural History in the University of Edinburgh, was, when minister of the parish of Moffat, regarded as rather of weak intellect, in consequence of the fondness which he displayed for weeds and vermin. On returning one afternoon in spring from Edinburgh, he was observed to have the pocket of his coat full of what appeared *fir branches.* The witnesses now imagined that a crisis in his lunacy had arrived, and began to set a watch on his future motions. He was observed in the course of the evening going forth to a corner of the glebe and putting some plants into the ground. When he had retired to the manse, the spies immediately proceeded to the spot and found that he had been planting some young firs—that these had appeared as branches sticking out of his pocket, and hence they were led to conclude that their minister was not so great a fool as they had suspected. The plants took root, were protected, and as trees now prove an ornament to the glebe, and a monument of the Doctor's arboricultural tendencies.

The species is the Cluster Pine, *Pinus Pinaster*. Dr Walker, in his "Catalogue of some of the most considerable trees in Scotland," which contains entries so late as 1799, takes no notice of the Moffat trees, and of this species he merely says:—"In the year 1742 a number of Pinasters were planted at New Posso, in Tweeddale, on the hill behind the house. In November 1762 several of these were then twenty-five feet high and in a thriving state; but one of them being cut, the wood was found to be of a coarser grain, softer and more spongy than any Scotch fir of the same age. There is no advantage, therefore, to be expected from the wood of the Pinaster. It is a tree that grows luxuriantly on the sandy beach upon the western coast of France. As it is hardy, and grows very bushy, its chief use, probably, with us, is to obtain shelter on the sea shore." *Essays*, p. 73.

The date of the planting of these trees cannot now, I fear, be satisfactorily determined. Dr Walker became minister of Moffat in 1762, and was translated to Colinton, in this neighbourhood, in 1783. All that we can infer from these dates is, merely, that these trees are, at least, seventy-three years of age, but they may be twenty years older. The largest of the three now living is six feet three inches in circumference at the ground; five feet three inches at six feet from the ground; and total height forty-five feet.

These trees to this day preserve the name of the *Pouch Firs*, in memory of the part of the Doctor's dress in which they were first observed.

Dr Fleming stated that he was indebted to his young friend Mr Carruthers, and to the Rev. Dr Macvicar, for prompt and friendly assistance, and the promise to procure for him any local information illustrative of the character and habits of the most learned and intelligent of the naturalists which Scotland had produced.

A branch with a cluster of cones was exhibited, together with two photographs, executed by Dr Macvicar, exhibiting the trees. We have here a proof that this usually esteemed maritime species can grow in such an inland site as Moffat, and at a considerable elevation above the level of the sea.

III. *Notes on some New Species of Marine* Diatomaceæ *from the Firth of Clyde.* By Professor Gregory.

The author stated that, having found in the Glenshira sand a large number of marine species, many being undescribed, which must have come from Loch Fine, a branch of the Firth of Clyde, he felt convinced that these forms, though hitherto unnoticed there, must exist in that estuary. He therefore procured a number of dredgings and similar materials for the purpose of examination.

These consisted of,—

1. Some sand or dirt, washed from the nests of *Lima hians*, dredged in Lamlash Bay, in four fathoms, by Prof. Allman. 19th July 1856.

2. Seven dredgings from different spots in Loch Fine, four off Inveraray, and three off Strachur, the former by himself, the latter by the Rev. Dr Barclay. October 1856.

3. Two dredgings made in Lamlash Bay in June 1856, by the Rev. Dr Miles, one of them being the sand from lima nests; and a quantity of *Corallina officinalis* from rocky pools at Corriegills, Arran, to which many Diatoms adhered.

In all eleven materials. The last three only reached him in October.

The results of the exploration of these materials are briefly as follows:—

1. They yielded a large number of known species, among which were many very rare and interesting ones, such as *Campylodiscus Horologium* frequent in one Loch Fine dredging; *Eupodiscus Ralfsii* of great size, having frequently a diameter of 0·008 of an inch; *Navicula Lyra*, Ehr.; *Navicula Hennedyi*, Sm.; *Pinnularia Pandura*, Bieb.; *Coscinodiscus concinnus*, Sm.; *Coscinodiscus centralis*, Ehr.; and many others.

2. They yielded, as the author had anticipated, nearly the whole of the new species described by him in the Glenshira sand, and most of these in considerable abundance. It is unnecessary to give a list, since more than three-fourths of these new forms have occurred in these dredgings. But we may specify *Synedra undulata*, *Navicula clavata*, *N. splendida*, *N. latissima*, *N. maxima*, *N. incurvata*, *Cocconeis distans*, *C. costata*, *Amphora crassa*, *A. Grevilliana*, &c.

3. Seven or eight curious forms occurring in the Glenshira sand, but not hitherto described, from want of good specimens, or from being imperfectly understood, occur in these dredgings, and have, in every case, been found to be true and distinct species.

4. Besides the known British forms and those described by me in the Glenshira sand, these deposits have yielded a very large number of entirely new species; as far, at least, as Britain is concerned, there are only a very few of them which have been described even by foreign authors. These forms belong to but few genera, and may be summed up in the following groups:—

Group I.	Naviculæ and Pinnulariæ, . .	15
II.	Cocconeides, ...	7
III.	Filamentous forms, . . .	15
IV.	Discs and Campylodiscs, . .	8
V.	Amphiproræ, ...	5
VI.	Amphoræ, ...	25
	Total new species	75

The author did not enter on this occasion into a detailed description of the new species, but he exhibited beautiful drawings by Dr Greville of the whole of them.

He stated that one of the forms in the above list, though not strictly a new one, namely, that which is figured in Smith's Synopsis as *Himantidium Williamsoni*, with a mark of doubt as to the genus, the form being hitherto so scarce that the side view was unknown,—that this form is so abundant in these dredgings, as to settle the question negatively at least. The side view proves it not to be a *Himantidium*, nor can it be referred with certainty to any genus in the Synopsis; the author is inclined to refer it to Kützing's genus *Diadesmis*.

Many of the new forms are extremely beautiful, and several of them appear to belong to new genera.

One remarkable and beautiful form, *Navicula prætexta*, Ehr., had hitherto occurred only fossil and in one of the oldest deposits in which Diatoms are found, namely, the clay marl of Æginè which belongs either to the chalk or to the very oldest tertiary strata. It is now found to be living in the

Firth of Clyde, as is also the case with most, probably with all, the forms which accompany it in the Æginè marl. This, which is a very frequent case, led the author to express the opinion, that in all probability there are no extinct species of Diatoms. This differs *in toto* from what is seen in the other departments of Natural History, but then it must be remembered that the greater number of existing species of Diatoms are found in every country and in every sea, in all latitudes and in every climate, so that it is certain that this class of organisms—which is very low in the scale, and of extreme simplicity of structure, the only established parts being a siliceous shell, usually of four parts, a lining membrane and an inclosed watery fluid—is not in the least affected by any climatic conditions now occurring on the earth. They may, therefore, have been as little affected, at whatever period they began to appear (and it is doubtful whether any remains of them occur in strata prior to the chalk formation), by geological changes, as they now are by climate, when we see numbers of absolutely identical forms in the arctic, temperate, and torrid zones, and every known country. Some years ago, many species were regarded as exclusively fossil, and of course as extinct, but these are daily detected as existing, and if several of the cretaceous species still exist, all of them may do so.

IV. *Notice of Hepaticæ found near Aberfeldy.* By John Lowe, M.D.

After some preliminary remarks on the geographical distribution of this family of cryptogamic plants, the author enumerated the following species:—

1. *Jungermannia*, L. (*Gymnomitrium*, Nees) *concinnata*, Lightf. Plentiful on the moors near Aberfeldy, and in Glen Lyon.

2. *J.* (*Sarcoscyphus*, Corda) *Funckii*, Nees. Sparingly on rocks south of Aberfeldy.

3. *J.* (*Sarcoscyphus*) *Ehrharti*, Corda, (J. *emarginata*, Ehrh.) Glen Lyon, and Moness Falls.

4. *J.* (*Alicularia*, Corda) *scalaris*, Schr. Moness Woods. Common.

5. *J.* (*Plagiochila*, N. & M.) *spinulosa*, Dicks. Lower Moness Fall, and Black Wood, Glen Lyon.

6. *J. (Plagiochila) asplenioides*, L. Moness Woods. Common.—Var. *γ. minor*, Lindenberg. Moness Woods. Rare.

7. *J. (Scapania*, Lind.) *undulata*, L. Moness Woods.

8. *J. (Scapania) nemorosa*, L. Moness Woods. Common.

9. *J. (Scapania) uliginosa*. In springs on hills near Aberfeldy.

10. *J. (Scapania) umbrosa*, Schr. Craig Mohr, Glen Lyon. Rare.

11. *J. albicans*, L. Common everywhere.

12. *J. crenulata*, Sm.—var. *β. gracillima*. Moness Woods. Not common.

13. *J. curvifolia*, Dicks. Chesthill, Glen Lyon. Rare.

14. *J. cordifolia*, Hook. In mountain springs. Frequent.

15. *J. reclusa*, Tayl. Craig Mohr, Glen Lyon. In fruit. Rare.

16. *J. scutata*, Wils. Craig Mohr, Glen Lyon. Rare.

17. *J. riparia*, Tayl. Moness Burn.

18. *J. Bantriensis*, Hook. Moness Woods. Not common.—var. *γ. minor*. Moness Woods. Frequent.

19. *J. inflata*, Huds. Hills near Aberfeldy.

20. *J. Orcadensis*, Hook. Moness Woods. Sparingly.

21. *J. Lyoni*, Tayl. Abundant in fruit. Near Coshieville, and in Moness Burn.

22. *J. Taylori*, Hook. Near Loch Ghlassie. Growing on Sphagna, and identical with *J. anomala*, Hook.

23. *J. barbata*, Schr. Moness Woods. Common.

24. *J. excisa*, Dicks. Glen Lyon.

25. *J. incisa*, Schr. West Fortingal.

26. *J. minuta*, Crantz. Hills south-east from Aberfeldy. Not plentiful.

27. *J. divaricata*, Sm. Hills south-east from Aberfeldy, and in Moness Woods.

28. *J. bicuspidata*, L. Hills south-east from Aberfeldy, and in Moness Woods.

29. *J. connivens*, Dicks. Hills south-east from Aberfeldy, and in Moness Woods.

30. *J. setacea*, Wils. Moorlands near Aberfeldy. Not common.

31. *J. trichophylla*, L. Moness Woods. Frequent.

32. *J. julacea*, Lightf. In fruit, at the foot of the Breadalbane range (alt. not more than 200 feet), Glen Lyon.

33. *J. (Saccogyna*, Dumort) *polyanthos*, L. Hills near Aberfeldy. Common.

34. *J. (Calypogeia*, Raddi) *Trichomanis*, Corda. Moness Woods. Plentiful.

35. *J. (Lepidozia*, Nees) *reptans*, L. Moness Woods.

36. *J. (Mastigobryum*, Nees) *trilobatum*, L. Black Wood, Glen Lyon.

37. *J. (Trichocolea*, Dum.) *tomentella*, Ehrh. Moness Burn.

38. *J. (Ptilidium*, Nees) *ciliare*, L. Craig Mohr, Glen Lyon.

39. *J.* (*Radula*, Nees) *complanata*, L. Moness Woods. Common.

40. *J.* (*Madotheca*, Dumort) *lævigata*, Schr. Black Wood, Glen Lyon.

41. *J.* (*Madotheca*) *platyphylla*, L. Black Wood, Glen Lyon, and Moness Woods.—Var. *Thuja*. Black Wood, Glen Lyon.

42. *J.* (*Lejeunia*, Gottsche) *serpyllifolia*, Dicks. Moness Woods. Plentiful.—Var. *β. ovata*, Hook. Moness Woods. Very rare.

43. *J.* (*Lej.*) *hamatifolia*, Hook. On birch trees, Moness Woods.

44. *J.* (*Frullania*, Raddi) *Tamarisci*, L. Common on rocks and trees.

45. *J. Blasia*, L. (*Blasia pusilla*, Mich.) Moness Woods, and Chesthill, Glen Lyon.

46. *J.* (*Pellia*, Raddi) *epiphylla*, L. Moness Burn.

47. *J.* (*Pellia*) *calycina*, Tayl. Moness Burn.

48. *J.* (*Aneura*, Dumort) *pinguis*, L. Moness Burn.

49. *J.* (*Aneura*) *multifida*, L. Moness Woods.

50. *J.* (*Metzgeria*, Raddi) *furcata*, L. Moness Woods.—Var. *γ. æruginosa*. Moness Woods.

51. *J.* (*Metzgeria*) *pubescens*, Schr. Moness Burn.

52. *Marchantia polymorpha*, L. Moness Burn.

53. *Fegatella hœmisphœrica*, Tayl. Moness Burn.

54. *Fegatella conica*, Tayl. Moness Burn.

55. *Riccia glauca*, L. Near the bridge which crosses the Lyon at Fortingal.

V. *List of Hepaticæ added to the Flora of Edinburgh.* By John Lowe, M.D.

Jungermannia (*Scapania*, Lindenb.) *nemorosa*, L.—var. *recurvifolia*, Roslin.

J. barbata, Schrad. Swanston.

J. riparia, Tayl. Bonally Burn.

J. Funckii, Nees (*Sarcoscyphus*, Corda). Swanston.

J. Wilsoniana, Nees. Banks of the Almond below Cramond Bridge,—growing in dense tufts several feet in diameter.

8th January 1857.—Professor Balfour, V.P., in the Chair.

Professor Balfour stated that the following donations had recently been made to the Museum at the Royal Botanic Garden:—

From R. Etheridge, Esq., Bristol—Specimens of White Coal, from the South-East Coast of New Holland.

Mrs Millar—" Sweet Nuts," from Gold Coast, Africa.

Mr Scott—Specimens of Rice and Sprigs of Olive (*Olea europæa*) bearing fruit, produced at Leigh Park.

M. Courtois Gerard, Paris—Roots of *Dioscorea Batatas* (Yams).

Mr J. W. Brown—Specimen of *Callithamnion Rothii*, from M'Duff's Cave, Fife.

Edward Ravenscroft, Esq.—Nuptial Jacket, used in China.

A Visitor to the Garden—Specimens of Silicified Wood from Jersey.

Professor Christison—Cluster of *Pinus Pinaster*, and fruit of *Hylomeum pyriforme* (Wood Pear of New Holland); also section of the fruit of *Feronia Elephantum*.

Messrs Duncan, Flockhart, and Company—*Pyrethrum roseum*, a kind of Tea Powder.

Mr Stephens—Cotton from *Bombax Ceiba*, grown in the Governor's garden, Ceylon.

Professor Fleming—Cluster of Cones of *Pinus Pinaster*, from Moffat,—the trees were planted by the late Dr Walker.

Alexander Thomson, Esq.—Sections of the Wood of Scotch Fir, attacked by *Uroceras gigas*; also, specimen of the Insect.

The following papers were read :—

I. *On the Production of Ergot on Rye.* By Kenneth Corbet, Beauly. Communicated by Dr Douglas Maclagan.

The author noticed the occurrence of ergot on rye in the neighbourhood of Beauly, and stated that he found that this native ergot was more certain in its medical action than that imported from the Continent. He expressed his opinion that the production of ergot was connected with an abortive condition of the pollen, whose application to the stigma did not result in the development of an embryo. He found that, by cutting off the stamens in the early stage, the ovary became liable to an attack of ergot. Specimens of ergot on rye and barley were exhibited.

II. *On a Monstrosity in the Fruit of* Silene inflata; *with some remarks on Placentation.* By A. Dickson.

The plant from which these specimens were gathered was obtained in Peeblesshire last October, when the capsules were fully matured. The peculiarity consists in the division of the cavity of the capsule into several cells, by *septa* stretching from the walls of the ovary towards the centre, and being absolutely adherent to the column from which the seeds are developed. Mr Babington has described a monstrosity in a *Cerastium*, somewhat similar to this, but in which the partitions did not reach the central column, and had of course no connection with it.*

Various opinions have been held by botanists regarding the different kinds of placentation and their relation to each other. We may adduce the following:—1*st*, That the placentation in every case may be deduced from the parietal form. According to this doctrine, the placentæ termed *central*, are all originally attached to, if not parts of, the walls of the ovary, and the parts of which they are supposed to have been formed having become adherent to each other in the middle line, and a rupture having taken place, subsequently, between these and the carpellary leaves from which they took origin, they thus remain as a central column, free and isolated from the walls of the capsule. 2*d*, The view of Adolphe Brongniart, that ovules on *central* and *parietal* placentæ are formed upon two distinct types, that the former are modified leaves developed upon the prolonged floral axis, while the latter are merely lobes or denticulations on the margin of the carpellary leaf, and consequently not specific structures. 3*d*, That ovules on parietal placentæ, are leaves or buds, developed upon the margins of the carpel, comparable to those found upon the leaf of *Bryophyllum.* 4*th*, Schleiden's theory that all placentæ are prolongations of the floral axis, whether undivided and central or divided, so as to be applied to the margins of the carpellary leaf or leaves.

The *first* theory is rendered untenable by the examination of the ovaries of the Primulaceæ, &c., which at no period of their development exhibit any connection between the central column and the carpellary leaves.

The *second* theory is founded upon a monstrosity in the fruit of a *Delphinium*, described and figured by M. Brongniart† where the ovules had retrograded into the condition

* Gardener's Chronicle for 1844, p. 557.

† Brongniart Sur Monstruosités Végétales.—Archives du Museum, iv., p. 43, 1844.

of what he terms "lobes" upon the margin of the carpellary leaf. He considers these "lobes" to be portions of the carpel itself, and that the vascular cord from which the mid-ribs of the lobes proceed is manifestly derived from the lateral veins of that leaf. Now, admitting that such was the apparent state of the case, how can it be affirmed that this vascular cord may not be formed by the confluent extremities of these lobes? The lateral veins of the carpel may *join* this cord, but it does not necessarily follow that they *form* it; and even although it had been proved by examination of its development that this said cord was the product of the lateral veins, yet it by no means proves that the "lobes" are not specific structures. The buds on the leaf of *Bryophyllum* are formed at the extremities of the lateral veins, and yet no one doubts that *they* are specific structures. We see no reason why these lobes should not be considered as specific formations—leaflets—and homologous to the ovules of the Primulaceæ, &c., which M. Brongniart has clearly shown to be modified leaves.* We would further ask, to what kind of denticulation or lobing could the appearance presented by the placenta of a poppy be referred, in which a vast number of ovules cover the surface of a broad plate or lamina? It seems to us unphilosophical to suppose that structures, so manifestly similar to each other in their general anatomical details, and which are identical as regards their physiological function, as the ovules throughout the higher phanerogamia, should be specific formations in one set of plants, and not so in another. In the *ovule*, in fact, the archetypal or ideal leaf, receives its highest development. The ovule is the culminating point in that beautiful series of homologous structures, each of which occupies a definite position as regards the succession of forms, and performs its own specific function in the economy of the organism. M. Brongniart discovered the key to this truth, but he neglected, as it were, to turn it round, or rather, by a peculiar perversity—perhaps not uncommon—he turned it in the wrong direction, in a way of his own.

As to the *third* theory it is evident that it does not ne-

* Ann. des Sc. Nat., 2 Ser. I., p. 308, Botanique, 1834.

cessarily affect the homology between the ovules upon central and parietal placentæ, since we have only to suppose the force which, in the leaf of *Bryophyllum*, would have been distributed in the formation of a succession of green leaves composing a bud, to be concentrated in the perfection of the *leaf first formed*, so as to constitute that reproductive structure which we term ovule.

The only problem now to be solved is, whether Schleiden's view of a divided parietal axis be the true one, or are we to follow the analogy of the *Bryophyllum?* To this we are hardly prepared to give a complete solution; we would only state that such a monstrosity, as that we have now brought forward, would seem to exhibit a tendency (even in those plants in which the placentation is most strictly central) to adhesion between the carpellary leaves and the prolonged floral axis, which, so far as it goes, would give support to Schleiden's supposition. Indeed, this theory of Schleiden's is, in our opinion, the most philosophical, as being most in accordance with that unity of plan which is known to pervade nature, which has yet been brought forward on this subject.

As it is foreign to the object of the present notice to enter upon the very difficult subject of what constitutes the plant individual, we shall not here discuss the nature of the ovule; we would only observe, however, that this most important discovery by Brongniart, of the morphological constitution of the ovule, in the *Primula sinensis* more particularly*, has been overlooked by several of the most eminent authors who have treated of the analogies between the zoophyte and the plant. Professors E. Forbes†, Steenstrup‡, and Owen§, in their works in reference to this subject, agree in viewing the carpellary leaf as the female generative individual of the organism, the seeds being considered as comparable to the ova of the animal. We believe that this must have proceeded from a mere oversight, as we think it must be evident to every one who examines Brongniart's

* Ann. des Sc. Nat., 2 Ser. I., p. 308, Botanique, 1834.

† Forbes on the Morphology of the Reproductive System of the Sertularian Zoophytes. (Ann. and Mag. of Nat. Hist., xiv., p. 387, 1844.)

‡ Steenstrup on the Alternation of Generations. (Ray Society's Translation, p. 115, 1845.)

§ Owen on Parthenogenesis, pp. 55-56, 1849.

statements and figures, that, in accordance with the doctrine which these authors maintain, and with which our own views coincide, viz., that the leaf is the phyton or plant individual, the obvious conclusion to be derived from the monstrosities which Brongniart has described, is, that the ovule itself is the female generative leaf or phyton, and, therefore, not comparable to the ovum of the animal—involving of course the non-sexuality of the carpel.

III. *Analysis of Plantain Meal.* By MURRAY THOMSON, late assistant in the Laboratory of the Industrial Museum of Scotland.

It has often been suggested that the plantain and banana, the fruit of the *Musa paradisiaca* and *Musa sapientum*, should form an article of export from our West Indian colonies, but hitherto this has not been accomplished, at least, to any extent, chiefly from the difficulty of preserving the flavour of the fruit. This difficulty, however, does not hold when the plantain or banana are to be used as articles of diet in the form of flour or meal. The plantain is an important article of diet; and as there is not as yet any published analysis of it, at least, so far as I am aware, I have, at the suggestion of Professor G. Wilson, analyzed a sample of plantain, ground into flour or meal, sent to him by W. W. Anderson, Esq. of Jamaica.

According to Mr P. L. Simmonds, in his *Commercial Productions of the Vegetable Kingdom*, "This meal is prepared by stripping off the husk of the plantain, slicing the core, and drying it in the sun, and when thoroughly dry powdering and sifting it." "In that state," he says, "it is called by the creoles of the West Indies 'Conquin Tay.' It has a fragrant odour, acquired in drying, resembling fresh hay or tea. The sample I operated on possessed this tea odour in a remarkable degree. In colour it is whitish-gray, not unlike Scotch oat-meal, but in much finer powder. It has a sweetish taste and partially dissolves in the mouth. When treated with cold water it is little acted on, but in boiling water it rapidly dissolves, and on being strained and cooled, the solution consolidates into a grayish-brown jelly. I should here remark that, as far as appearance goes, the jelly given by the plantain meal is inferior to that given by arrow-root when treated in the same manner, but possibly a little more attention to the manufacture of the meal would improve this. It has been remarked in reference to plantain meal, that cooking it in iron vessels colours it very much. The specimen I examined gives a colour when some of it is stirred up with dilute solutions of sesquichloride of iron, but certainly not more so than the meal of wheat or oats when similarly treated."

The following short details of the analysis may not prove uninteresting :—

The amount of nitrogen was determined by Peligot's modification of Will and Varentrapp's process. It was twice estimated, and a mean struck between the two determinations. The number was 0·31 per cent. of nitrogen. This number, when multiplied in the usual way by 6·5, gives the amount of the albuminous or plastic constituents amounting to 2·01 per cent. Simmonds, in the work above quoted, gives the amount of nitrogen as 0·88, and of plastic constituents as 5·45. This result is certainly too high, yet it may to some extent be accounted for by the difference of samples operated on. As noticed above, cold water acts very little on this substance, sufficiently, however, to dissolve out all the gum, sugar, and salts. These were therefore determined by washing a known quantity of the meal with cold water on a filter, the accumulated washings were evaporated down in the water bath to perfect dryness, weighed, and the residue digested in ordinary spirit of wine. This dissolves out the sugar, leaving the gum and salts.

The spirituous solution of sugar when concentrated was quite sweet. The sugar was represented by the loss of weight the gummy residue had suffered by digestion in spirit after being dried and weighed. This gave 2·40 per cent. of sugar. The gummy residue was then completely incinerated, and gave 0·64 per cent. of soluble salts, which, deducted from the weight of the residue, gives 4·42 per cent. of gum. The total ash of the meal was 0·92 per cent.

This process for separating gum, sugar, and salts, answers very well for such a substance as plantain-meal, and gives good results.

The starch was determined in the usual way by washing a known quantity of the meal in a fine muslin bag, until the washings gave no more colour with tincture of iodine. The method followed for drying the starch is worth notice. It should be collected on a weighed filter, and at first left to dry by simple exposure to the air, in which, after being well dried, it is put in the water bath, and more fully desiccated. If put at once in the water-bath when newly washed, it passes into a pasty mass, out of which it is very difficult to drive the last traces of moisture, but if treated as above, it remains as a powder, and is easily rendered quite dry.

The starch amounted to 71·60 per cent. What was left in the muslin bag, representing cellulose, was also dried and weighed, when it gave 5·99 per cent.

It is perhaps worth noticing that the liquor from which the starch deposited had a very pleasant odour, reminding one of raspberry juice. When a portion of this fluid was boiled, it gave, as might have been expected, flakes of albuminous matter.

The results of the analysis, stated in 100 parts, are as follows:—

Water,	12·33
Starch,	71·60
Gum,	4·42
Sugar,	2·40
Cellulose,	5·99
Plastic constituents, as albumen,	2·01
Oil,	0·50
Soluble Salts,	0·64
	99·89

Total Ash per cent. 0·92.

It would thus appear that plantain meal is to some extent richer in blood-forming principles than arrowroot and such substances. Also, as far as I can ascertain, it contains less water, containing therefore more nutritious matter, bulk for bulk, than these others. And, if we add to their qualities, its agreeable flavour, this substance must be regarded as equalling in nutritious value the most highly prized among the farinaceous aliments, although very much inferior to the meal of wheat or oats.

IV. *Analyses of Three Australian Wines.* By Murray Thomson.

Australia has in many ways proved a fruitful source of rare natural productions. Besides being a vast gold field, it also seems likely to become an extensive vineyard, so that wine may probably be sent home in large quantities. Through the kindness of W. Campbell, Esq., three samples of Australian wine were sent to Professor Wilson, who has kindly permitted me to examine them chemically, and to bring the results before this Society.

These samples of wine were labelled, "Mitaro, 1855;" "Frontignac, 1854;" "Casignan, 1854." The dates, I presume, refer to the vintage. It is to be regretted that the quantities sent (about 6 fluid-ounces each) did not admit of a more extended examination. However, the results of this investigation, carried as far as possible, may not be without interest.

No. 1, *Mitaro.*—This sample in colour resembled port wine, and was pronounced by a connoisseur to be pleasant in taste, but rather sweet, and its bouquet good. It was distinctly acid to test paper, from the presence of a trace of free acetic acid, as was afterwards ascertained.

The amount of alcohol in the wine was first determined, and for this purpose an attempt was made to do so by a process detailed in *Normandy's Commercial Analysis*, page 592, but it was unsuccessful, as there was an undoubted retention of alcohol on the part of a large precipitate, produced by the sub-acetate of lead used in the process. Recourse accordingly was had to distillation, which answers very well if the condensation be good.

Two fluid ounces of the wine in this case were distilled, the distillate measured $1\frac{1}{2}$ fluid ounces, and was of sp. gr. 977 at 69°. This is equivalent to 15 per cent. of alcohol. But as the $1\frac{1}{2}$ oz. corresponds to 2 oz. of wine, that difference had to be allowed for, and the amount of alcohol was thus reduced to 11·30 per cent.

The residue left in the retort was tested for sugar and tartrate of potash in the following manner:—the residue was boiled with some well-washed animal charcoal, but the colour was only partially removed by this; it was, however, decolorized enough to try the bile test for sugar, when that substance was found to be present in the wine in distinct quantity. The remainder of the residue was dried up and burned, and the charred mass treated with dilute hydrochloric acid, when distinct effervescence ensued; therefore a vegetable acid, such as racemic or tartaric acid—most probably the latter—must have been present in the unburnt wine as a tartrate. This carbonate could not have existed in the wine, as that was, as before mentioned, distinctly acid; a condition of matters, I need not remark, incompatible with the existence of a carbonate undecomposed. The acid solution of the charred residue was tested for alkalies; potash only was found. A fresh portion of the wine was evaporated, charred, and acted on by dilute nitric acid; none of the heavy metals were present. Hydrosulphuret of ammonia produced a trifling precipitate, which was proved to be phosphate of lime, and, probably, also of magnesia, as lime and magnesia were both present. Besides these substances, sulphuric acid and chlorine were detected.

Mitaro wine contains 11·30 per cent. of alcohol; also sugar and tartrate of potash in small quantity, and traces of phosphate of lime and magnesia, lime and magnesia in some other form of combination, acetic and sulphuric acids, and chlorine.

No. 2, *Frontignac.*—The colour of this sample was pale brown, like sherry wine; pronounced to be a fine wine, having a fine bouquet, but rather sweet. It also was acid to test paper, and from the same cause.

The analysis of this wine was performed in precisely the same manner as in No. 1; therefore, a mere statement of the results will suffice.

Three fluid ounces of the wine were distilled—2½ oz. came over. Its sp. gr. was 971 @ 60° = 20 per cent.; but the error before alluded to being corrected, gave only 16·00 per cent. of alcohol. The residue in the retort in this wine gave abundant evidence of sugar, even to the extent that the decolorized solution gave crystals of sugar on standing. Tartrate of potash also is present, and likewise tartrate of soda.

Frontignac wine contains 16·00 per cent. of alcohol; also sugar, tartrates of potash, of soda, and traces of lime and magnesia, acetic acid, and chlorine.

No. 3, *Casignan.*—In regard to colour it is, like Mitaro, port coloured; pronounced a good wine, bouquet good, but also rather sweet; acid to test paper, proceeding from the same cause as the others.

Casignan wine contains 18 per cent. of alcohol, and, besides sugar, tartrates of potash and soda, traces of lime, magnesia, and a little of these in combination with phosphoric acid; also traces of acetic, sulphuric acids, and chlorine.

It may be concluded that these wines are pure and good, although not so strong or so full-bodied as the wines supplied from Spain, and the other wine countries. Their poverty in bouquet may be accounted for by their comparative youth, being at most only 3 years old. Their all being *acid* may be explained by the circumstance, that the sample bottles were not tightly closed. But on the whole, these wines are beyond the average of many wines sent to the British markets, both as regards purity and strength. The cultivation of the vine, and the wine manufacture, will no doubt be carried on extensively in Australia.

These analyses were made in Professor Wilson's laboratory, to whom I take this opportunity of returning thanks for his great kindness.

In reference to Mr Thomson's analyses, Mr Charles Lawson, jun., sent a specimen of Australian wine, accompanied by the following note:—

"The accompaning specimen of Australian wine was imported in 1855; the cost, delivered in London, about 9s. 6d. to 10s. per gallon. Supposed to be made originally from Rhine grapes taken out to Australia; but with the view of suiting the British taste by an approximation to dry sherry, it has been highly brandied, and possibly there is also a slight admixture from the White Cape produce. All this, however, was done in the colony. There can be little doubt that Australia can produce good wine. It would be well that it was exported pure, at all events not manufactured with other growths. It is possible that a larger per-centage of brandy must be added to make it stand the voyage."

V. *On the Injurious Effects of* Uroceras gigas *on Fir Trees.* By Alexander Thomson, Esq., Banchory.

The author stated that last summer his forester had observed a Scotch fir tree about thirty-five years old die very suddenly. The tree was cut down and taken to the saw-mill. During the preparation of the wood a large fly was observed in a burrow in the wood. Subsequently another fly, a grub, and the remains of a cocoon were seen. The insect was examined, and found to be the *Uroceras gigas*. It has been rarely noticed in Scotland. It appears, however, that in Germany it often causes great destruction in the forests. If there be any appearance of the insect spreading in this country, it would be well to draw further attention to it, so that every tree showing symptoms of it might be destroyed. This is the only remedy found of use in Germany, where they say hundreds of acres have been sacrificed on one estate after another, with the view of checking its progress. Specimens of the timber and of the insect were exhibited, along with a piece of foreign timber containing a grub of a similar nature.

VI. *On the Occurrence of the Seeds of Bearded Darnel in Inferior Samples of Wheat.* By George S. Lawson.

VII. *Notes on* Pinus cephalonica, *and other Coniferæ, at Craigo House, Montrose.* By P. S. Robertson, Golden Acres Nursery.

Mr Robertson read a notice of a large number of plants of *Pinus cephalonica*, which are growing at Craigo House, about three miles from the sea, on dry sandy soil which overlies soft freestone rock, and in the vicinity of limestone. The trees had all been raised from seed by the late Thomas Carnegie, Esq., and planted by him about eighteen years ago. They appeared to be in perfect health, making growths of 12 to 15 inches each year; a good many having now attained to 12 and 15 feet in height. In the same pinetum are good plants of *Pinus nobilis*, *P. grandis*, and *P. Nordmanniana* from 7 to 10 feet in height; *P. Menziesii*, 36 feet;

variegated Norway spruce, 27 feet; and *Araucaria imbricata*, 22 feet in height; all of which are thriving well. In the same collection, a large number of nearly all the more recently introduced conifers have been planted, but they have not been sufficiently tested to be fully reported on as to their ultimate success. Meanwhile, they promise well, and the collection is a most valuable one, as showing what species of conifers thrive on the east coast, and at a low elevation.

VIII. *Remarks on the Effects of Lightning upon Larch Trees.* By John Lowe, M.D.

During the violent storm which occurred on the 7th August last, a larch tree, standing in a field at the west end of the village of Fortingal, was struck by lightning. Commencing about a yard from the summit, the electric fluid passed in a spiral direction down the trunk, making five and a-half coils in its descent, and peeling off the bark to the breadth of five or six inches. Half-way down the tree the current appears to have been divided by an intervening branch, and from this point the spiral coil is double, diverging as it nears the base, where one of the currents has passed into the earth to the west and the other to the east side after having thrown down a portion of stone wall which opposed its progress. At the point of entrance of this current the earth was torn up, and a large opening left. Another larch, about a mile to the east of Fortingal, was struck in a similar manner, and on the same evening. The cause of these not having been splintered, as is commonly the case with other trees, is probably owing to their tapering form being better adapted for conducting the fluid, without affording any direct points of opposition to its course. The large size of the branches in other trees, and the acute angles which they form with the stem, is an obvious cause of their being more frequently splintered. The direction of the currents in the present instance was most likely caused by the spiral course of the woody fibre, which is well seen in the fir, and especially when grown in open situations.

12th February 1857.—Professor BALFOUR, V.P. in the Chair.

The following Candidates were balloted for and duly elected:—

As Ordinary Resident Fellows.

CECIL A. FERNANDO, Esq., 13 Gayfield Square.
GEORGE M. REID, Esq., M.D., Edinburgh.
JOHN MONTGOMERIE BELL, Esq., East Morningside House.
JOHN DE LA CONDAMINE, Esq., 28 Broughton Place.

As Non-Resident Fellow.

Dr JAMES ALLAN, 52 Hanover Street, Sheffield.

The following donations were announced to the Society's Library and Herbarium:—

Allgemeinen Schweizerischen Gesellschaft für der Naturwissenschaften: Verhandlungen, Jahrg, 1854.—Mittheilungen, Nos. 314-359—From the Society.

Actes de la Société Helvetique des Sciences Naturelles, 1855—From the Society.

Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg, vol. 3me.—From the Society.

A collection of Arctic Plants—From Dr Dickson of Jersey.

A parcel of British duplicates, chiefly desiderata—From Mr A. G. More, Isle of Wight.

Dr Balfour stated that there had been added to the University Herbarium Dr Harvey's collection of Australian Algæ, consisting of 533 specimens.

Dr Balfour also mentioned that the following donations had been made to the Museum at the Botanic Garden:—

From the Oregon Association—Cones of *Pinus Murrayana*, *P. Monticola*, *P. Benthamiana*, *Picea nobilis*, and *Abies grandis*.

Andrew Murray, Esq.—Specimens of the following Coniferæ: *Pinus insignis*, *P. radiata*, *P. Fremontii*, *Abies bracteata*, *Cupressus macrocarpa*, and *C. Lambertiana*.

Messrs Lawson & Son—Specimens of wheat, oats, barley, rye, &c.

Sir H. Dalrymple, Bart.—Cone of *Picea nobilis*, ripened at North Berwick House in 1856.

J. F. Ziervogel, Esq.—Spoon made of wood by the Caffres.

L. P. Capewell, Esq., Ballarat, Australia—A species of *Polyporus* growing on the branches of *Eucalyptus*, usually called Punk; another specimen of *Polyporus*, growing on the large trunks of *Eucalyptus robusta*.

W. Jameson, Esq., Saharunpore, per Professor Christison—Bdellium, the produce of *Amyris Agallocha.*

W. Gorrie, Esq., Prestonhall—Canadian or Swamp Rice of America, *Zizania aquatica ;* along with Ergot produced on it.

D. P. Maclagan, Esq.—Specimens of Peccau nuts, the produce of *Carya olivæformis.*

The following papers were read :—

I. *Notes of a Botanical Excursion to Switzerland and other parts of the Continent during last summer.* By Robert M. Stark.

II. *List of Plants observed in the neighbourhood of Blackford, Perthshire.* By Alexander Buchan.

After detailing the physical peculiarities of the district, embracing a circuit of four miles around Blackford, Mr Buchan gave a full list of the plants which he had observed, including *Trollius europæus, Corydalis claviculata, Viola palustris, Silene maritima, Radiola Millegrana, Genista anglica, Spiræa salicifolia, Rubus saxatilis, Epilobium angustifolium* and *alsinifolium, Circæa lutetiana* and *alpina, Montia fontana, Sedum anglicum, Saxifraga stellaris, oppositifolia,* and *hypnoides, Meum athamanticum, Thrincia hirta, Utricularia minor, Listera Nidus-Avis, Poa Balfourii, Hymenophyllum Wilsoni,* and other interesting plants.

III. *Notice of the Plants of Mount Olympus.* By Dr John Kirk. *With an account of the Ascent of the Mountain, and Observations on the Country near Broussa.* By Dr David Christison.

Dr Christison observed :—" Mount Olympus of Asia Minor, although fully seventy miles from Constantinople, is a very constant object in the landscape,—thanks to the clear Eastern atmosphere—and forms the boundary of the magnificent view from that city towards the south. From Constantinople it presents the appearance of a long ridge, without any great variety of outline ; and probably all the year round shows a considerable quantity of snow, although travellers who talk of its summits clothed in perpetual snow must not be understood literally, as our party ascended to the top without ever treading on snow unless from choice; and this in the end of June, before the greatest summer heat had commenced. The altitude of the mountain, moreover, does not bring it within the limit of perpetual snow. This is stated variously in different maps; but, according to Marshal Marmont, by the temperature of boiling water it is nearly 7400 feet."

Dr Christison and his party went by steam from Stamboul to Mandanich, situated on the south side of the Gulf of Gimleck. Thence they proceeded to Broussa, passing through a fertile valley with vineyards and mulberry plantations, and well wooded, chiefly with olives. They then ascended a hill, where a fine view was obtained, and finally descended to the plain of Broussa, at which place they took up their quarters. Dr Christison observed, "that nothing could be more beautiful than the situation of Broussa. Mount Olympus, the Keshish Dagh or Holy Mountain of the Turks, here descends by a long steep uniform slope directly on the plain, much in the fashion of the south side of our own Ochils, though on a far grander scale. At the very foot of this the city extends for two and a-half or three miles, with a varying breadth of from that of a single street to perhaps half a mile. In front of it is a belt of vineyards, mulberries, and fields interspersed with trees, among which sycamores, chesnuts, figs, walnuts, and olives are most common. This belt is a mile or more in width, and then comes the plain proper, which is quite open, beautifully green at this season (June), with groups of trees, having much the appearance of an English park. Finally, the plain is bounded by the fine range of hills separating it from the sea. A plateau of travestine, elevated about one hundred feet, projects from the flank of Olympus over the town, and is ornamented with mosques and villas, under the extensive ruins of old fortifications. The luxuriance of vegetation, the fresh greenness of the foliage, and the noise and sight of running water in every part of the city, make it a delightful contrast to the dry parched aspect of Constantinople and its surrounding country, which, with the exception of the immediate shores of the Bosphorus, and a few valleys leading to it, is about the dullest and most forbidding country I have seen. Unfortunately, this beautiful city has been nearly ruined by an earthquake; and, considering the indolence of the Turks, it may be doubted if it will ever recover. During February and March shocks occurred almost daily; and, indeed, at the period of our visit in June, they had not ceased, as we felt two very distinct shocks one night when we had lain down to sleep on Mount Olympus. Each was preceded by a dull rumbling noise like that of a railway train crossing a wooden bridge at some distance, immediately followed by a sharp shake; the sound and the shake only lasting a few seconds."

Dr Christison describes the ascent of Olympus, or the Keshish Dagh:—"The ascent of the Keshish Dagh presents no difficulty, and may be accomplished from Broussa on horseback, or even on foot by a first-rate pedestrian, in one long day. The first part of the ascent consists in climbing by a zig-zag path the steep slope towards the plain, by which I should think three thousand feet of elevation are gained. The path now strikes upon a long narrow valley that cuts into the mountain for about six miles, nearly in a straight line. Its sides slope very steeply and uniformly, and are completely clothed with trees of considerable size. So steep are the sides, that clambering down them would be a work of great difficulty, if not danger. The perfect silence of this wooded valley was almost oppressive. When we got to the head of this valley we had to surmount a very steep hill-face covered with pine trees, for we had gained much additional elevation during our ride up the valley, and pines were the only trees now met with. Our wretched-looking horses scrambled up this part in the most wonderful manner, and we soon found ourselves on an extensive plateau at a height of perhaps between 5000 and 6000 feet, covered with fine pasture, and bounded on the south by an extensive pine forest. We proceeded at a brisker pace for two or three miles across this plain, and then came to a shallow but rough and rocky valley, where we bivouacked for the night, at the edge of the forest. In the morning the ground was white with hoar-frost, and we felt rather cold, which was a new sensation, but the sun was very powerful even at eight A.M., when, after crossing a low intervening hill to another valley, we left our horses and commenced the ascent on foot."

The party finally reached the summit of the mountain, and had a fine view of the country around, although the distant landscape was concealed by the mists which were gathering on the heights around. The party descended to Broussa by the same route.

Dr Kirk's list of plants gathered on Olympus showed the different heights at which the various species occur. He observed:—"In the plain of Broussa and on the slopes of the coast range of hills, the vine and olive are extensively cultivated. The white mulberry is grown all throughout the plain for the silk-worm. The peach and cherry are grown in gardens, as well as the Bamia (*Abelmoschus esculentus*), and the Aubergine (*Solanum ovigerum*), the water and sugar melon. The trees are intertwined with the wild vine, and, wherever moisture is abundant, vegetation is most luxuriant."

Dr Kirk divided the mountain into three zones, each of which presented certain peculiarities in vegetation, as illustrated by his specimens, which were as follow:—1. Plants from Broussa and the first part of Olympus. 2. The zone of forests of chesnut, silver fir, and *Pinus Pinaster*, hung with *Viscum album* and lichens, the open ground furnishing hazel, Campanulas, Althæas, and Cistuses. 3. The region of the middle plateau, mostly free of wood, and rocky. Verbascums are frequent, and grow socially. The ground is generally moist. The juniper grows abundantly. 4. The slope of the highest peak and summit plateau consisting of loose stones, the ascent being steep.

12th March 1857.—Professor BALFOUR, V.P., in the Chair.

The following donations were announced to the Society's Library and Herbarium, viz.:—

British Plants—From Mr Waddell, Cumbernauld.

Proceedings of the Boston Society of Natural History—From the Society.

Proceedings of the Academy of Natural Sciences, Philadelphia, and Notice of the Origin, Progress, and present Condition of that Academy.—From the Academy.

The following donations were announced to the Museum at the Botanic Garden:—

From Miss Ellan Rate, Lampock Wells, Tranent—Skeleton Leaves of Magnolia, Ivy, Willow, Poplar, &c., in Frame with Glass.

From Mrs R. W. Hamilton—*Racodium cellare*, found growing on Corks of Wine Bottles in a Cellar.

From Miss Brodie, 4 Duncan Street—Specimens of *Helipterum eximium*.

From Mr Cousin—Specimens of Dry Rot in Wood.

From R. Dundas Cay, Esq., Lauriston Lodge—Two pieces of Pith of the Rice-paper plant, *Aralia papyrifera*.

The following papers were read:—

I. *Notice of a Botanical Trip to Moffat in August* 1856. By Professor Balfour.

On the 18th July 1856, a party of about forty met at the Caledonian Railway Station at 5 P.M. and proceeded to Beattock, which they reached about $8\frac{1}{2}$ P.M. They were met by the Rev. Mr Little, Kirkpatrick-juxta, who had kindly made arrangements for their excursion. The party then walked to Moffat, passing the "Three Stannin Stanes," which are said to commemorate a battle, and took up their quarters in the Annandale Arms Inn.

Messrs Fraser, Hope, and Maingay, who had been botanizing in the neighbourhood for several days, exhibited some of the results of their trip.

Moffat is situated at the upper part of Annandale in Dumfriesshire, and is about 370 feet above the level of the sea. An excellent guide to it and its neighbourhood has been compiled by Mr Keddie.

On the 19th July, after an early breakfast, the party proceeded by omnibus and carriages along the banks of the Moffat water for 10 miles. Thence they continued their excursion on foot, and visited, in the first place, the famous waterfall called the "Grey Mare's Tail." A convenient road has been cut along the sides of the hill, approaching within a few yards of the fall. From this a striking view is obtained of the foaming cauldron which receives the water, and of the black savage steep over which it bounds, with two or three partial breaks, by a leap of about 300 feet.

From the water descending in a thin waving sheet of shining spray, the wild mountain cataract has received its name. The waters of the fall come from Loch Skene. On the rocks in the vicinity the party gathered *Oxyria reniformis*, *Hymenophyllum Wilsoni*, *Saxifraga oppositifolia*, *Epilobium alpinum*, *Allosorus crispus*, *Thalictrum minus*, and *Festuca ovina vivipara*. The rocks here, and in the mountains around, belong to the Greywacke or Lower Silurian group.

Under the guidance of a shepherd provided by the Rev. Mr Little from Mr R. Johnston of Polmoodie, the party then walked to Dob's Linn, where a mountain torrent tumbles over the rocks in a succession of rushing falls. Along with the Greywacke there are here strata of dark shale and anthracite, the former being very crumbling, and containing graptolites. There is a cave on the rocky sides of Dob's Linn, in which it is said the Covenanters often found a hiding place. The precipice is about 300 feet high. On the way to the Linn, *Saxifraga stellaris* and *Sedum villosum* were gathered. On rocks near the Linn, *Saxifraga hypnoides* and *Botrychium Lunaria* were seen.

The next point of interest was Loch Skene, which was reached after a scramble up the rocks at the Linn, and a toilsome walk through moss haggs and black morass, which only supplied a few common plants along with *Rubus Chamæmorus* and the alpine form of *Melampyrum pratense*.

Loch Skene is a very desolate tarn, situated about 1000 feet above the level of the sea, three-fourths of a mile in length, and one-fourth of a mile in breadth. In it we looked for *Isoetes lacustris* which is said to grow there, but we only got *Littorella lacustris*, which very probably had been mistaken for *Isoetes*.

The water of the loch rushes through a rocky barrier at the lower part, forming a brook which flows rapidly down to the ravine over which it falls to join the Moffat Water.

Sir Walter Scott, in Marmion, in alluding to Loch Skene and the scenery in the vicinity, says :—

"Where deep, deep down, and far within,
Toils with the rocks the roaring Linn;
Then issuing forth in foaming wave,
And wheeling round the giant's grave,
White as the snowy charger's tail,
Drives down the pass of Moffat dale."

The rocks around Loch Skene were said to furnish *Woodsia ilvensis*, but I fear it has disappeared from this locality as well as from the station called the Beef Tub. Mr Sadler, who started very early in the morning and examined all the rocks, as well as Messrs Fraser and Hope, failed to find a specimen of the fern.

Leaving Loch Skene, the ascent of Whitcoom was next undertaken. This is said to be the highest hill in the south of Scotland, rising to a height of nearly 2700 feet. This was the best botanical ground visited by the party. The following were among the species gathered:—*Salix herbacea*, *Salix Lapponum*, *S. Myrsinites*, *Saussurea alpina*, *Saxifraga stellaris*, *Allosorus crispus*, *Epilobium angustifolium*, *E. alpinum*, *Carex rigida*, *C. pilulifera*, *Oxyria reniformis*, *Thalictrum alpinum*, *Sedum Rhodiola*, and some alpine *Hieracia.*

From the summit of the hill a grand view of the surrounding country was obtained, more particularly in the direction of the Solway and the hills of Cumberland.

From the mountain, under the direction of Messrs Carruthers, the party proceeded along the neighbouring hills, and ascended Hartfell, which rises to the height of 2635 feet, and commands an extensive view. This hill journey was not a little fatiguing, and tried the ardour and perseverance of the party. Some preferred to take an easy descent by one of the glens, so as to reach the road along Moffat Water. This was so far fortunate, for by doing so, Mr Macfarlan was enabled to gather *Woodsia ilvensis* in considerable quantity in a new station.

In the Hartfell group of mountains arise the Annan, the Tweed, and the Clyde. Hence the old Scottish rhyme:—

> "Annan, Tweed, and Clyde,
> Rise a' out o' ae hillside.
> Tweed ran, Annan wan,
> Clyde fell and brack its neck ow'r Corra Linn."

There were no additional plants gathered of particular interest on this hill. In general these round-backed Greywacke hills are not productive, and the only spots where good plants are obtained are on the moist rocks and ravines a little below the summit.

Leaving the summit of Hartfell, the party passed by the top of the ravine in which the Hartfell spa—a chalybeate spring—is situated, and then descended by the well-burn to the famous sulphuretted mineral well, reaching Moffat after a fatiguing day's work about 5 P.M. From Moffat the party returned by the train passing Beattock at 6·40 P.M., and reached Edinburgh at 8·30.

II. *On an Abnormal Development of the Nectary in* Ranunculus. By A. J. Macfarlan.

The author observed:—"I have taken the liberty of bringing this abnormal development of the nectary in Ranunculus under the notice of the Society, in the hope that it may not be uninteresting, as illustrating to some extent one view of the formation of the tubular petals of some of the Ranunculaceæ; and also, the metamorphosis by which the fringed glandular scales of *Parnassia palustris* are produced. The petal was more elongated than usual, and became narrowed towards the base, so as to have the appearance of being stalked. The nectary was similar in shape, though not quite so large, and seemed to have been developed in size at the expense of the petal, which was smaller than the others, they being all normal. In examining the connection between the nectary and petal, considerable difficulty was experienced, owing to the time the specimen had been kept (since last summer), and its consequent softness; and here I must express my regret that not having originally intended to give a notice of the abnormality, I did not examine it in the fresh state with the same care I would otherwise have done. The petal and nectary seemed to be connected throughout all the narrow portion, though whether or not they formed a tube I could not distinctly ascertain. This is unfortunate, for if it could have been positively stated that a tube was formed, the change from the petal as we find it in Ranunculus to the state in which it is in many of the other genera would have been explained at once to be dependent upon changes in the nectary. But although this cannot be positively stated to have been the case, it seems at least as good a method of accounting for the change in the petals to suppose that the tube is formed by a nectary being enlarged, as in the present case, and its edges united to those of the petal, as that the petal should fold upon itself, and its edges become united. We have also, by this theory, a good explanation of what becomes of the nectary, for we may surely expect to find it in some shape or another in plants nearly allied to the Ranunculus.

"In reference to *Parnassia palustris*, each fringed glandular scale has a very considerable resemblance to the enlarged nectary, not only in position of attachment to its petal, but also in shape, with this difference, that, while the one is lobed to so great an extent as to become fringed, the other is only slightly lobed. This abnormality, therefore, seems to support the view that the scales are enlarged nectaries, which would be a sufficient reason for not finding them alternating with the petals as we might expect them to do were they either an inner row of petals modified, or an altered state of the stamens."

III. *Notice of the occurrence of* Chara syncarpa *in Scotland.* By W. Nichol, M.D.

Dr Nichol observed :—" In August 1856, when crossing, by Glen Turrit, the hills which separate Crieff from Loch Tay, I observed some specimens of Chara growing in Loch Turrit which seemed to differ from *Chara flexilis.* The same form occurred pretty abundantly also in Loch-na-Ghat, on Ben Lawers, at an elevation of nearly 2000 feet. These, on examination, seemed to be *Chara syncarpa;* and in this I have been confirmed by Mr Babington, to whom specimens from both localities were sent."

IV. *Remarks on Boucherie's Method of Preserving Timber.* By Professor Balfour.

Dr Balfour gave a short account of the various modes adopted for preserving of timber, and then proceeded to notice the method proposed by Boucherie about fifteen or twenty years ago, and which has since been improved. He referred particularly to the use of a solution of sulphate of copper, in the proportion of 1 lb. of the sulphate to 100 of water, as a preservative. He detailed the plan adopted by the Permanent Way Company, and illustrated the method by drawings. He pointed out the importance of removing fermentescible sap from recent wood, and substituting a substance not liable to undergo chemical changes ; and he dwelt on the importance of having timber well seasoned and exposed to a current of air when employed in building. The results of the trials made of Boucherie's plan in France were given, and the report of the commission appointed to examine the subject. The conclusions drawn from these data were favourable to the employment of sulphate of copper for the prevention of decay in timber.

The author concluded by exhibiting a piece of wood affected with dry rot, and reading the following letter from Mr Cousin, the city architect, regarding it :—

" The specimen of dry rot affords a rather striking example of that disease. The timber was new and of good quality, and had not been fixed in its place more than twenty months before the rot had committed the ravages which you see. It was in a floor of a shop in Princes Street, and the rot commenced at the top ; indeed, the *floor-boarding* was the first part infected, and the disease gradually crept downwards.

" The deafening in this case consisted of dry furnace ashes, covered with a coating of lime, the whole depth being about 2½ inches.

" The timber was all new when put into its place, and although it had got the ordinary amount of exposure to the air, or ' seasoning,' as it is called, the natural sap could not be entirely dried up.

" Now, all this is just what happens in every new building, without exception, and therefore dry rot must be explained as arising from some other cause.

" In my humble opinion, it arose from the following cause :—So soon as the premises were finished, the first thing the tenant of the shop did was to cover the entire surface of the floor, except under the counters and side cases, with " Kamptulicon," as it is called, or a kind of floor-cloth, composed principally of India-rubber, and forming a perfectly *air-tight* and compact body.

" The floor-boarding speedily showed indications of rot, by yielding under the foot on passing over it ; and on the floor-cloth being removed, the boards were found to be covered over with a white fungus, and completely decayed.

"The portions of the deals under the counters and along the side walls, were not decayed to the same extent, though to some degree."

V. *Recent Botanical Intelligence.* By Professor BALFOUR.

Dr Balfour read a letter from Mr L. P. Capewell, Ballarat, Victoria, accompanying specimens of *Stemonites fasciculata*, Pers., on a Eucalyptus. Mr Capewell had also sent a gathering of Diatomaceæ, which was examined by Dr Greville, who observes:—"Mr Capewell's gathering is a very interesting one, not as containing anything new, but because every form in it is British. It is quite a nest of Epithemiæ; the predominant form is *E. gibba;* then come *E. turgida*, *Westermanni*, and *ventricosa*. The remaining form is *Diatomella Balfouriana*, only recently discovered and described in this country. How strange that it should next be found at the antipodes, in company, too, with a colony of British species!"

Dr Balfour stated that his friend, Professor Smyth, who had lately visited Teneriffe, had occasion to examine the famous Dragon tree (*Dracæna Draco*) of the Canaries, a drawing of which is given in Humboldt's large work. The drawing in that work does not give a correct representation of the form and size of the tree. Dr Balfour explained, on a large drawing, the errors which had been committed by Humboldt's artist.

Dr Balfour then gave a *resumé* of Cohn's researches on the reproduction of *Spheroplea annulina* and of Pringsheim's on *Œdogonium ciliatum.* Dr Balfour also referred to Dr Hilgard's explanation of the law of phyllotaxis, which he refers to the numerical genesis of cells.—(*Edin. Phil. Jour.*, v. 375–6.)

Dr Balfour exhibited a specimen of *Sycomorus antiquorum,* presented by Mr G. S. Lawson, and taken from the famous Sycomore near Heliopolis. He also stated that the peculiar partitioned wood presented to the Museum some time ago by Mr Daw, appeared to be the produce of *Cecropia peltata.* Principal Dawson, of M'Gill College, Montreal, was disposed to think that it threw light on the structure of Sternbergia.

VI. *Register of the Flowering of certain Plants in the Royal Botanic Garden, from 1st February till 12th March 1857, compared with the five previous years.* By JAMES M'NAB.

Name.	1857.	1856.	1855.	1854.	1853.	1852.
Rhododendron atrovirens	Feb. 6	Feb. 16	Apr. 6	Feb. 18	Feb. 1	Jan. 14
Erica herbacea............	— 6	— 15	Mar. 5	— 20	Jan. 28	— 24
Galanthus nivalis	— 8	— 14	— 2	Jan. 24	— 24	— 28
Eranthis hyemalis	— 9	— 14	— 2	— 26	Feb. 1	— 31
Garrya elliptica............	— 9	— 18				
Hepatica triloba, varieties	— 13	— 16	— 7	— 20	— 2	— 30
Arabis albida................	— 13	— 24	Apr. 8	Feb. 15	Mar. 15	Feb. 18
Sisyrinchium grandiflorum	— 14	— 26	Mar. 5	— 14	— 3	— 3
Crocus Susianus............	— 15	— 18	— 5	— 14	— 8	— 3
Corylus Avellana............	— 16	— 15	— 21	Mar. 10	— 9	Jan. 25
Rhododendron Nobleanum	— 18	Mar. 16	Apr. 13	— 2	— 22	— 28
Crocus vernus varieties....	— 19	Feb. 24	— 6	Feb. 4	— 15	Feb. 18
Tussilago alba...............	— 20	— 24	Mar. 15	— 14	— 1	— 27
Daphne Mezereum	— 23	— 19	Apr. 6	— 18	Feb. 1	Jan. 21
Leucojum vernum	— 24	Mar. 1	Mar. 3	— 15	Mar. 21	Feb. 21
Aubretia grandiflora	— 26	— 1	Apr. 8	— 17	Feb. 1	Mar. 18
Nordmannia cordifolia ...	— 27	— 8	— 9	Mar. 1	Mar. 24	— 10
Doronicum caucasicum...	— 27	— 24	— 11	— 11	— 26	— 16
Symplocarpus fœtidus.....	— 28	Feb. 26	Mar. 20	— 3	— 16	— 20
Tussilago nivea............	— 28	Mar. 18	Apr. 14	— 18	Apr. 1	Feb. 27
Symphytum caucasicum..	Mar. 3	— 12	— 10	— 11	Mar. 26	— 2
Pulmonaria angustifolia...	— 8	— 11	20 20	— 19	— 20	Mar. 1

Mr M'Nab also presented the following list of Plants observed in flower in the Botanic Garden, Belfast:—*Helleborus lividus* and *Helleborus olympicus*, Dec. 24, 1856; *Erica herbacea*, Jan. 4, 1857; *Galanthus nivalis*, Jan. 12, 1857; *Hepatica triloba*, varieties, and *Helleborus fœtidus*, Jan. 15, 1857; *Primula vulgaris* and *Bellis perennis*, Jan. 16, 1857; *Daphne Mezereum*, Jan. 25, 1857; *Eranthis hyemalis*, Feb. 6, 1857; *Leucojum vernum* and *Erica mediterranea*, Feb. 10, 1857; *Anemone coronaria*, Feb. 6, 1857; *Corylus laciniata*, Feb. 26, 1857; *Salix Caprea*, Feb. 27, 1857; *Sisyrinchium grandiflorum*, Feb. 28, 1857; *Ribes augusta* and *Arabis saxatilis*, March 1, 1857; *Ribes sanguineum* and *Narcissus Puesdo-Narcissus*, March 6, 1857.

9th April 1857.—Professor BALFOUR, V.P., in the Chair.

The following Candidates were balloted for and duly elected:—

As Ordinary Resident Fellows.

1. WILLIAM JOHNSTON, Esq., 28 Pitt Street.
2. ROBERT MACLAGAN, Esq., 28 Heriot Row.
3. Dr JAMES HECTOR, 57 Inverleith Row.
4. FRANCIS T. BOND, B.A., M.R.C.S., 27 Drummond Place.
5. JAMES S. BEVERIDGE, Esq., 49 Albany Street.

Professor Balfour stated that the following donations had been made to the Musuem at the Botanic Garden:—

From Mrs Allardyce, Cromarty—Beautiful Specimens of Plants cut out of paper by a pair of small scissors, the venation of the leaves being put in by the points of the scissors.

From Professor Christison—Fruit of *Bassia Parkii* from the Niger (Dr Baikie's expedition).

From Wm. T. Y. Smith, Esq.—Collection of Fossil Plants from the neighbourhood of Barnsley, Yorkshire, including specimens of *Ferns, Lepidodendrons, Calamites, Stigmaria, Sigillaria,* &c.

From Alex. Beattie, Esq.—Specimens of Green Wood from Tunbridge Wells used for making some kinds of Tunbridge ware; the colour being due to the action of a fungus called *Peziza æruginosa.*

Mr I. Anderson, S.S.C., exhibited a plant of a hybrid Rhododendron, between *R. atrovirens* and *R. formosum,* which was stated to be quite hardy, being chiefly remarkable for its large blossoms, which were triple the size of the seed-bearer (*R. atrovirens*).

The following papers were read :—

I. *On the Effects of a Solution of Bicarbonate of Ammonia in promoting Vegetation.* By C. J. Burnett.

The author stated that the carbonate of ammonia had been recommended, as existing in the refuse liquor of gas-works, on account of the comparative cheapness of the ammonia in this form ; but that he was inclined to recommend the carbonates of ammonia also on other very important grounds, that the compound of ammonia with carbonic acid was the most natural of all the ammonia manures, and that, in converting it into the sulphate and other salts commonly sold for manure, we drive off a most important element of plant food, of much more universal value than the sulphuric or other acid by which it was replaced. For healthy growth, a proper proportion of carbon should accompany the nitrogen added ; and we should not attempt to dissever those substances which nature had shown such an evident desire to associate in their application to plants. Instead of driving off the carbonic acid, he would recommend adding more of it, so as to convert the mono-carbonate, or mixture of carbonates, into a more fixed and more nutritious bicarbonate. Till a cheap form of bicarbonate, corresponding to the other agricultural salts, should be in the market, a solution of the proper nature might be easily and conveniently made by any one, by saturating with carbonic acid, evolved from muriatic acid and chalk or limestone, a solution of the common carbonate, or perhaps the common gas liquor. The manufacture was one which any farmer or gardener could readily carry on with two barrels and a bent piece of lead tube, and the solution might be carried to the field in barrels, and applied by a rose or pierced tube. The solution should be very dilute when applied. To make more clear the particular object for which he now recommended the use of this manure, he would say a word or two on the different natures and applications of manures in general. They might be divided into two classes. 1*st*, Manures which afforded ingredients of plant food which could be supplied by the soil alone. 2*d*, Manures which supplied ingredients which were also contained in the air. As to the first class, whether (as in the majority of instances) required during the whole period of plant growth, or merely in its later stages (as phosphate in case of corn crops, &c.), they should be added in a quantity sufficient for one crop at least, and in a sparingly or gradually soluble form, to prevent serious loss from their being washed down out of reach of the roots. As to the second class, however, the case was very different indeed. Though the carbon and nitrogen which they supplied were essential elements of plant food at every stage, yet, as it was only in the earliest stages that the earth was their only source, and, as it was manifestly bad economy to pay money for what you could have for nothing, the use of manure of this class should be principally confined to the plant in the earliest stages of growth, and then made with the view of giving the plant such a start as would enable it to draw, at an earlier period than it otherwise would, on the unlimited and untaxed supplies of carbon and nitrogen which our atmosphere provides. He could not doubt that one pound of nitrogen and carbon applied at the critical period so as to lift the plant expeditiously out of helpless infancy and entire dependence on mother earth into comparative independence, drawing still gratefully on earth for what she alone could supply, but able to forage for much in free air, would, at the seasons when harvest arrived, be found to have produced a much larger addition to our crop than the same pound protractedly doled out as a supplementary supply during the entire period of growth by the decay of organic matters in the soil. He would recommend the application of the bicarbonated ammoniacal solution to the young crop to be made during what the farmer most expressively terms "growing weather," when the ground is moist enough to ensure its immediate penetration, and there is sufficient warmth and geniality in both air and earth. The author stated that he had made numerous and varied experiments with the bicarbonate during the last five or six years, on wheat, oats, peas, &c., as well as roses, lupins, sweet peas, and many other garden plants; and that their results, along with the theoretical considerations alluded to, justified him in recommending the bicarbonated ammonia solution, as deserving of a thorough trial both by farmers and gardeners.

II. *Does Magnetism Influence Vegetation?* By H. F. BAXTER. Communicated by Professor BALFOUR.

The author states that the results of his inquiry into this subject are negative, that is, no positive evidence has been obtained to show that magnetism either does or does not influence vegetation. After noticing the opinions of Becquerel, Dutrochet, and Wartmann, the author says:—"As it may be considered a law in vegetable physiology that all plants have a tendency, during the germination of their seeds, to develope in two diametrically opposite directions (the root and the stem), the question arose—might not this direction be influenced or counteracted by submitting the seeds, whilst germinating, to the influence of magnetic force." Accordingly, a series of experiments were undertaken by the author, which are classed under two principal heads: 1*st*, Those in which the line of magnetic force was directed *perpendicularly* to the plants; and 2*d*, in which the line of force was directed *transversely* to the plant. The author gave details of the experiments, which were varied and multiplied. No definite conclusions, however, could be drawn from them relative to the effect of magnetism.

III. *On* Lycium mediterraneum. By Dr THOMAS ANDERSON, H.E.I.C.S. Communicated by Professor BALFOUR.

Dr Anderson states that, after careful and repeated examination of specimens of *L. Edgeworthii*, Dunal, he is convinced that Dunal's so-called species is only a variety of *L. mediterraneum* (*L. europæum*, Linn.) Dr Anderson then gave revised characters for the species, and concluded with observations on the effects of the climate of India in modifying the habits of plants, and giving rise to numerous varieties.

IV. *On the Application of Botany to Ornamental Art.* By George Lawson, Ph. D.

The author of this paper exhibited a panel carved by Mr B. Reeve, representing in its side ornaments *Polypodium alpestre* and *Polystichum Lonchitis.* In connection with this study from nature, he called attention to the inexhaustible source of novelty in design which the vegetable kingdom presents, and which he hoped would be made more fully available than hitherto; for, although "flowers have in all ages been used by the aspiring ornamentist, and have ever been the basis on which the science of ornament has stood," much still remains to be done. The papyrus and the lotus, in their numerous combinations, were the chief subjects of Egyptian ornament; the acanthus leaf formed a pattern for the capital of the Corinthian pillar; the *Fleur-de-lis* is also an ornament which has stood the test of time. Even in our own day novelties are occasionally introduced by enterprising designers; still how easy would it be to catalogue all the vegetable forms that have actually been referred to in design! Of the ninety-three thousand living plants (not to speak of dead species), how few have actually come into general use for this purpose! Dr Lawson stated that in a lecture lately delivered to the Royal College of Surgeons, Professor Balfour had pointed out the wonderful symmetry that prevails throughout the vegetable kingdom, both in the minute tissues and in the compound organs of plants. Professor M'Cosh and Professor Dickie have illustrated the laws of form, and the relations of colour to form in plants; Dr Lindley, and, more recently, Mr Dresser, have done much to elucidate this very subject of the relations of botany to ornamental art; and with such aids, the wall of separation that has so long existed between the botanist and the ornamentist will surely be speedily broken down. Dr Lawson then referred to some of the artistic authors who had been instrumental in drawing attention to this subject, alluding particularly to Pugin's "Floriated Ornament," and to various writers in the *Builder*, *Art Journal*, &c. He proceeded—It is to be kept in view, when the artist is recommended to study nature under the light of science, that this does not *necessitate* a naturalistic treatment of his subject. Attention to botany is even more essential to him who would create a design by the conventional treatment of natural forms, than it is to the naturalistic designer. It is what anatomy is to the painter of the human figure. It enables him to modify his leaves and flowers according to the requirements of his design, without overstepping the boundaries of truth, and originating a caricature, instead of adapting nature to his special purpose. It is a common error to suppose that the artist has merely to take natural forms as his starting point, and give these a geometrical disposition, modifying them according to his taste. Truth to nature is necessary in all decorations intended for an educated eye, and especially so in an age of science. And the beautiful laws of form, and of colour, of number, and of arrangement of parts, that prevail throughout the vegetable kingdom, are necessary to be known by the artist who has high aims. This knowledge loosens him from the trammels that must ever accompany the mere copyist, and gives him a wide range of conventional treatment, while his work assumes the character of an exposition of principles instead of a slavish copy of details.

It is a well-known fact that many of the finest carved works, in both ancient and modern buildings, are *direct* studies from nature; and several modern writers have lately pointed out to designers, that it is to "*natural forms geometrically disposed*," that they must *all* look for new inspirations. "By repeated copying (says Pugin), the spirit of the original work is liable to be lost, so in decoration, the constant reproduction of old patterns, without reference to the natural type from which they were composed, leads to debased forms and spiritless outline, and in the end to a mere caricature of a beautiful original. It is impossible to improve on the works of God, and the natural outlines of leaves and flowers must be more perfect and beautiful than any invention of man." And the same writer observes—"Nature supplied the mediæval artists with all their forms and ideas; the same inexhaustible source is open to us, and if we go to the fountain-head, we shall produce a multitude of beautiful designs treated in the same spirit as the old, but new in form. We have the advantage of many important botanical discoveries which were unknown to our ancestors; and surely it is in accordance with the true principles of art, to avail ourselves of all that is beautiful for the composition of our designs."

Dr Lawson illustrated, by means of drawings, the beautiful designs that may be occasionally produced from the judicious treatment of even the simplest materials, such as the trifoliate leaf. This led to a discussion of the origin of the trefoil as an architectural ornament, which was stated to belong to a very early period, although its extensive use during the Christian era was probably connected with the myth of St Patrick and the Irish shamrock. The differences of opinion that prevailed respecting the species of plants which form the national emblems, were alluded to in detail. Such matters, the author observed, are of little importance in a botanical point of view; but it must be confessed, that when an artist asks such questions as—What plant is the Scotch thistle? or, What is the Irish shamrock? and we cannot tell, it places botany in a humiliating light; and we are not to charge him with wanton neglect if he does not refer to nature in embodying these our national emblems.

V. *Remarks on Dust Showers, with Notice of a Shower of Mud which occurred at Corfu on 21st March* 1857. By GEORGE LAWSON, Ph. D.

Dr Lawson remarked:—The attention of botanists has at different times been attracted to showers of various kinds, most of which have been more or less dependent upon, or connected with, vegetable phenomena. The red snow of the arctic regions, which has been known since the days of Aristotle, owes to botany its proper explanation as not a product of the clouds at all; the appearance being due to a minute Alga that vegetates on the surface of the snow. Showers of pollen are familiar to all travellers who have penetrated far among the coniferous forests of North America. In this case also, although the pollen forms immense clouds of dust, and is often conveyed to considerable distances, becoming in its course intermixed with foreign matters, till it can scarcely be referred to as a "shower," in the meteorological sense of the term, the plants to which it owes its origin being present, and connecting the phenomenon more or less closely with what occurs to a certain extent in all flowering plants. Of a different character are the showers of dust or sand described by Humboldt and by Ehrenberg as occurring near the Cape de Verd Islands, at a distance of several hundred miles from the African coast, where the decks of ships navigating the ocean became covered with it. In this dust many minute organisms, especially Diatomaceæ, have been found. Dr Lawson then noticed a shower of mud that occurred in the Island of Corfu about a fortnight ago, the particulars of which are contained in the following letter from Mr Mackenzie:—

"A singular meteorological phenomenon occurred here on Saturday, 21st March. The day was squally and showery; those light showers brought down a great quantity of mud; the next morning I found the cauliflowers covered over with this fine dust. On examining the surrounding fields I found the trees and every other object covered in the same manner. As some writers have asserted, and other have denied, that the same phenomenon is of frequent occurence in Malta, I send you a few leaves with the precipitate still upon them, which will, I think, put the question to the test for ever. The second question is more difficult to solve; namely, is this native dust, or has it been imported by aërial currents from Africa? From the state of the weather during the three previous days, I am led to favour the latter opinion. I forward an extract from my meteorological register.

"Dr Calla tells me that he remembers something of the same kind when a boy, about forty years ago.

Date.	Thermometer.		Barometer.			Wind.
	Max.	Min.	8 A.M.	3 P.M.	8 P.M.	
March 18	60	52	30·11	30·09	30·09	W.S.W.*
March 19	59	50	30·10	30·10	30 09	S.E.†
March 20	60	51	30·05	29·99	29·94	S.E.‡
March 21	59	51	29·81	29·80	29·81	S.E.§

"Corfu, 25th *March* 1857."

Observations of the barometer, &c., as registered by Mr Cockburn at the Royal Society's Rooms, were laid before the meeting for comparison.

Dr Lawson then proceeded to notice in detail analogous showers of mud, dust, &c., which had occurred at different

* "Overcast and calm.

† "Densely overcast.

‡ "Gloomy and threatening; high wind in the night.

§ "Squally and showery throughout the day and night, and with yesterday's rain there fell a great quantity of mud of a dirty red colour. The plants throughout the island are covered with this fine precipitate. The phenomenon is said to be of frequent occurrence in Malta."

times and in various parts of the world, particularly one described by Dareste (*Annales des Sciences Naturelles*, ser. 4, Botanique, tome i., p. 81), which fell from a cloud at Shanghai, and consisted in great part of minute confervoid vegetation. This dust had been traced to various probable sources; but Dareste, who finds the colouring of the Chinese Sea to depend upon a minute confervaceous plant (*Trichodesmium erythrœum*), which exists in its waters, believes that the dust of the shower was derived from this source. Showers and clouds of dust carried by whirlwinds, &c., have been occasionally observed in Britain. One which occurred in connection with a thunder-storm is described by Mr E. J. Lowe (*Treatise on Atmospheric Phenomena*, p. 193). Mr R. A. Salisbury, F.R.S., has given (*Linn. Trans.* viii. 286) an account of a "storm of salt which fell in January 1803 in Middlesex." It incrusted the windows like hoarfrost, and proved very injurious to vegetation. The salt was, in this case, no doubt derived from the sea. Ehrenberg has published most elaborate details of the examination of various specimens of dust which have fallen in different parts of the world, containing numerous organisms, especially Diatomaceæ, but including also portions of the tissues of the higher plants, such as stomate-bearing epidermis, pollen grains, and other substances. One sample, collected on a ship's deck 500 miles off the African coast, exhibited numerous species of fresh water and marine diatoms, presenting the greatest resemblance to South American forms; and several other dust-showers in the Atlantic gave similar results. Dust which fell at Malta on 15th May 1830, during a south-east wind, gave a large assemblage of organisms, resembling the Atlantic forms, and among which were no characteristic African ones. This led Ehrenberg to the conclusion that these showers, with the hot winds that attend them, are quite foreign to the Sahara Desert, to which they had been referred. Sirocco dust of Genoa, May 16, 1846, and at Lyons on 17th October of the same year, gave similar results. Storm of red snow in the Tyrol, March 31, 1847, owed its colour to a red dust, which presented the same general characters, many of the species being identical. Dust which fell in Italy in 1803, and in Calabria in 1813, had a similar character; and although ten years apart, these two samples had twenty-eight species in common. The mud of Mr Mackenzie's Corfu shower is, when dry, of a pale brown colour, and in the form of fine dust. On submitting it to examination under the microscope, Dr Lawson found it to consist for the most part of minute angular pellucid fragments, others being rounded; the whole apparently consisting of quartzose sand. In some of the fragments, the sharp edges of the crystals are very distinct; and a few perfect columnar crystals, identical in form with those figured by Ehrenberg in his meteoric dust, were observed. In size, the grains of sand varied from minute molecular particles not exceeding 0·00005 inch, to larger irregular crystallized masses 0·005 inch in diameter, the most common size being about 0·0015 inch. In addition to the above, there were present occasional irregular more or less rounded masses of mineral matter varying from pale yellow to a deep orange colour. To these orange particles the brownish colour of the powder appeared to be due. The only conspicuous organic matter observed was in the form of numerous long unicellular vegetable hairs. These, however, were found to be identical with the hairs of the leaves from which the dust was collected, so that their source became evident, affording an illustration of the caution required in such investigations. If instead of falling upon leaves this dust had fallen upon moist soil, it would have contained microscopic algæ instead of hairs, and no doubt given rise to much speculation. Dust, therefore, which is collected in ships at sea, being free from such sources of error, is better adapted for examination, although even in such cases it is to be recollected that the washing of the decks is sufficient to introduce a notable quantity of sponge spicules and minute organisms. In addition to the exceptional hairs and the mineral matter above described, two minute bodies were observed belonging to a simple unicellular alga, and presenting the form of a simple globose thick-walled cell with slightly granular contents. A single disc, which might be referred to *Discoplea atmospherica* of Ehrenberg, was also noticed. Organic forms, therefore, form no conspicuous feature of this sand, and thus we have absent one of the most important aids to the elucidation of its origin and history. So far as known, it does not seem to have been connected with any volcanic eruption or earthquake. As indicated by Mr Mackenzie's concluding remark, such phenomena are not entirely unknown on the shores of the Mediterranean, and in fact Ehrenberg has attempted to define their geographical limits. In Dr Hennen's *Medical Topography of the Mediterranean*, the occurrence of "showers of mud" is mentioned as occurring at Malta; but Dr Francis Sankey, the author of a pamphlet on "*Malta as a place for the Residence of Invalids*," contradicts the assertion. He says that the only "showers of mud" are the dust, which, wafted before the wind, is in part united with the aqueous vapour in the atmosphere, and is thus deposited over the land, as happens by every road-side in England. It is evident, however, that Mr Mackenzie's shower has been of a different kind, and his observation serves to reconcile such adverse statements as those of the two authorities just quoted; for while it shows Dr Hennen to be quite right in so far as such showers do occur, it at the same time indicates their rarity to be such that they cannot possibly affect the salubrity of the climate so far as Corfu is concerned.

Ehrenberg does not obtain the explanation of such phenomena in local meteorological conditions, nor in volcanic actions and whirlwinds, nor even in the theory of evaporation advanced by Dareste. He seeks one general law which will connect together the whole phenomena, and to whose operation all dust showers may be referred. He says, I cannot longer doubt that there are relations according to which living organisms may develop themselves in the atmosphere; and he speaks of this as a self-development and not a production from introduced ova. He says these showers are not to be traced to mineral material from the earth's surface, nor to revolving masses of dust-material in space, nor to atmospheric currents simply; but to some general law connected with the earth's atmosphere, according to which there is a self-development within it of living organisms! The organisms that fall in dust-showers are, therefore, according to him, of atmospheric origin, and he says they have relation to the fall of aërolites. This startling hypothesis, so contrary to all the results of modern science, need not be argued against in this place; and those who desire to pursue it further will find a most elaborate account of the details upon which it is founded in Ehrenberg's paper (*Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin*, 1847). In the meantime we must be contented to seek for the causes of dust-shower phenomena in those operations of nature with which we are acquainted.

VI. *Register of the Flowering of certain Spring Plants in the Royal Botanic Garden, Edinburgh, from 12th March to 15th April 1857, as compared with the five previous years.* By JAMES M'NAB.

Names.	1857.	1856.	1855.	1854.	1853.	1852.
Tussilago Farfara.........	Mar. 12	Mar. 12	Apr. 11	Mar. 14	Apr. 4	Feb. 21
Anemone Pulsatilla.......	— 14	— 10	— 11	— 14	— 13	— 21
Asarum europæum........	— 14	— 18	— 18	— 16	Mar. 28	Mar. 29
Dondia Epipactis.........	— 14	— 10	— 9	— 11	— 25	— 8
Narcissus pumilus	— 15	— 16	— 2	— 10	— 21	— 11
Knappia agrostidea	— 16	— 20	Mar. 2	Feb. 28	Feb. 1	Jan. 31
Primula nivalis	— 17	— 18	Apr. 10	Mar. 4	Mar. 15	Feb. 20
Vinca minor	— 18	— 25	— 16	— 7	Apr. 4	—
Erythronium Dens-canis	— 20	— 24	— 11	— 10	Mar. 19	Mar. 12
Gagea lutea	— 20	— 19	— 14	— 23	Apr. 12	Apr. 6
Orobus vernus	— 20	Apr. 4	— 16	— 16	— 8	Mar. 31
Scilla bifolia alba	— 20	Mar. 15	— 5	— 13	Mar. 27	— 21
Draba aizoides	— 22	— 20	— 11	— 20	Apr. 1	— 26
Ranunculus Ficaria......	— 24	— 26	— 24	— 29	— 7	— 15
Scilla bifolia cærulea	— 24	— 20	— 10	— 15	Mar. 27	— 20
Corydalis solida...........	— 25	— 24	— 16	— 14	Apr. 8	— 28
Ribes sanguineum; first flowers seen open on standard plants	— 26	— 26	— 19	— 14	— 4	— 21
Potentilla alba.............	— 27	— 24	— 16	— 16	— 12	—
Tussilago hybrida	— 27	Apr. 3	— 15	— 14	— 4	—
Scilla bifolia rubra	— 28	Mar. 16	— 6	— 14	Mar. 30	— 28
Hyoscyamus Scopolia.....	Apr. 1	— 26	— 15	— 14	Apr. 4	— 25
Anemone apennina	— 2	Apr. 8	— 30	Apr. 3	— 12	Apr. 7
Cochlearia officinalis......	— 2	— 4	— 20	Mar. 28	— 9	—
Orobus cyaneus............	— 2	— 9	— 29	— 17	Mar. 28	—
Corydalis cava	— 3	— 1	— 14	— 14	Apr. 5	—
Anchusa sempervirens...	— 4	— 1	— 13	— 25	— 12	Feb. 21
Holosteum umbellatum...	— 6	— 2	— 15	— 20	Mar. 30	—
Puskenia scilloides	— 6	Mar. 25	— 16	— 27	Apr. 2	Mar. 28
Muscari botryoides.......	— 7	— 30	— 14	— 24	Mar. 22	— 20
Carex montana............	— 8	Apr. 2	— 20	— 30	— 22	—
Hyoscyamus physaloides	— 9	Mar. 27	— 14	— 15	Apr. 12	Apr. 2
Narcissus moschatus......	— 9	Apr. 6	— 13	— 28	— 8	— 1
Dalabarda geoides........	— 10	— 6	— 19	Apr. 25	— 12	— 2
Arabis flaccidus...........	— 11	— 7	— 19	Mar. 18	— 1	— 3
Doronicum Pardalianches	— 13	— 2	— 20	— 26	— 12	—
Narcissus Pseudo-Narcissus..................	— 13	— 2	— 20	— 25	— 6	Mar. 28
Alyssum saxatile	— 13	— 8	May 1	Apr. 11	— 7	— 28
Saxifraga crassifolia......	— 13	— 8	Apr. 21	Mar. 20	Mar. 27	— 27
Scilla sibirica............	— 14	— 7	— 21	— 30	Apr. 10	Apr. 1
Adonis vernalis...........	— 15	— 2	— 19	— 28	— 6	Mar. 6
Fritillaria imperialis	— 15	— 9	— 14	— 26	— 12	Apr. 3

14*th May* 1857.—Professor BALFOUR, V.P., in the Chair.

The following donations were announced to the Society's Library, viz. :—

Transactions of the Tyneside Naturalists' Field Club, Vol. III., Part 3.—From the Club.

Proceedings of the Berwickshire Naturalists' Club, Vol. III., No. 7.—From the Club.

Dr Lowe presented specimens of *Schistostega pennata*, collected at Todmorden by Mr W. Marshall.

Professor Balfour exhibited the following donations, which had recently been made to the Museum at the Royal Botanic Garden :—

From Mrs Davidson—Two Burmese Books, made from strips of palm leaves.

F. G. Myburgh, Esq.—Fruit of *Gethyllis spiralis* from Cape of Good Hope.

Mrs A. Diana Acworth—Cones of *Pinus insignis*, ripened at Northaw, Herefordshire.

James Bonar, Esq., Hamilton House, Leamington—Fruit of Fir Trees of Australia.

Messrs P. Lawson & Son—Cones of *Cupressus macrocarpa.*

Mr Meintjes—Joss-sticks from Pondicherry.

Dr G. M'Nab, Jamaica—Flower, with sections, and young germinating plant, of *Victoria regia ;* Fruit of Ivory Palm and seed germinating; Seeds of the Antidote Cacoon (*Feuillea cordifolia*) ; Circassian Pea (*Adenanthera pavonina*) ; Seeds and Oil of the Spanish Walnut (*Aleuritia triloba*); Seeds and Oil of the Eboe Nut ; Coarse and Purified Hog Gum, the produce of the *Monorobea coccinea;* Gum of the Logwood (*Hæmatoxylon Campechianum*) ; Gum of the Cashew (*Anacardium occidentale*); Seed Vessels of the East Indian Okra (*Luffa acutangula*) ; Nutmeg and Mace (*Myristica moschata*) ; Essence of Cayenne Pepper (*Capsicum annuum*); Starch from the Root of the Bitter Cassava and refuse after the starch has been removed, likewise Cakes made from the starch ; "Hallelujah" Starch and Arrow-root, made from the tubers of *Maranta arundinacea ;* Guinea Corn (*Holcus Sorghum*) ; Fungoid growth from the interior of Papaw fruit (*Carica Papya*) ; Legumes of the Overlook, or "Jamaica Horse-bean" (*Canavalia ensiformis*) ; Male Spadix of Ivory Nut Palm (*Phytelephas macrocarpa*) ; Double Mango Seed ; Fruit of the Bitterwood (*Xylopia glabra*) ; *Areca oleracea*, or Cabbage Palm, showing a forked division of the stem, which is two feet in circumference, each branch being eighteen inches in circumference.

There have also been added to the collection—Flowering Stalk of *Colocasia odora*, and specimens of Blood Oranges.

Mrs Carstairs—Rhizome of *Asparagus officinalis*, called Giant Asparagus, with roots and turio.

Mr Archibald Hepburn—Specimens of Cider from Worcester. Mr Hepburn remarks :—

Three hogsheads of apples produce one hogshead of cider (pure), two hogsheads of pears produce one hogshead of perry (pure). The apple thrives in greatest perfection on soils lying on the Old Red Sandstone, in Hereford, Gloucester, and Devon shires. The cider produced on the lighter or sandy soils in Hereford is said to be more fiery than that produced on the stiffer or more clayey soils in that county. The finest cider is produced in the vale of Berkeley, Gloucester. I do not know the geological character of the soil. In pressing the apples in a mill made of a large circular stone, revolving in a stone trough, care is taken to thoroughly crush the seeds. These contain an albuminous principle, which is considered in Hereford and Gloucester shires essential; hence the preference is given to small crab-like varieties, producing many seeds for the proper preparation of cider. In Devonshire this matter is overlooked. Since railways opened up Herefordshire, large quantities of apples are sent to the Welsh mines and iron works, and to the midland counties, for culinary purposes. The uncooked fruit (apples or pears) is unfit for human food, leaving, when eaten, a harsh burning sensation in the mouth. Considerable quantities have of late been sent to Manchester to produce *malic acid*, said to be used in fixing dyes on cottons. Pears for perry attain the highest perfection in Worcestershire on the New Red Sandstone. Horses, cattle, sheep, and pigs devour them with the greatest relish.

The following papers were read :—

I. *Notice of Two Cases of poisoning with the Seeds of* Thevetia nereifolia. Communicated with remarks by Dr Douglas Maclagan.

The history of these cases, which occurred in India, was furnished by Dr John Balfour, H.E.I.C.S. The symptoms were narcotico-irritant, the irritant character predominating, and the somnolence and other cerebral phenomena being, in Dr Maclagan's opinion, probably as much those of exhaustion as of true narcotism. There was vomiting of a peculiar character. The letter enumerating the cases contained portions of the plant sufficient to enable Dr Maclagan to identify it as *Thevetia nereifolia*, Juss. (*Cerbera Thevetia*, L.) This plant, now naturalized in India, appears to have been introduced probably from South America. Dr Maclagan had compared the *Thevetia nereifolia* of the Indian collections with the *Cerbera peruviana* of Matthew's catalogue, and had no doubt of the identity of these plants, which are given as synonymous in De Candolle's Prodromus. This communication has appeared at length in the *Edinburgh Medical Journal.*

II. *Account of the Insect which infests the Seeds of* Picea nobilis. By Andrew Murray, F.R.S.E.

This beautiful silver fir (the *Picea nobilis*) was first introduced into this country from the north-west of America, by Douglas, in 1831. In what state the seed sent by him arrived here I have been unable to ascertain with perfect accuracy. The fact that plants of an age corresponding to that period are exceedingly rare would seem to indicate either that the quantities imported by Douglas were less than we have reason to suppose, or that from some cause or other they had not been productive. On the other hand, Professor Lindley informs me that he never heard that Douglas' importations were in any way attacked by insects, and that the Horticultural Society of London raised what he sent home without anything of the kind being observed; and I am informed by my friend Mr M'Nab, that the cones sent by Douglas, which have been preserved as specimens, show every symptom of having been perfectly sound. No second importation of seed to this country was made in any quantity till Jeffrey sent home some packages in 1852. These proved all bad, and apparently had suffered from the ravages of an insect. Mr Beardsley and my brother next sent home a quantity in 1854, along with the seeds of other pine trees, some of which proved new. In an account of their expedition, and of the novelties discovered by them, which I had then the honour of reading to this Society, I noticed the fact, that in almost every cone of *P. nobilis* the seeds were being eaten by a small caterpillar. My brother had found these caterpillars in the green as well as in the mature cone, their eggs evidently having been deposited in the kernel while the cone was yet soft, and easily penetrated. One or two subsequent importations of seed (the last a very large one, made last autumn on behalf of the Oregon Botanical Association) proved to be also to a greater or less extent infested by an insect. From these importations I have bred the insect, and find that it belongs to the genus *Megastigmus,* one of the Chalcidites, a family of the so-called ichneumon flies. These flies have hitherto been supposed to be entirely parasitic; but the fact of immense numbers coming out of the cones, without any intermixture of species, would seem to render this unlikely, so far as regards this species, as it is highly improbable that all the larvæ could have been ichneumonised. Out of hundreds of insects which I have seen developed from the cones of *Picea nobilis* I never saw any other species than this, except one small moth; and further, no trace of the skin of the sacrificed larvæ is to be found in the empty kernel from which the insect emerges, which would not have been the case had they fallen victims to Ichneumonidæ. There thus appears no reason to doubt that the larva in question is that of the Chalcis, which afterwards appears; and it follows as a corollary, that it is simply an ordinary vegetable feeder; and that the whole species falling under this group are not parasitic. Similar exceptions to the general economy of a family have been found in other groups. For instance, till lately, the neighbouring family of *Cynipidæ,* or gall-flies, was always supposed to live exclusively in gall-nuts or morbid excrescences, on oak leaves, and other plants; Westwood, however, has satisfactorily shown that some of them, like the Chalcidites, are parasitic on other insects. I see no reason, therefore, why a similar aberration from the normal mode of life of the Chalcidites should not occur among them also. Mr Murray then gave a description of the species.* The im-

* Since this paper was read to the Society, I have seen the April number of the "Zoologist," in which I find the species described by Mr Parfitt, under the name of *Me-*

mense quantities in which the insect has been found in the cones, at least in all the later importations, and the fact that the early stage in which the cone is attacked, renders protection or prevention by man nearly impossible, is likely, I fear, to keep this pine always comparatively scarce. Any hints as to its propagation, otherwise than by seed, will therefore probably be acceptable, and I shall accordingly mention a mode of propagating it by cuttings, which I have tried and found singularly successful, and which I believe has not yet been made known. In the month of June last year, when the young buds were pushing out their beautiful tender pea-green leaves, I nipped or tore off a number from a young worked plant, in order to bring it into better shape. In doing so a little of the old alburnum and bark, of course, adhered to these new fresh green portions, which were from half an inch to an inch in length; and with no great expectation of their doing anything, but rather as an experiment, I stuck them into the open border. To my gratification I found, on examination some time afterwards, that they had rooted. They did very well till the heats of August began to tell upon them, when the weakest gave way; but some stood and were taken up and potted on the approach of winter, and are now ready to come away with fresh vigour. I have no doubt that if the cuttings had been potted and taken care of, instead of being left in the open border, not one of them would have failed.

III. *On the supposed influence of the Moon on Vegetation in Peru.* By Archibald Smith, M.D.

The author alluded to the prevailing belief in Peru of the moon's influence on vegetation, and gave a *resumé* of the results arrived at by various scientific observers who had had opportunities of noticing the lunar influence in the tropics. He thought it not unreasonable that the lunar ray might have a peculiar chemical agency on the functions of plants and animals, as it appears to have on dead animal

gastigmus Pini. I have therefore withdrawn my description, and cancelled the name which I had given it. Mr Parfitt has described only the female, not having seen the male, which he seems to anticipate must be rare. I obtained specimens of both, which I have placed in the British Museum. The male is smaller than the female, and differs in having its upper surface entirely black.

matter. While the moon was not regarded in Peru as influencing so much the changes of weather as indirectly effecting increased growth, it must be borne in mind that the light afforded both by the sun and moon in Peru is much greater than in the British Islands,—so that, although we may reasonably repudiate any marked effect from the moonlight in these islands, the more intense lunar light of Peru may exercise a sensible power in plants. In noticing special instances in which this might be supposed to be shown, the author alluded particularly to the surprisingly rapid growth of lucerne, which is extensively cultivated in Peru, and is evidently much favoured by light, whether of sun or sun and moon together. During the prevailing misty season on the coast (which is the time when the low and maritime sand hills are garnished with grass and flowers to their summits) the growth of lucerne in the plains and valleys is greatly stinted. In these wet months, as they are called, though the rain very rarely forms into a light shower, or exceeds the limits of a dripping mist, the clover or lucerne does not attain to a flowering maturity; but no sooner do the vapours of the coast begin to break up, and the sun show itself in a brightening sky, than this useful plant, on which the horses and other cattle thrive admirably, receives a fresh impulse, yielding two or three luxuriant crops in succession. This remarkable vigour of vegetation, under the influence of a returning sun, argues on behalf of light more than of heat, as the vivifying power, because the requisite degree of heat does not appear to be deficient at any season, where the thermometer of Fahrenheit seldom sinks under 60° on the coast. Besides, in the temperate valleys of the Sierra or Andine heights, where the summer temperature of the air does not exceed the winter temperature of the coast, the lucerne grows luxuriantly under a bright clear sky during the dry season, though there also its growth is checked in the cloudy and rainy months; and yet the sunny season of the mountains is subject to night chills, or even frost at certain elevations, whereas the wet months are not so. Light, therefore, seems the essential condition to the recurrence of the more luxuriant vegetation, as observed in the successive climates of the Andes from the headlands of the coast to the temperate agricultural elevation of 10,000 feet, where the lucerne still attains a perfect growth in a clear but cool atmosphere of about 60° Fahrenheit. And, then, as we descend into yet deeper valleys at only 6000 or 7000 feet elevation, where the rains of the so-called wet season are only slight and transitory, and not to be compared to those that fall at twice this height, the sun is seen throughout the year, and, in the dry months, actually dazzles in reflected brilliancy from every stone and rock. In these favoured inland valleys there is a predominating sun all the year over; and, in the dry season especially, a profusion of sun by day, followed by a most luminous moonlight, with a calm, clear sky. Here, then, so liberal a supply of light from sun, moon, and stars, appears to be singularly favourable to vegetation; and the lucerne yields inland, two crops to one on the coast, though the temperature of the air on the coast be in the shade 10° or 12° higher during the dry season than in the inland valleys under consideration, and this, too, on soil generally inferior to that of the coast now compared with it in strength of vegetation. The author concluded by some observations on the effect of light in promoting the discharge of oxygen from the leaf tissues of plants, showing that light, independently of heat, increased their vital actions.

Professor Piazzi Smyth, in remarking upon Dr Smith's paper, made some observations on the amount of heat given by the moon, and shortly traced the history of this inquiry, detailing many experiments by himself and others, and alluding particularly to the researches of Sir John Herschell, Professor J. D. Forbes, &c.

IV. *On some of the leading Plants of the lowest zone in Teneriffe.* By Professor C. Piazzi Smyth.

The author described the manner and characteristics of growth of the chief plants met with in advancing from the sea-coast inland, and found both the indigenous and cultivated plants to exhibit a poverty of growth as compared with many other lands in the same latitude, or 28 degrees. The cause of this, he thought, was owing to the special predominance of the trade-wind throughout the Archipelago of the Canaries during the whole of the summer season, and to the want of rain, and the low temperature which the said wind produces, both primarily and secondarily. In the details of the native plants, the author treated at length on the *Dracæna Draco*, as being, *par excellence*, the characteristic plant of the lowest zone of Teneriffe, and having in one of its specimens, the "Great Dragon Tree of Orotavo," acquired more fame than any other individual specimen of the vegetable kingdom; and he concluded with an exhibition of the forms of the dragon tree at different ages, and other Teneriffe plants optically projected on a screen eight feet square, from photographs of which the original negatives had been prepared by himself last summer, and positive copies had been made with much skill and success by M. Orange, in the course of the winter.

Professor Balfour read the following analysis of specimens of volcanic sand from the Andes, sent by Professor Jameson of Quito, and analyzed by Mr Bloxam, assistant in the Industrial Museum:—By qualitative analysis it appears to be composed of silicic acid, peroxide of iron, alumina, carbonate of lime, and small quantities of potassa and soda. A stream of carbonic acid passed through water, in which the sand was suspended, dissolved out much carbonate of lime. The sand contains small quantities of the protoxide of iron. Its quantitative composition is as under:—

Silica, ...	68·00
Peroxide of iron, and alumina, .	21·20
Carbonate of lime, . .	9·10
Magnesia and alkalies, . .	1·70
	100·00

14*th June* 1857.—Professor FLEMING, Pres., in the Chair.

The following Candidates were balloted for and duly elected—

As Ordinary Resident Fellows.

John Stoddart, Esq., surgeon, Kirkcaldy.
Æneas M'Leod Ross, Esq., 3 East Claremont Street.

Professor Balfour stated that the following donations had been recently made to the Museum at the Royal Botanic Garden :—

From Mrs Dr Smith—Specimens of *Borrera Trulla*, Ach., and *Cetraria*, n. sp., from near Lima, at an elevation of 10,000 feet, on the Andes.

Mrs Mackay—Wax models of Potatoes, Turnips, Carrot, and French Bean.

Professor Syme—Double Fruit of *Pyrus Malus*, var.

Mrs Millar—Various articles of dress from the Feejee Islands, prepared from the Paper Mulberry, *Broussonetia papyrifera ;* and Gulfweed from the South Seas.

Fleetwood Shaw, Esq.—Section of Bully-tree.

Dr G. M'Nab, St Andrews, Jamaica—Section of Red Bully-tree (*Bumelia montana*), twelve feet in circumference.

Dr Alexander Harvey, Southampton—Seeds of the *Pinea de Terra* of Spain.

Dr John Kirk—Cone and Section of Branch from one of the Cedars on Mount Lebanon, and Fruit of Dôm Palm from Egypt.

The following papers were read, viz. :—

I. *On the Identity of* Achorion Schönleinii *and other vegetable parasites, with* Aspergillus glaucus. By John Lowe, M.D., F.B.S.E., &c.

In the year 1839, it was first announced by M. Schönlein of Berlin,* that a vegetable growth existed in the favous crust of *Porrigo lupinosa*, Willan ; but the priority of the discovery was claimed by Remak,† on the ground that he had observed it two years previously. He appears, however, to have regarded it as an accidental formation, and denied its vegetable nature.

Fuchs and Langenbeck, Gruby, Textor, Hannover, Bennett, and others, subsequently observed and figured this peculiar structure.

Lebert, who describes it in his *Physiologie Pathologie*,‡ assigned to it the name of *Oidium Schönleinii ;* but Remak, under the direction of Professor Link, placed it, about the same time, in the genus *Achorion*, with the above specific title, and under this name it has since been known.

* Schönlein. "Zur der Pathogeine der Impetigenes." Müller's Archives, 1839, p. 82, pl. iii. fig. v.

† Dissertatio. inaug. De morbo Scrofuloso. Berlin, 1837, p. 19.

‡ Lebert, Physiologie, Path. t. ii. Paris, 1845, p. 477.

Viewing the growth as merely an initial form, one designation is about as correct as the other.

In the present communication, it is proposed to show the relation which exists between this (as well as some other epizootic growths) and a common well-known fungus, *Aspergillus glaucus;* and to establish the identity of several forms which have hitherto been regarded as distinct, but which we believe to be the same species.

In an investigation of this nature, where the objects to be examined are so minute, a considerable degree of difficulty is naturally experienced in affording satisfactory proof of the accuracy of the remarks concerning their development. For instance, in watching the germination of any given fungus, it may often be difficult to prove that no other plant of the same tribe is present to complicate the result; and this in consequence of the myriads of spores of various species which are constantly floating about in the atmosphere, ready to become located, and grow upon any suitable pabulum.

In the following observations, however, we hope to prove that no such fallacy has occurred; and further, to adduce facts which will bear out the foregoing assertion respecting the common identity of many of the parasitic vegetable formations.

One of the chief reasons of their having been so long considered as distinct species, appears to be, that imperfect and various stages of their development have been observed, and thus a merely initial stage of the *mycelium*, which is capable of assuming an almost endless change of form, has, in each instance, been figured as a distinct species, provided the seat and forms of the diseases differed; the observers apparently ignoring the fact that, in order to define a species accurately, all the parts of it should be present; or, at any rate, those which are most important, and above all, the fructification.

During the past winter, a number of well-marked cases of favus have been treated in the Royal Infirmary of Edinburgh; and from one of these, a most unique specimen of *Porrigo lupinosa*, a mass of the favous crust was obtained. I was thus enabled, by placing this in a position favourable to germination, to watch the development and fructification of the so-called *Achorion Schönleinii*, whose claims to be ranked as a distinct species I had long doubted.

When viewed under the microscope, the mass itself was seen to consist of minute, non-nucleated, spherical cells mixed with a few epithelial scales. The cells were uniform, and of a pale straw colour, quite distinct from the ordinary aerial sporules of allied species (fig. 1).

On the 12th February 1857, the mass was divided into three portions, one of which was placed in a solution of coarse brown sugar; the second, upon a piece of cheese moistened by a few drops of water and kept in a corked phial; the third was put in a small quantity of pure glycerine. A portion of each of these was subjected to daily microscope examination, with the following results:—

(I may state that the bottles containing them were placed in a moderately cool atmosphere, in order that the development might not be so rapid as to render it difficult to follow the changes which might ensue).

The cells placed in glycerine remained entire for about ten days, but made no attempt at germination; and, finally, became disintegrated and disappeared, leaving a granular, homogeneous mass; and although the glycerine was kept for a month, no cellular structure became apparent.

This experiment was made with the view of ascertaining the precise remedial value of glycerine as an external application in the treatment of favus; for which purpose it is used by Dr Bennett, who supposes it to destroy the plant by excluding it from the atmosphere. The above experiment appears to confirm this view, but I am inclined to think that it would have given a different result at a more elevated temperature; for we find that yeast grows with tolerable facility in glycerine during the preparation of propionic acid. The portion of cells placed on cheese became decomposed in about the same time as that in glycerine. Probably the cheese was not sufficiently prone to decay, and in this case the spores died for want of nutriment.

The cells placed in saccharine solution, after remaining for forty-eight hours, were observed to become swollen, and the majority of them assumed an oval form (figs. 1, 2); some, however, retained the spherical form, were slightly increased in size, and resembled yeast cells. On the day following they began to form moniliform chains by the contact and union of their extremities (fig. 3, *a*).*

At the end of a week from the time of their immersion, the whole of the forms in fig. 3 were apparent. On the 21st February, nine days after the cells were placed in the solution, the chains of cells became elongated and began to put forth processes from their walls. These are seen in fig. 4. By the end of February the whole mass had assumed a filamentous form, the walls of the tubes still remaining somewhat uneven, owing to the imperfect fusion of the cells. By the 11th March these inequalities on the surface of the filaments had entirely disappeared, and the tubes which had hitherto been empty, or containing only fine granular matter, were now observed to have in their interior small greenish bodies or cells arranged in a single row (fig. 7). About the same time, other tubes were seen to contain one or two larger oval cellules (figs. 5, 6, 7). On the 15th March, some of the filaments were found to contain both small and large cells (fig. 7.), but the majority had still only one kind. On the 20th March the fructification appeared as in fig. 8, and was recognised as *Aspergillus glaucus*. By the 4th April other structures were observed as in figs. 9, 11. These consisted of sacculated moniliform tubes (*asci*) containing one or two nuclei in each sacculus. Extensions from these tubes (fig. 11, *b*) were of much smaller diameter (often not above one-third or one-fourth), and contained a number of the

* A doubt having been expressed as to the union of cells here mentioned, I may state, that the individual cells were seen to come in contact after they had assumed the oval form, touching only at their extremities. After a most careful examination of many portions of the mass, no appearance of segmentation, germination, or nucleation, could be observed, and the oval cells were invariably of uniform size and aspect. Dr Pereira observed a similar arrangement in surface yeast, but could not satisfy himself that it was anything more than a mere contact of the cells. Kützing * noticed a phenomenon of the same kind in *Protoccocus Monas*, Ag., which has been found to be the initial state of *Barbula muralis* and *Bryum argenteum*. Kützing's opinion was that the cells really united in the way I have mentioned.

It was not until after repeated examinations that I could at all satisfy myself that there was more than a mere contact of the cells; but when they are seen to come thus into contact, and form tubular filaments, without segmentation, gemmation, or the formation of nuclei, I think the conclusion that the cells coalesce is a legitimate one. An additional argument in favour of this view is found in the fact that gemmation takes place indifferently at any part of the cell; but in the present case, the cells were uniformly in contact at their extremities alone, seeming as if they were thus arranged by some polarizing influence. I have since seen the same phenomenon occur in the yeast plant, but never under such favourable circumstances as above.

* Annales des Sc. Nat. 1834, p. 129.

small granules which appeared to change into cells, the tube at the same time becoming swollen. A number of free bodies were also visible, and these were of various sizes—some having the appearance of the smaller cellules contained in the slender filaments; others of a larger kind, resembling those contained in the sacculi, from which they had probably escaped; and a third form four or five times larger than the last, and apparently the same in process of germination; these contained three or four nuclei, and in a more advanced stage they were observed putting forth mycelioid filaments (fig. 10, *b*). This form resembles that figured by Robin* (Pl. iii. 13.), from favus grown upon an apple.

It becomes an interesting point to inquire what are the functions of these various sporelike cells, for we have them of three distinct kinds, most likely distinct also in their functions. *Firstly*, there are those produced on the receptacle, which I cannot quite coincide with Mr Berkeley in regarding as true spores, and for this reason, that they do not germinate after the manner of those which are the result of a true reproductive process. Thus, instead of containing nuclei and putting out confervoid filaments, they either simply become elongated and branched, or unite together in chains to form a mycelium, which, I think, may be very well regarded as analogous to the prothallus in ferns; and the same analogy would therefore exist between these spores and those of Filices or Equisetaceæ, which are now regarded by some as mere gemmations. In the mycelium thus formed we observed two other kinds of cell produced—the one contained in sacculi or asci, the other either associated with them, or occurring in separate tubes. These I have previously indicated as *large* and *small* cells; and though no conjugation or other reproductive process has yet been seen to take place between them, it is probable that they are analogous to the *pistillidia* and *antheridia* of ferns, or to the large and small spores of Lycopodiaceæ. The large cells, I have little doubt, are the true reproductive spores, for I have observed them, after their escape from the asci, become enlarged to four or five times their original size; and they differ from the cells of the sporangia in not uniting together, in containing two or more nuclei, in giving off con-

* "Des Vegetaux parasites qui croissent," &c. Paris, 1853.

fervoid filaments from one or more points, while the cell retains its spherical form, and lastly in not elongating.

On comparing the accompanying plates with those of *Achorion Schönleinii* figured by various writers on skin diseases, they will be found to correspond very closely. Thus, figs. 1, 3, 4, 5, 8, are identical with figs. 3, 4, 5, 2, of Dr Bennett's paper.* The sporangia in his fig. 2 are imperfect, owing to the crushing which the section of the skin has undergone, but there is one near the right hand corner which is distinctly an Aspergillus, giving off three moniliform chains. The whole of the forms figured by Robin† as stages of Achorion (pl. iii. figs. 6–13, and xiii. figs. 1–3), I have also observed in the development of the favus-sporules. Lebert's fig. 5, pl. xxii., bears a remarkable resemblance to my fig. 7.

The genus Aspergillus belongs to the Hypomycetous division of Fungi, subdivision Mucedines, according to the classification of Fries. It is an extremely common fungus, growing upon decaying organic matter of almost every description. The present species of it constitutes the blue mould upon oranges and frequently upon cheese. It is extremely probable that more than one genus and species infest living animal bodies, and I am glad to find myself supported in this opinion by so eminent a mycologist as Mr Berkeley.‡ Speaking of their morbific influence, he says, "It is true that in many cases the fungi may be of very common kinds, or under disguised forms, but this is what may be very readily supposed, for it is very rarely the case that such peculiar matrices as the human skin or mucous membrane should nourish fungi absolutely peculiar to themselves. It is in such cases far more easy to believe that the common Penicillia or Aspergilli, which are notoriously indifferent about their matrix, provided the proper chemical conditions be satisfied, are the real antagonists."

This I believe to be true of almost the whole of these parasitic plants which grow upon man, and of many of those which infests the lower animals. Remak,§ who made

* London and Edinburgh Medical Journal. June 1842.

† Robin, *op supra cit.*

‡ Introduction to Cryptogamic Botany. 1857, p. 238.

§ Lebert, Diagnost. und Pathogen. Berlin, 1845.

some experiments on the development of the Achorion, obtained no results from favus-sporules placed in a saccharine solution and other matters, but found that those placed on apple germinated and put out processes in twenty-four hours, but on the *sixth* day the surface was covered with *Penicillium glaucum.* From this he concluded that the result was negative, but I am inclined to think that the favus was in this case really due to that plant, and that it, as well as Aspergillus, is capable of originating the disease.

In the observations already made, the species has been indicated as *Aspergillus glaucus.* With very many there is some difficulty in allocating the forms to any individual species, and in some this is impossible. I shall therefore merely attempt to show, in the succeeding remarks, that there is a probability of numerous forms now ranked as distinct species, being nothing more than mere variations of one or other species belonging to the two genera just mentioned—that the same characters are common to each—and that there are no legitimate grounds for their being considered as specifically, much less generically, distinct. Perhaps the strongest argument against their being thus considered is, that they have never yet been met with in a state of fructification; hence it is difficult to conceive how, in the absence of free sporules, they can be communicated from one person to another, if they are to be regarded as peculiar to the localities in which they have been found. That the spores are borne by the wind, from some source where they are produced in immense quantities, seems evident from the frequent occurrence of the plant in various diseased conditions of the body, as in aphtha, muguet, and in the sordes which collect upon the teeth in fevers. The spores may be found in abundance on the tongues of healthy persons if examined early in the morning; their development, however, does not ensue except the person be attacked by a debilitating disease. When thus developed they become the *Oidium albicans*, &c. In the state of spores, again, they are frequently present as *torulæ* in the urine and other fluids containing organic matter. They constitute the *Cryptococcus cerevisiæ*, which Messrs Berkeley and Broome have demonstrated to be the *Penicillium glaucum.*

Trichophyton tonsurans, Malmsten (Robin, pl. ii. figs. 7

8), formed in the hair of those affected with *Plica polonica*, and *Herpes tonsurans*, is evidently only the sporular form of *Achorion Schönleinii*, Lem., or *A. Lebertii*, Ch. Rob.

Trichophyton ulcerum? Ch. Rob., found by Lebert upon an atonic ulcer of the leg, is merely an early condition of the germinating sporules, closely resembling *Torula guttata* (vide *Lebert's Physiol. Pathol.* Paris, 1845. Atlas, pl. xxii. fig. 7.)

Microsporon furfur, Ch. Robin., was found by Robin in *Pityriasis versicolor*. The figure of it given by Dr Gull,* is evidently an imperfect condition of Penicillium or Aspergillus. The mycelium is identical with that of a fungus which I have found in *Lichen annulatus solitarius*, Wils.; with my figs. 5, 10; and with that of Remak, drawn from specimens obtained by inoculating his arm with favus-sporules.†

Microsporon Audouini, Gruby, found in *Porrigo decalvans*, is said by Robin to differ from *Trichophyton tonsurans* in its branches being more numerous, crooked, and undulated; in the spores being smaller and always devoid of granulations in their interior; and by the adherence of these to the filaments and their branches. After a careful examination, I am convinced that this description will as accurately apply to the forms which I have figured, pl. v. figs. 3, 4, 5.

Microsporon mentagrophytes, Ch. Robin, differs from the preceding, in having larger spores and filaments, "il en differe aussi par la siège,"‡ being situated in the hair follicle, between the hair and the follicular wall, and not in the substance of the hair as in *Trichophyton tonsurans*, nor around the aerial part of the hair, as in the last-named variety. This difference in situation will, I apprehend, suffice to account for the very slight degree of variation between these so-called species. The mere difference in the size of the spores is a matter of little import, since they vary so much according to the stage of their development.

Mucor mucedo, L. A fungus was figured and described, under this name, by Sluyter, from a gangrenous cavity of the lung.

Robin remarks that Sluyter's figure bears a close resemblance to *Aspergillus nigrescens*, and believes it to be that species rather than a mucor. This tends to confirm the

* Guy's Hosp. Reports, Ser. III. vol. ii. 1857.

† Robin, *op. supra cit.*, pl. iii. fig. 12.

‡ Robin, *op. supra cit.*, p. 431.

view regarding the common origin of vegetable parasites. At the same time there does not appear to be any good reason why the mucor should not be present in a lung cavity.

The fungus found in a tubercular lung by Dr Bennett,* is identical with *Oidium albicans* and also *Achorion Schönleinii;* and some of the sporules are so arranged as to have a faint resemblance to the sporangium of an Aspergillus.

Dr Hassall† remarks that it bears a close resemblance to the forms which he has obtained from the fructification of the yeast plant. The occurrence of Aspergilli in similar localities in birds has been observed by several writers. Thus *A. candidus*, Mich., has been found by Rayer & Montagne,‡ growing in tubercular matter in the air-sacs of *Pyrrhula vulgaris*, L.; *A. glaucus*, Fries, under similar circumstances in the golden plover (*Charadrius pluvialis*, L.), by M. Spring;§ and *A. nigrescens*, by M. Robin in *Phasianus colchicus.* (*Op. cit.*, p. 518, pl. v. fig. 11.)

Other species have also been described in different birds, but whether they are properly regarded as distinct, or are merely modified by their situation and matrix, is a point requiring further observation.

Many instances of *similar* apparent conversion of one species or genus into another are noticed by Mr Berkeley, (*Introd. to Cryptog. Bot.*), as, for instance, *Sclerotium* into *Mucor* (p. 267); *Asp. glaucus* into *Eurotium* (p. 248); and *Penicillium* into *Coremium* (p. 302).

M. Robin figures, after Meyer, a fungus which he believes to be an Aspergillus sp.? (Pl. iii. fig. 1.) It was found by Pacini, contained in cysts in the external ear. The fructification is also figured, but it bears little resemblance to that of an Aspergillus, and has, I think, been improperly removed from the genus Mucor, under which M. Robin described it in a former edition of his work.

M. Spring * found in the eggs of a fowl, a fungus with which he performed sixteen experiments, including a portion of the mycelium in glass tubes, and watching the

* Trans. Roy. Soc. Ed. 1842, vol. xv. pl. ii. pp. 277, 294.

† On the Adulteration of Food, p. 155, 1855.

‡ Rayer et Montagne, Journ. de l'Institut. Paris, 1840, p. 270.

§ Spring, Sur une Mucédinée, &c. Bulletin de l'Academie Royale, des Sciences de Belgique, Brux. 1848. t. xv. p. 486.

‖ Quoted by Robin, "Des Veg. Parasites, &c.," p. 547.

development. The original mycelium he named *Periconia ramosa.* In the two first experiments the plant did not grow; in the third, a form appeared which he called *Periconia pulverulenta*; a second form in the same tube he named *Asp. incrassatus*; in the fourth appeared *Asp. glaucoides*, and a Sporotrichum; in the fifth *Himiscyphe trizemina;* and in the remainder one or other of these forms, as well as some new ones, which he names *Mucor oogenus, Sporotrichum sulphuroides, Aspergillus heterocephalus*, and *Penicillium glaucum.* The whole of these forms M. Spring regards as mutable conditions of the same species, to which M. Robin gives the name of *Dactylium oogenum.* Why so much nomenclature expended upon *one species?*

Oidium albicans, Ch. R., appears, like the foregoing forms, to be produced only under vitiated conditions of the body; in aphtha, which occurs usually in badly nourished children; in muguet, which appears to be only an exaggerated form of the same affection; and in croup. In the latter disease I have found it occupying the whole surface of the trachea and larger bronchi.

Oidium Tuckeri, which causes such havoc in the vineyards on the Continent, does not greatly differ from the last form, and is possibly only a variety of the same fungus. (See *Harris on Oidium Tuckeri.* London, 1853. Third edition.)

Botrytis Bassiana, BALSAMI, is one of the fungi which have proved so fatal to the silk-worm, upon which it grows luxuriantly when these insects are unhealthy, and can be produced to almost any extent by placing them in damp and ill-ventilated rooms. I have said that the Botrytis is *one* of the species which infest these insects, for it is clear from the elaborate and beautiful figures of Robin (pl. vii.), that Aspergillus is also one of their enemies. It is evident also, on comparing this plate with figs. 3–8, pl. vi., that two distinct species and genera are included under the same name of *Botrytis Bassiana.*

Of the genus Leptomitus a number of species have been described by Robin, as, for instance *L. Hannoveri*, Ch. R., found by Hannover in the œsophagus,* and on the tongue during various febrile affections of an adynamic form, in delirium tremens, apoplexy, &c., and also in the urinary passages.

* Robin, op. cit. pl. ii. figs. 11, 12.

Robin remarks that, owing to the similarity between this and the fungus of *Porrigo lupinosa*, Mayer thought them identical, an opinion which he holds to be erroneous, and he condemns the tendency shown towards classing plants together by mere form alone. Whilst we admit the justice of his remarks in this respect, we cannot but feel how much more objectionable is the opposite practice of raising to the rank of species, plants which are simply imperfect or variable forms of another species, and this, too, in cases where the form of the plant is the sole guide, and without any reference to its ultimate development. This tendency is, we think, eminently displayed in the description of the genus under consideration, in which six *species* are recorded from various localities, as the œsophagus, the epidermis, the eye, &c. In none of these has any fructification been observed, and they have no peculiar or distinctive characters; for exactly the same forms are seen in the development of the Achorion, and Robin himself figures specimens of other species in which I fail to find any material difference either in the description or plate. They appear to be considered specifically distinct merely from the fact of their inhabiting different situations, certainly not a satisfactory mode of classification. In the ranks of those arising from common species, we may probably also place the fungus growing on the gold fish (Robin, pl. ii. fig. 1), as well as a number of others figured by the same author, as, for instance, one from the eggs of *Coluber natrix*, *Leptothrix insectorum* (pl. iv. figs. 1, 2), *Enterobryus Juli terrestris* (pl. iv. figs. 5, 6), and various species of Moulineia (pl. vi., figs. 9–11). In addition to these, many others forms might probably be added, but it is impossible to speak of them with any degree of certainty, unless they were fully developed, and had their sporangia entire.

Mr Berkeley remarks, that "no fungus, however curious its external appearance may be, should be regarded as of generic value unless fructification be present. This principle alone will dispose of a multitude of supposed species."* *Sporendonema muscæ*, Fries, is thought by the above-mentioned author to be merely an incipient stage of another fungus. The description given by Robin would make it an initial form of Aspergillus, and this I have found perfectly de-

* Introd. to Cryptog. Bot. p. 266.

veloped upon dead flies at the extremity of the underground quarry at Burdiehouse.

In conclusion, I would remark, that I have several times repeated the above-detailed observations, and that the results have been invariably the same. The observations were made with great care, and no opinion has been advanced without repeated verification of the facts adduced. Should the experiments be deemed by any to be inconclusive, I can only wish that they may be repeated and put to the test.

EXPLANATION OF PLATE.

PLATE V.

Fig. 1. Spores from a favous crust.
2. Do. forty-eight hours after being placed in a saccharine solution.
3. The same after three to seven days.
4. The same after nine days; commencement of budding.
5. The same after a month; the tubes contain oval cellules.
6. Mycelium of the same age as the last; some of the tubes containing cellules; others having granules in their interior.
7. Mycelium four days older than the last; contains both cellules and granules.
8. The fungus arrived at its full development thirty-six days after the immersion of the spores.
9 and 10. Sacculated and moniliform tubes, containing spores. Spores in process of germination.

II. *On the Properties of* Lolium temulentum. By John Lowe, M.D.

After noticing the physiological effects which have been ascribed to the action of Darnel, the author remarked that there exists a great want of information as to the amount of the seed requisite to produce these results. From all that has been written on the subject, it would appear as if the virulence of the herb varied in different localities. A series of experiments was given in detail, showing that Darnel grown in the Edinburgh Botanic Garden produced no effect when taken in dozes of half an ounce. The observations of Professor Christison on the *Œnanthe crocata* show an analagous result, this plant being a virulent poison when grown in England, but innocuous in Scotland. A similar example is seen in the *Cannabis indica*, which only yields its gum-resin when grown in a hot climate. Further experiments are required with regard to *Lolium*. The difficulty experienced in obtaining the pure seed has prevented the above series from being extended further, but it is hoped that others will make further observations in different parts of Scotland.

III. *Further Observations on Dust Showers.* By George Lawson, Ph.D.

After some preliminary observations, referring to the views adopted in his previous paper on this subject, Dr Lawson laid before the Society a letter from Dr J. O. M'William, R.N., in which that gentleman remarks:—"In your paper on dust showers, you allude to the sand showers described by Humboldt and by Ehrenberg, as occurring near the Cape de Verd Islands, when the decks of ships navigating the ocean became covered with sand. While I was at Boa Vista, the easternmost of the Cape de Verd group, during the months of April, May, June, and part of July 1846, I had ample opportunity of witnessing these phenomena. In my meteorological register, which includes observations three times in the twenty-four hours, of the barometer, thermometer, the dry and wetted bulb thermometer, the temperature of the sea, the force and direction of the wind, and the character of the clouds, I find that in April 1846 the atmosphere is recorded as hazy, and filled with sand *ten* days; in May, eleven days; in June, five days; and during the first ten days of July, three days. As a general rule, when these sand fogs prevailed, the north-east trade winds were blowing with more than usual force; they sometimes lasted for three or four days without any intermission. At the period of their prevalence, the sand heaps which abound in this barren, parched, volcanic region, are drifted about from the windward to the leeward side of the island, filling the hollows in the plains, and, sometimes in the course of a few hours, obliterating all traces of pathways, and thus bewildering the newly-arrived traveller. I was in the leeward side of the island when the first sand shower occurred, and the residents differed in opinion as to its source, some saying that it came from the beach and sand-hills on the windward side of the island; while others more correctly, as I consider, attributed its origin to the African desert. I had soon an opportunity of ascertaining that they did not originate on the island itself, for I witnessed a sand shower of considerable density over the sea to *windward of the island, between which and the African coast* *no land intervened*, and I therefore came to the conclusion that that coast was its source."

The following letter, addressed by the Hon. C. A. Murray, H.M. Envoy to Persia, to Sir Charles Lyell, has appeared in the *Literary Gazette* :—

"My dear Sir Charles,—We have lately witnessed here a phenomenon so strange, that a brief description of it may not be uninteresting to you. On the 20th instant, a few minutes before 6 P.M. (which is here about an hour before sunset), I was sitting with my mirza reading some Persian letters, when on a sudden I became sensible of an unusual obscuration of the light on the paper. I jumped up, and, on going to the window, saw a huge black cloud approaching from the north-west, exactly as if a pall were being drawn over the face of the heavens. It must have travelled with considerable rapidity, for in less than three minutes we were enveloped in total darkness, a darkness more intense than an ordinary midnight when neither stars nor moon are visible. Groping my way amidst chairs and tables, I succeeded in striking a light, and then feeling assured that a simoon of some kind was coming on, I called to my servants to come up and shut the windows, which were all open, the weather having been previously very sultry. While they were doing so the wind increased, and bore with it such a dense volume of dust and sand, that before they could succeed in closing the windows the room was entirely filled, so that the tables and furniture were speedily covered. Meanwhile a panic seized the whole city; the Armenians and other Christian sects rushed through the gloom to confess and pray in the churches; women shrieked and beat their breasts in the streets; and the men of all classes prostrated themselves in prayer, believing that the end of the world had arrived. After a short time the black darkness was succeeded by a red lurid gloom, such as I never saw in any part of the world, and which I can only liken in imagination to the effect that might be produced if all London were in conflagration in a heavy November fog; to me it was more striking (I may almost say fearful) than the previous utter darkness, and reminded me of that 'darkness visible' in which the poetic genius of Milton placed the demons and horrid shapes of the infernal regions. This lurid fog was doubtless occasioned by the rays of the western sun shining obliquely on the dense mass of red sand or dust which had been raised from some distant desert, and was borne along upon the blast. I inclose you a specimen of the dust. The Arabs here think that it came from the Nejd. The storm seems to have travelled in a circular direction, having appeared first from the south, then south-west, then west, then north-west. After about two hours it had so far passed away, that we were able to open the windows again and breathe the outer air. It cannot have been a simoon, for during those which I have experienced in Arabia and Egypt the wind is hot and stifling. On the 20th the wind was high; but only oppressive from the dense mass of dust that it carried with it.—I remain, &c.,

"CH. A. MURRAY."

Professor J. Quekett, of the Royal College of Surgeons, having examined the specimen of red dust from Bagdad, which accompanied Mr Murray's letter, states that he could detect, under the microscope, only inorganic particles, such as quartz sand, in the dust. There are no relics of Diatomaceæ apparent; and, though a small portion of calcareous matter was present in the sand, yet he could observe no microscopic shells or other organic matter.

The results of this examination accord with those arrived at by Dr Lawson respecting the sand shower at Corfu.

IV. *Analogy between the Serial Arrangements of the Leaves of Plants and Crystalline Forms.* By WILLIAM MITCHELL. Communicated by Professor BALFOUR.

Having, some time ago, had my attention drawn to the series expressing the spiral arrangements of the leaves of plants, and more recently to the same series as regulating the scales of cones, I was led to inquire whether a similar relation might not be found to exist among crystalline forms. The result of this inquiry will form the subject of this short paper.

The series for plants, as given in Professor Balfour's Class-Book of Botany, and here extended a few terms, is

$$\frac{1}{2}, \frac{1}{3}, \frac{2}{5}, \frac{3}{8}, \frac{5}{13}, \frac{8}{21}, \frac{13}{34}, \frac{21}{55}, \frac{34}{89}, \frac{55}{144}, \text{ \&c.}$$

If $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}$, represent any three consecutive terms of this series, then $\frac{a+c}{b+d}=\frac{e}{f}$ will express their relation.

If the alternate terms are arranged in two series, we have

$$\frac{1}{2}, \frac{2}{5}, \frac{5}{13}, \frac{13}{34}, \frac{34}{89}, \text{ \&c.}$$

$$\frac{1}{3}, \frac{3}{8}, \frac{8}{21}, \frac{21}{55}, \frac{55}{144}, \text{ \&c.}$$

And if $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}$, denote, as above, any three terms of either of the two series, then $\frac{a+e}{b+f}=\frac{c}{d}$ will express their relation.

I shall now endeavour to show that this relation holds exactly throughout the different systems of crystals.

To begin with the cubic system—the *tetrakis-hexahedron* is considered a simple crystal, and is bounded by 24 equal and similar isosceles triangles. When referred to 3 axes of co-ordinates, its symbol, according to the notation of Naumann, is $\underline{\infty\mathrm{Om}}$, or $\underline{\infty\mathrm{m}1}$, which signifies that the planes or faces of the crystal cut the three axes respectively at the distances $\underline{\infty}$, $\underline{\mathrm{m}}$, $\underline{1}$, where the variable $\underline{\mathrm{m}}$ may be any whole number or rational fraction.

Every different value of $\underline{\mathrm{m}}$ would yield a tetrakis-hexahedron of correspondingly different dimensions, but the values hitherto observed in nature, arranged in the order of their magnitude, form the following series:—

$$1,\ \tfrac{5}{4},\ \tfrac{4}{3},\ \tfrac{3}{2},\ 2,\ \tfrac{5}{2},\ 3,\ 4,\ 5.$$

At first sight, no regular law seems to connect the terms; but writing the whole numbers in a fractional form, we have

$$\tfrac{1}{1},\ \tfrac{5}{4},\ \tfrac{4}{3},\ \tfrac{3}{2},\ \tfrac{2}{1},\ \tfrac{5}{2},\ \tfrac{3}{1},\ \tfrac{4}{1},\ \tfrac{5}{1},$$

which now exactly agrees with the formula $\frac{a+e}{b+f}=\frac{c}{d}$.

Again, taking the co-efficients of the *octahedral* or rhombic axes corresponding to each of the preceding forms, we find the series to be

$$\tfrac{1}{2},\ \tfrac{5}{9},\ \tfrac{4}{7},\ \tfrac{3}{5},\ \tfrac{2}{3},\ \tfrac{5}{7},\ \tfrac{3}{4},\ \tfrac{4}{5},\ \tfrac{5}{6},$$

which observes precisely the same law.

Another solid in this system, to which Naumann gives the symbol $\underline{\mathrm{nO}}$ or $\underline{\mathrm{n}11}$, affords the series—

$$\tfrac{5}{4},\ \tfrac{4}{3},\ \tfrac{3}{2},\ \tfrac{8}{5},\ \tfrac{5}{3},\ \tfrac{7}{4},\ \tfrac{2}{1},\ \tfrac{3}{1},\ \text{\&c.}$$

and this, as well as that for the corresponding octahedral axes, agree with the given formula.

The forms expressed by the general symbol $\underline{\mathrm{mOm}}$ give the series

$$\tfrac{1}{1},\ \tfrac{4}{3},\ \tfrac{3}{2},\ \tfrac{2}{1},\ \tfrac{9}{4},\ *\ *\ *\ \tfrac{3}{1},\ \tfrac{4}{1},\ \text{\&c.}$$

the asterisks indicating that I am not aware if the intermediate values have yet been observed to occur in nature.

Passing on to the pyramidal system of crystals, we find for $\underline{mP\infty}$ the series

$$\frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{1}{1}, \frac{3}{2}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}, \frac{5}{1}, \text{\&c.}$$

in which the relation is also $\frac{a+e}{b+f}=\frac{c}{d}$.

In $\underline{\infty Pn}$ we have

$$\frac{8}{7}, \frac{7}{6}, \frac{6}{5}, \frac{5}{4}, \frac{4}{3}, \frac{7}{5}, \frac{3}{2},$$

and in $\underline{mP}$,—

$$\frac{1}{7}, \frac{1}{5}, \frac{2}{9}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{3}{5} \quad * \quad * \quad * \quad \frac{3}{2}, \frac{2}{1}, \frac{5}{2}, \frac{3}{1}, \frac{4}{1}.$$

Next, we take an example from the rhombohedral system, and find in $\underline{mR}$ the series

$$\frac{1}{8}, \frac{1}{7}, \frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{2}{7}, \frac{1}{3}, \frac{2}{5}, \frac{1}{2}, \frac{3}{5}, \frac{5}{8}, \frac{2}{3}, \quad * \quad * \quad * \quad \frac{3}{2}, \frac{5}{3}, \frac{7}{4}, \frac{2}{1}, \frac{5}{2}, \frac{3}{1}, \frac{7}{2},$$
$$\frac{4}{1}, \frac{5}{1}, \frac{11}{2}, \frac{6}{1}, \frac{7}{1}, \frac{8}{1}.$$

Lastly, let us take three examples from the prismatic system, as the oblique prismatic systems give similar series:

In $\underline{m\bar{P}\infty}$, we find

$$\frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{1}{1}, \frac{3}{2}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}.$$

In $\underline{m\breve{P}\infty}$,

$$\frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{1}{1}, \frac{4}{3}, \frac{3}{2}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}, \frac{5}{1}, \text{\&c.}$$

And in $\underline{mP}$,

$$\frac{1}{8}, \frac{1}{7}, \frac{1}{6}, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{1}{1}, \frac{4}{3}, \frac{3}{2}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}, \text{\&c.}$$

The most of the foregoing numbers I have found very conveniently arranged in a small but comprehensive treatise on Crystallography by Professor Tennant and the Rev. Walter Mitchell, lately published in Orr's *Circle of the Sciences;* and as here applied, it will be seen that they conform to the law expressed by the formula $\frac{a+e}{b+f}=\frac{c}{d}$.

In combination, the several members of each series have their faces in the same zone-circle, and form parallel edges of combination; and this taken in connection with the similar adherence to *position*, evidenced by the series for plants, would seem to indicate the action of polar forces in the production of similar forms in both the vegetable and mineral kingdoms. Besides, may we not infer, from the serial law, here shown to be common to both, that a series of nodes in plants corresponds to a series of similar crystalline forms, and dissimilar appendages of the plant to dissimilar crystals? At least the subject seems worthy of consideration, and might lead to still closer analogies, illustrative of unity with diversity, which we already know to be a distinguishing characteristic of the works of God.

9th July 1857.—Professor FLEMING, President, in the Chair.

The following donations were announced to the Society's Herbarium and Library:—

From Miss Robertson—A parcel of European and Indian Plants.

Rev. H. Macmillan—Specimens of *Chroolepis Arnottii*, Hook., from Yews at Cleish Castle.

Mr John Nowell—Specimens of Jungermanniæ from Yorkshire.

The Warwickshire Natural History and Archæological Society, their Twenty-first Annual Report.

Professor Balfour stated that the following donations had been made to the Museum at the Royal Botanic Garden:—

Professor H. D. Rogers, Boston—Specimen of *Gossypium* sp., furnishing cotton and fibre from the bark; Seeds used for making oil-cake; Refuse of Cotton, and Seeds used as a manure; Acorns of White and Chestnut leaved Oak from the same tree.

Mrs Laycock—Fruit of Palm.

Mr John Pollock—Philadelphia Moss, incrusted with calcareous matter, from Falls of Niagara.

Dr Harvey—Cone and Wood of the *Pinea de Terra.*

Rev. Zerub Baillie—Leguminous Pods and Seeds.

Professor Balfour exhibited specimens of *Bryum pallescens*, collected by Mr W. Wilson, near Warrington. He observes:—"I never gathered it before, and have reason to think it a rare British species. I believe it grows on the Ochils; but somehow my friend Dr Lyell never obtained satisfactory specimens for me."

Dr George Lawson exhibited a series of photographs of microscopical objects, by Mrs Colonel Spottiswood, Benares, including spiral cells of *Collomia*, scales of *Elæagnus sporangia*, and spores of ferns, sections of various woods, &c. Dr Lawson also exhibited specimens of *Peucedanum Ostruthium*, collected by Mr Peter Mackenzie, near West Plean, Stirling, where he had known the plant for nearly thirty years in a perfectly wild state, having the appearance of a bed of gout-weed.

The following papers were read:—

I. *Notice of Cryptogamic Plants found near New Abbey.* By Rev. Hugh Macmillan.

While residing for a few weeks, during May 1857, at New Abbey—a well-known district in Kirkcudbrightshire—I gathered several rare and interesting cryptogamic plants among the surrounding woods, which it may be useful to notice briefly, as a small contribution to the stock of knowledge already accumulated with regard to the distribution of these obscure plants in this part of the kingdom. I was particularly struck with the immense profusion of *Parmelia Borreri* and *Parmelia tiliacea*, two of our rarest and most interesting lichens. They occurred on almost every tree—pines, oaks, and ashes indiscriminately, sometimes even to the complete exclusion of the common species, such as *P. saxatilis* and *pulverulenta*, which usually monopolize their bark. I found them, also, occasionally spreading in large patches over rough boulders of the characteristic grey granite of the district—a matrix on which they are seldom observed to develop themselves. They very rarely fructified; yet I gathered here and there a few specimens of both species covered with fine apothecia. I am not aware that the *Parmelia Borreri* has ever previously been gathered in Scotland; and the only Scottish station recorded for the *Parmelia tiliacea* was the battlements of Brodick Castle, in the Island of Arran. In order to facilitate the discovery of these lichens by those who may deem it worth their while to search for them in the locality I have indicated, I may mention more particularly that they occur in a little wood, with a stream running through it, at the base of Criffel, a lofty mountain, rising up immediately behind New Abbey. They also occur in Shambelly Wood, along with immense quantities of *Parmelia caperata* and *perlata*, *Sticta limbata*, *fuliginosa*, and *scrobiculata*, and *Opegrapha elegans*, which affects most of the smooth-barked trees, and is particularly beautiful and luxuriant on the hollies. *Hypnum Crista-*

Castrensis is very abundant on mossy boulders, in damp shady places in the same wood; and *Parmelia sinuosa* occurs sparingly on the exposed rocks at the top of the wood; while *Neckera pumila* spreads in large patches over the oak and beech trees, amid dark masses of *Jungermannia tamariscifolia*. Upon the whole, I may safely say, there are few districts in Scotland richer in rare and interesting cryptogamic plants.

II. *On the Occurrence of* Pertusaria Hutchinsiæ *and other rare Lichens, on the Breadalbane Mountains.* By ALEXANDER C. MAINGAY.

III. *Notice of Localities for some of the rarer Plants collected during the recent Excursions of the Botanical Class around Edinburgh.* By Professor BALFOUR.

Draba muralis, rocks at Corra Linn, Lanarkshire (Mr M'Taggart Cowan). *Poterium Sanguisorba*, Eildon Hill (Mr Gorrie). *Carum Carui*, near Cleghorn Junction, and about two miles from Burntisland inland road. *Carex limosa*, near Melrose (Mr T. Ainslie). *Ophioglossum vulgatum*, near Ford (Mr Gorrie).

IV. *Remarks on Certain Glandular Structures in Plants.* By GEORGE LAWSON, Ph.D.

The author of this paper, after briefly alluding to Meyen's researches on vegetable secretion, stated that the advancement of our knowledge of this subject had not kept pace with other branches of vegetable physiology, for it was very much in the same position as Meyen left it twenty years ago. He then referred to Dr Carpenter's views as expressed in the new edition of his *Principles of Comparative Physiology*, and especially called attention to the following statement of that author: "Besides that separation of effete matters (in animals) from the blood, for the purpose of maintaining its purity, which is usually distinguished as excretion, we find that certain products are elaborated from it for special purposes in the economy; and it is to the process by which this is accomplished that the term secretion, in its more restricted sense, is applicable. But even this has scarcely any parallel in the vegetable kingdom. For although there is a large class of substances which are commonly designated as ‘vegetable secretions,’ yet these are not poured out upon the surface nor into the cavities of the plant, but are stored up in its constituent cells, of which they form the characteristic contents; and thus they bear the same relation to it as the oleaginous contents of the fat cells, or the calcareous deposit in the cells of shells, &c., bear to the animal organism.” Dr Lawson pointed out many instances in which the secretions of plants *were* poured out upon the surface and into the cavities of the plant, and not stored up in its constituent cells; and referred particularly to the glands of Rubiaceæ, Galiaceæ, Aurantiaceæ, Passifloraceæ, &c., specimens of which were exhibited under the microscope. Dr Lawson then observed:—The next remark which I wish to make in regard to vegetable glands has reference to the homological character of these bodies. The statement that glands are modified epidermal cells long remained unquestioned. Some years ago Dr Weddell discovered peculiar glands in Cinchonaceæ, and the results of his observations, as well as of my own on the similar glands of Galiaceæ, were detailed to the Society. (*Ann. Nat. Hist.*, ser. 2, vol. xiv.; *Trans. Bot. Soc.*, vol. v.) The homological character of these glands were not then referred to; for, when viewed in connection with the glands of Sundew and some other plants, their structure did not appear explicable on the supposition that they were formed of epidermal cells. Since my former paper was published, an extended series of observations on vegetable glands, and especially on the stipules of plants belonging to the Apocynaceæ, has shown that the cinchonaceous glands, and all other forms, are, in reality, reconcilable with the idea of epidermal origin. The cinchonaceous gland consists of two kinds of cells,—viz., those forming the central cone of tissue, which represent ordinary leaf tissue, and those forming the outer layer of the gland, which may be regarded as the epidermal cells transformed for secretion. The gland is, in fact, the homologue of the leaf,—a leaf very much reduced in size, as stipular leaves usually are, and with its epidermal cells changed into secreting ones; and it closely resembles in structure the stipules of Dipladenia, which no one can regard as being other than reduced leaves. When we see a gland thus formed by a cone of tissue elevated above the general surface of the organ to which it is attached, with its whole epidermal surface consisting of secreting tissue, we can readily understand how an epidermal gland can also be formed in the tissue of the plant, by simply introverting the epidermis. In this way the remarkable ovarian glands of endogenous plants are explained, and probably also the imbedded glands of the orange, the latter bearing the same relation to the cinchonaceous gland as the conical receptacle of the strawberry does to the hollowed-out receptacle of the fig. The ovarian glands of endogens are especially deserving of attention on this point, for we find them to be of very frequent occurrence; and in cases where three or more carpels are united into one fruit, these glands always occupy a position corresponding with the points of union of the carpels. Irrespective of histological characters, the glandular tissue is seen in these cases to be necessarily formed by the contiguous layers of epidermis where the two surfaces of the carpels are brought into contact.

V. *On the Development of the Yeast Plant.* By John Lowe, M.D., F.B.S.E., &c. &c.

One of the very few writers of the present day who coincide with Kützing in recording this plant as an alga is M. Robin, who, after describing the gemmation of the cells, says, "We only know of this mode of the plant's propagation; its aërial fructification has not been seen, and cannot be seen, because it (the plant) dies on coming into contact with the atmosphere. This plant is in fact an alga, and not a fungus."* How far this statement is correct will be shown presently.

Kützing, while he regarded the plant as an alga, looked upon it as such, in its lowest condition only, and, believing as he did, in the convertibility of species, imagined that it became exalted into a fungus.

Putting out of view the *conversion* of the plant into one of a higher order, the facts derived from Kützing's observations were correct; his deductions alone being faulty.

No doubt can be now entertained that the yeast plant is merely a stage in the development of one or more genera and species of mucedinous fungi,—the algoid form being due to the growth of the sporules in nitrogenous fluids, by

* "Végétaux Parasites qui croiesent, &c.," p. 323, 1853. Paris.

which multiplication of the cells is encouraged, and the formation of the normal mycelium checked.

This opinion appears to have been gradually gaining ground, and is now almost universally received. Pereira was amongst the first to arrive at a true conclusion regarding the precise nature of the plant; and, apparently without having seen it in its perfect condition, he says, "it is probably a fungus in all its stages, and it is perhaps allied to Penicillium."* It remained for Messrs Berkeley and Broome to prove that the fully developed yeast plant is identical with *Penicillium glaucum.*

Dr Hassall, without identifying the genus from which yeast is derived, came very near the truth. He figures what he considers to be the yeast-fungus in a state of fructification, but the specimen does not appear to have been a perfect one.

After numerous examinations of yeast in all its stages, and after repeated experiments, I have no doubt whatever that it is produced by more than one genus and by numerous species. In a former paper, an opinion was expressed to the effect that the vegetable growths found in skin diseases were referable to two genera of fungi; and from a long and careful investigation of the subject, I feel convinced that the same fungi which produce skin disease, also produce yeast; and conversely, those which produce yeast, may, under favourable circumstances, produce skin disease.

Dr Hassall remarks, that there are three kinds of yeast employed in making bread, viz.:—brewers' yeast, German yeast, and patent yeast. "The fungus is of the same species in each."†

This, which is asserted as a fact, is by no means proved, and I believe is far from being correct; for, as I shall afterwards show, there are certainly two genera, and probably many species of those genera which are equally capable of originating the ferment. Dr Hassall, indeed, shortly after making the above statement, says, that patent yeast "appears to belong to a distinct species, but the development was not followed out."†

Brewers' yeast, when seen under the microscope, consists, or should consist, entirely of cells, spherical in form, trans-

* Materia Medica, vol. ii. part 1. † On Adulteration of Food, p. 150.

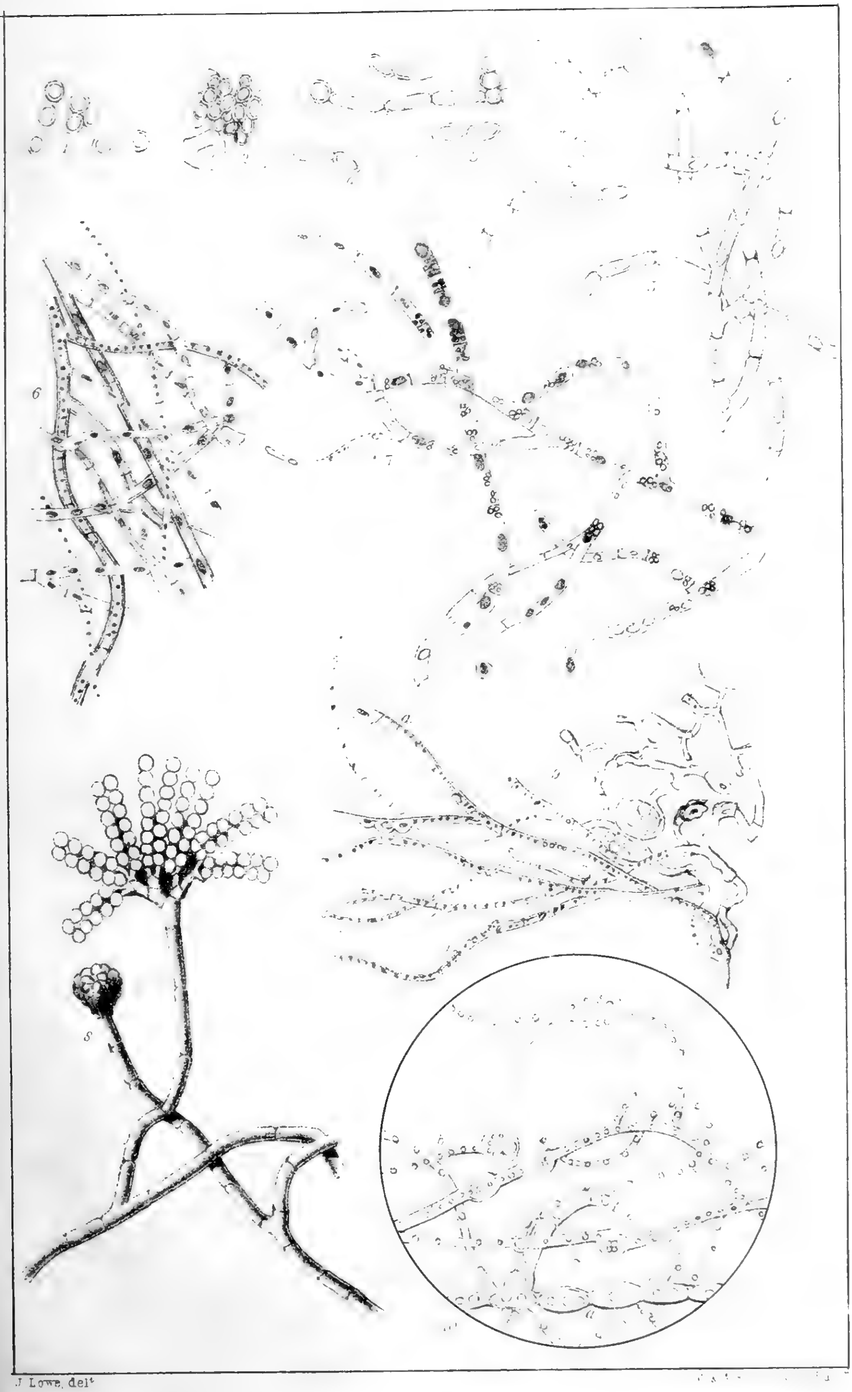
parent and nucleated, varying from 1-7500th to 1-2500th of an inch in diameter. The nuclei are highly refractive, and vary from two to ten in number. Pereira thought that there were nucleoli within them, but these I have never been able to see, although, in a certain stage of the cell's growth, the nuclei are granular, and exhibit in certain aspects a dark central spot resembling a nucleolus, but which I believe to be only an optical effect produced by the nucleus being out of focus. It appears to me that the mode of growth is altogether opposed to the idea of nucleoli being present. The nuclei were termed *globulin* by Turpin, who entertained the idea that they, as well as the globulin of the barley, were converted into yeast cells, and that they underwent a fissiparous development. Lindley confirms this view to a certain extent, by saying that he has seen the smaller granules sprout during fermentation.

After watching this phenomenon very carefully in some scores of slides, I formed the opinion that the bodies observed were not globuline, but a species of vibrio which is commonly found in all decomposing saccharine matter. Further observation has, however, convinced me that Turpin's opinion is true. At the same time, I think that there was sufficient reason for the above statement. The fact is, we have here one of those points upon which two observers may make different and opposite assertions, and yet each be correct.

I have now not the least doubt that the bodies described by Turpin as globulin have been by others described as a species of vibrio. I believe it to be, under certain circumstances, a permanent form of cell-growth; but that, under suitable conditions, this globulin or vibrio-like form will develop into a mycedinous fungus. This, however, is a point which need not here be considered, as I propose to make a few separate remarks on it at a future time. I shall therefore confine myself to the subject under consideration.

The growth of yeast has been divided by Pereira into three stages—1*st*, That in which the cells are single; 2*d*, That in which they have become elongated, and form a mycelium; 3*d*, That of aërial fructification. The first stage, or that of yeast proper, is said by Mitscherlich to consist of two kinds, viz.,—*oberhefe* (or surface yeast), and *unterhefe* (or sediment yeast). These two varieties are propagated in different ways, and each produces specific results upon the fermenting liquor. The *unterhefe* is the ferment of Bavarian beer, which is allowed to ferment very slowly, and at a low temperature. The formation of lactic and acetic acids is thus avoided. The following is a brief account of the changes which I have observed yeast to undergo in the process of fermentation at the distillery of Messrs Duncanson, and at the brewery of Messrs Jeffrey, to whose kindness I am much indebted. Before its application to the wort, yeast is seen to consist of isolated cells of a spherical form intermixed with some which are oval or tubular. These latter are only formed on the surface of the yeast where it has come in contact with the air. They are the commencing mycelium, and should never be present in any considerable quantity, as they materially affect the process of fermentation. The spherical cells are seen to be of two kinds; the one having a thin very transparent cell-wall, containing from two to ten nuclei—these are found in the yeast which has become sour, and they are usually met with at the bottom of the cask. They appear to correspond with the *unterhefe* of Mitscherlich. In specimens of yeast kept in bottles, I have found that the cell-wall became thinner and the nuclei more numerous in proportion as the fluid became more acid. The other kind of cell has a thicker cell-wall, and contains, instead of a number of nuclei, a large globular granular mass or blastema, which in older yeast is converted into nuclei. This is the most perfect form of yeast, and is the only kind which should be used. Its activity I have found to be always proportionate to the thickness of the cell-walls, and this, a most important subject to brewers, can easily be determined under the microscope, and thus the value of any specimen of yeast made apparent. After being added to the wort, yeast, which consists of the two varieties of cell above mentioned, is observed to undergo two kinds of growth. The nucleated cells with the thin walls burst and liberate the nuclei ('*globulins seminifères*' of Turpin), which then increase in size, and become like the second kind of cells. This is the form of propagation which Turpin observed in the rupture of the cells, although he makes the cell contents appear to be finely granular instead of nuclear. I am satisfied that it only takes in old acid yeast, and not, as Turpin imagined, as a result of normal fermentation; and this explains why others have failed to observe the process of bursting in fermenting yeast, for it can only be seen on the first addition of the yeast to the wort; and, moreover, in new yeast these are often altogether absent. The thick-walled cells, and the enlarging nuclei, after a period varying according to the temperature and the activity of the yeast, are observed to put forth minute bud-like processes, which soon separate and enlarge, and afterwards undergo the same process. This is the second mode of growth noticed by Turpin, and is, in fact, the only result of true fermentation. My own observations confirm those of Mitscherlich, who thinks the two modes of propagation just mentioned are the only ones, and that the conversion of "globulin" into cells is entirely erroneous. The budding was observed by Turpin to begin after an hour, and the gemmations were doubled in size in three hours; in eight they had attained the size of the maternal cell. There can, however, be no stated time for these changes, for they vary with the temperature. In distillery wash, which is worked at a much higher temperature than brewery wort, the process begins much sooner, and is sooner completed; and, as might be inferred from the fact of their rapid growth, the cell-walls are much thinner in the former than in the latter. One very important fact results from this, viz., that yeast which has been worked at a high temperature loses a considerable amount of its activity. It is, in fact, "forced," and if yeast of this kind be applied at once to work at a lower temperature, the process of fermentation will be late in commencing, and will often stop. If, however, the yeast be allowed to stand for a day or two it recovers some of its activity, but it is never so good for working at a lower temperature; and therefore, as a general rule, yeast should always be worked at a higher temperature in each succeeding operation—that is, it should, if possible, be worked in cool wort before being applied to wort which requires to be worked at a greater heat. As soon as the process of fermentation has attained its maximum, the budding begins to decline, and ceases towards the close of the operation. The cells, which were before of very variable size, now become more uniform, and the nebulous mass in their interior assumes a more definite outline, and appears to be finely granular. After remaining on the liquor for five or six days, a portion of the cells which is exposed to the atmosphere becomes oval and then elongated into tubes, multiplying still by gemmation and fissiparous division. Similar formations are also found in the sediment of the tun. This is the first stage in the formation of the mycelium, and exercises an influence of an important kind over the fermentation of the liquor. The subsequent changes consist in the formation of a mycelium composed of a network of ramifying tubes. These tubes are identical in form with those given in a previous paper, and need not therefore be again described. The perfect fructification in the specimens which I have examined is that of *Aspergillus glaucus;* but there can be no doubt, as I have before remarked, that other species and genera are also present. In proof of this, a series of experiments were made in Messrs Jeffrey's brewery, with the following results :—1*st*, a quantity of mixed Penicillia and Aspergilli (*P. glaucum*, *Asp. glaucus*, *A. nigrescens*, &c.) were placed in a gallon of wort at a temperature of 65° Fahrenheit, and allowed to stand in the tun-room. On the second day the surface was covered with specks of foam. On the third day the fermentation had fairly set in, and the surface became coated with pale yeast, which, under the microscope, exhibited oval non-nucleated cells in a state of gemmation. On the fourth day the fluid gave off a naseous "foxy" odour, which disappeared on the sixth day, when the yeast cells were observed to have become spherical, and in all respects like good yeast. On the eighth day the yeast was removed from the surface and applied to a fresh quantity of wort at the same temperature. This entered into fermentation on the first day, and exhibited all the characters of perfect yeast. The second experiment was made by placing a portion of *Penicillium glaucum* in wort, under the same circumstances as in experiment 1. The same series of phenomena ensued, ending in the production of good yeast. A third and fourth experiment were made with *Aspergillus glaucus* and *A. nigrescens*, with like results; the only difference being that the sporules produced by the latter were at the commencement larger and more spherical than in either of the other species, from which it may be inferred that this species would yield a better kind of yeast. The idea that yeast can be produced spontaneously in nitrogenous fluids, we hold to be entirely erroneous, for we see that the lower class of fungi are capable of yielding it; and, from the general distribution of these, they must be present in every kind of exposed fluid.

A subject which has not received the attention which it deserves, is the growth of fungi on malting barley. Whole floors of malt may be seen in summer time covered completely with various fungi, which grow from the interior of the grain, and ramify within the perisperm. These must have a most important influence on the saccharine matter contained in the grain; and there can be little doubt that they effect its decomposition, and cause an immense loss to the brewer. The fact that malt made in summer time is never so sweet as that made in winter, sufficiently attests to the truth of the observation. It is not improbable, where the fungus is so abundant as I have sometimes seen it, that one-third of the saccharine principle is destroyed, and the foundation laid for the inefficient working of the wort during fermentation. In conclusion, I would merely remark upon one or two cases of skin disease which I have met with in those engaged amongst the yeast in breweries. Brewers, generally speaking, are not likely subjects for the growth of parasitic plants, but I have met with several cases which seem to me to prove that these are derived from the growing yeast, and thus tend to establish the proposition laid down in my last communication regarding the origin of skin diseases. In one brewery, I met with two cases of *Lichen, Annulatus solitarius*, and one of *Sycosis*. These occurred in the only persons who were engaged amongst the yeast. I have recently met with another case of like nature, namely, of Favus occurring on a person engaged in a wine vault which was densely covered with fungi. The former were both situated on the right upper extremity—in the one case on the back of the hand, and in the other on the anterior of the fore-arm, about 3 inches above the wrist. The sore commenced as small red spots, and in eight days had attained to the size of a shilling. On examining them carefully under the microscope, a distinct mycelium was obtained, differing in no respect from



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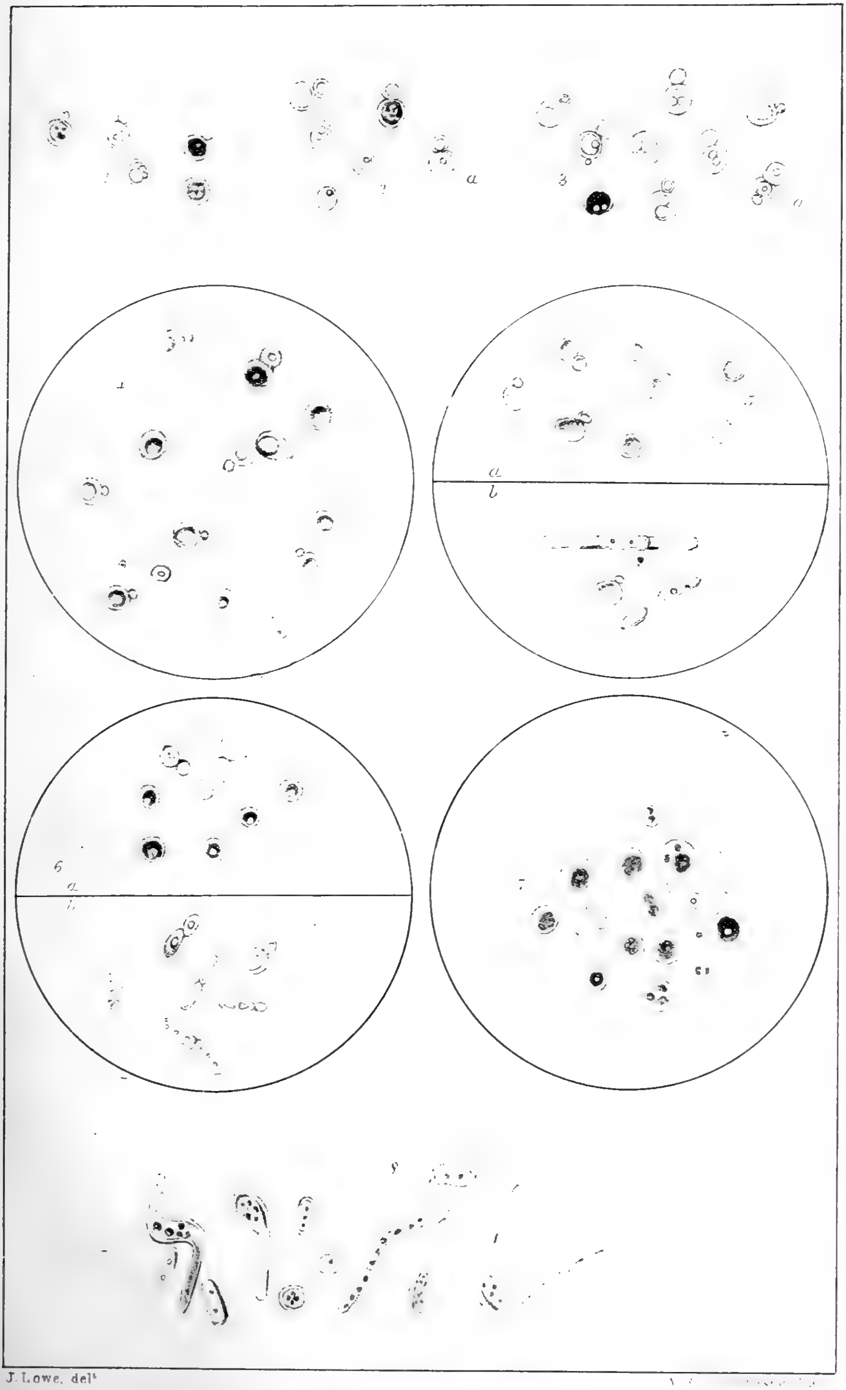

J. Lowe, del[t]

PROCEEDINGS

OF THE

BOTANICAL SOCIETY

OF

EDINBURGH.

FOR THE YEAR 1855.

EDINBURGH:
PRINTED FOR THE SOCIETY BY
DAVID GUTHRIE, 377, HIGH STREET.

MDCCCLV

ERRATA.

Page 6, line 14, for "sud," read "sub."
6, line 24, for "Aviemreo," read "Aviemore."
13, line 10 from bottom, for "Voandesia," read "Voandzeia."
13, line 29, for "in," read "for."
(For Errata in Mr More's Paper on the Flora of Castle Taylor, see p. 60.)
32, line 26, for "Polytrichum," read "Polygonum."
32, line 52, for "at," read "as."
37, line 16 from bottom, for "Vanderia," read "Voandzeia."
43, line 4, for "Rauge," read "Range."
43, after line 24, add the following note by Colonel Madden :—"Dr. Falconer has lately informed me that on specimens which occurred in Little Tibet, *four* carpels were matured, a fact which shows that the abnormal conditions of the flowers are not confined to the stamens."
49, line 21 from bottom, for "Calicium Bæomyces," read "Calicium chrysocephalum and Bæomyces rufus."
83, line 23, for "Grimmia deusta," read "Grimmia ovata."
96, line 12 from bottom, for "Spæliaca," read "Rhætica."
96, line 11 from bottom, for "Vincula," read "Venicula."
96, line 8 from bottom, for "Trebalana," read "Trebulana."
96, line 6 from bottom, for "Pharia,,' read "Phaia."
96, line 4 from bottom, for "Fivas," read "Troas."
98, line 5 from bottom, for "Simaruba," read "Simaba."
109, line 10 from bottom, for "Sorarmha," read "Jatropha."
109, line 4 from bottom, for "Sokaria," read "Souari."
110, line 1, for "Piassack," read "Piassava."
111, line 9, for "Ligusticum." read "Ligustrum."
112, line 4 from bottom, for "Blackhouse," read "Backhouse."
114, line 5, for "4°," read "-4°," and omit "and upwards."
116, line 24, for "Kay," read "Roy."
116, line 28, after "inches," insert "high."
117, line 3, for "the latter," read "all these."
123, line 14 from bottom, for "inerm," read "inerme."

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PROCEEDINGS OF THE BOTANICAL SOCIETY

FOR JANUARY 1855.

The Society met at 6, York Place, on Thursday, 11th January, 1855, Professor BALFOUR, President, in the Chair.

The following candidates were balloted for, and duly elected Ordinary (Resident) Fellows:—

OCTAVIUS JEPSON, Esq., 2, Nelson Street.
DAVID PHILIP MACLAGAN, Esq., 28, Heriot Row.
WILLIAM NICHOL, Esq., 2, Queen Street.
Dr STEVENSON MACADAM, F.R.S.E., Surgeons' Hall.
PHILIP DEMECH, Esq., 12, Hill Place.
HUGH MACMILLAN, Esq., 7, Rankeillor Street.

The following donations were announced to the Society's Library and Herbarium, viz.—Dr Balfour's paper "On certain Vegetable Organisms found in Coal from Fordel," from the Author; Mr Ondaatjee's "Observations on the Vegetable Products of Ceylon, with Suggestions for the Introduction of a few useful Plants into the Island" (two pamphlets), from the Author; Specimens of Hypnum Crista-Castrensis, from near Cupar-Fife, and of Juncus lamprocarpus, affected by Livia juncorum, from Mr Howie, St Andrews (per Mr Jenner).

Dr Balfour stated that the following donations had been made to the Museum of Economic Botany at the Royal Botanic Garden since last meeting of the Botanical Society:—

From Dr J. B. Balfour, Kilsyth, specimens of coal.

From Robert Begbie, Esq., twelve specimens of wood from Moulmain.

From Alexander Bryson, Esq., specimen of Cycadites megalophytum, Buckl.

A letter was read from Dr Senoner, Vienna, accompanying plants and papers for the Society.

Dr Balfour exhibited specimens of diseased Vines, sent by Mr James Alexander, wine merchant, Frederick Street. He made remarks on the extension of the disease throughout almost all the European wine countries, and read some observations by Mr Quarles Harris on the subject.

Dr Balfour exhibited some interesting plants which he had received from Mr Kirk, Coventry, including Potamogeton flabellatus, gramineus, and rufescens; Myriopyllum pectinatum; Chara flexilis, with the fructification on the faces of the branchlets, as well as in the axils of the leaves; Rubus Balfourianus; R. nitidus; Populus adalascenda; also specimens of a peculiarly delicate form of Pteris aquilina, Mr Kirk's remarks upon which are published in the *Scottish Gardener*, vol. 4, p 91.

The following papers were read:—

1.—*Notes on the Flora of Dumfries*, by W. LAUDER LINDSAY, M.D., Perth. —(*Scottish Gardener*, iv., p. 91.)

2. *Notice of Plants in the neighbourhood of Oban and in part of the Island of Mull*, by DAVID PHILIP MACLAGAN, Esq. Mr Maclagan's list embraced about 400 species and varieties.—(*Scottish Gardener*, iv. p. 93-5.)

Mr Evans stated that during a visit to Mull last summer, he observed Lobelia Dortmanna; Rubus saxatilis; and Œnanthe crocata, near Salen.

3. *On Plants found in Strachur, Argyllshire, and in Roxburghshire*. By WILLIAM NICHOL, Esq.—(*Scottish Gardener*, iv., p. 95-6.)

4. *On the Lichens collected on the Breadalbane Mountains and Woods*. By HUGH MACMILLAN, Esq.

5. *On Harmonious Colouring in Plants*. By Professor M'COSH, Belfast. An abstract has been published.—(*Scottish Gardener*, iv., p 96.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR FEBRUARY, 1855.

The Society met at 6, York Place, on Thursday, 8th February, 1855, Professor Balfour, President, in the Chair.

The following candidates were balloted for and duly elected Ordinary Resident Fellows, viz. :—

PHILIP BROKE SMITH, Esq., Abercromby Place.
Dr JAMES MATTHEWS DUNCAN, F.R.C.P., 55, Castle Street.
A. C. MAINGAY, Esq., 16, Salisbury Street.

Donations to the Society's Herbarium were announced from Professor Balfour and Mr Evans, the former including duplicates of rare Scotch Plants, and the latter, Orobanche rubra and others in quantity from the Island of Mull.

Dr Balfour mentioned that the following donations had been made to the Museum of Economic Botany since the last meeting of the Society:—

From Mr G. S. Blackie, specimens of brown coal from Bonn.

From Dr T. A. G. Balfour, specimens of sugar, the produce of Juglans cinerea the Butter-nut, and of the Sugar Maple.

From Wm. Murray, Esq., Monkland, specimens of Armadale and Calder Braes gas coal; the former being similar to Torbanehill, and in a like position in the strata; also Legbrannoch black band, rough band, and mussel band ironstones, from the Monkland Iron Works.

From Alex. Hunter, Esq., M.D., specimen of paper, made from the leaves of the Banana, from Madras.

From Chas. Jenner, Esq., a beautiful specimen of Sigillaria Ungeri, from the Wigan Colliery.

From Henry Paul, Esq., an abnormal specimen of Polyporus squamosus, found in a cellar at Portobello; also a piece of Honduras wood, perforated by a species of Xylophaga.

From Messrs P. Lawson & Son, cones of the following Pines :—

Pinus nobilis.
,, grandis.
,, Lambertiana.
,, tuberculata.
,, cephalonica.
,, Monticola.
,, Pinsapo.
Pinus Jeffreyi.
,, Beardsleyi.
,, Craigana.
,, Hookeriana.
,, Mac Intoshiana.
Abies Douglasii.

Also specimens of the timber of—

Pinus nobilis.
,, Lambertiana.
,, Monticola.
,, Jeffreyi.
,, Beardsleyi.
Pinus Hookeriana.
Thuja Craigana.
Taxus Lindleyana.
Pinus Benthamiana.

And Dissections of the parts of the cones, of the following species of Coniferæ :—

Pinus Mac Intoshiana
,, Craigana.
,, Lambertiana.
,, tuberculata.
,, nobilis.
,, Jeffreyi.
,, Monticola.
,, Beardsleyi.
Pinus grandis.
,, Hookeriana.
Abies Douglasii.
Taxus Lindleyana.
Cupressus Lawsoniana.
Thuja Craigana.
Cupressus Mac Nabiana.

Acorns of the Valonian Oak, and Herbarium specimen of Pinus Benthamiana.

Dr Balfour stated that models in wax of the following Fungi, made by Mr James B. Davies, had recently been added to the Museum of Economic Botany—many of which were exhibited:—

Agaricus campestris in the young and old states.
,, æruginosus.
Boletus luridus, with section.
,, edulis.
Polyporus Betulinus, (on Birch).
Cantharellus cibarius.
Hydnum auriscalpium.
Sclizophyllum commune.
Lycoperdon pyriforme.
Scleroderma verrucosum.
Helvella leucophæa.
Morchella esculenta.
Phallus fœtidus.
Tuber cibarium.
Hypoxylon vulgare,
Sphæria punctata.
Cryptosphæria pulchella, (on Birch).
Leotia uliginosa.
Geoglossum hirsutum.
Clavaria coralloides.
Ascyria punicea.
Penicillium glaucum.
Aspergillus glaucus.
Mucor caninus.
Peziza coccinea.
,, aurantiaca.
Nidularia campanulata.
Uredo Geranii (on Geranium).
Vermicularia trichella (on Ivy).
Erysiphe adunca (on Salix).
Puccinia rosæ (on Rose).
Polystigma rubrum (on Sloe).
Erineum aureum (on Populus niger).
Æcidium laceratum (on Hawthorn).
Geaster fornicatus.
Also the Red Snow Alga (Protococcus nivalis).

Dr Balfour exhibited from Mr T. Kirk, Coventry, a specimen of Cerastium triviale with the carpellary leaves partially turned inwards so as to show distinct parietal dissepiments, while the placentas were free in the centre.

The following papers were read:—

1. *Account of a botanical excursion to the Bræmar Mountains in August*, 1854, by Professor Balfour. In this paper it was remarked: "The records of botanical trips always possess a certain degree of interest, more especially to those who have taken part in them. It is seldom that a zealous botanical student visits even a well-known locality without making some observation which tends to the advancement of science. We cannot too strongly impress upon all naturalists the importance of accurately recording at the time, facts which may have been brought under their notice, however insignificant they may appear. It is only by the conjoint exertions of many labourers, both small and great, that the superstructure of science can be reared upon a sound and secure basis. Attention to minute objects is becoming of more and more importance as microscopic investigation proceeds, and the botanist of the present day who takes into account the recently added Diatomaceous department will find that this field alone will give him sufficient occupation for a lifetime. Dr Greville's report on the Diatoms collected during this Bræmar trip will, I doubt not, show you the interest connected with these microscopic organisms.

"Our botanical trip last autumn was confined to the Bræmar district, one which has often been visited by botanical parties, but which still presents unexplored treasures. It is a district interesting in many points of view, and a visit to it never fails to call forth the enthusiasm of the student. The grand mountain scenery, the peculiar localities of the plants, the fatigues and trials connected with the collecting of them, and the mode of living in a Highland district, all conspire to invest the scene with peculiar charms. We look back with singular satisfaction to our sojourns among the Scottish Alps, and our companionship is sweetened in after life by the recollection of the very hardships we underwent.

"My party last autumn consisted of the Rev. John Earle, of Oriel College, Professor of Anglo-Saxon, Oxford; Mr Barclay, Sheriff-Clerk of Fife; Dr Gilchrist of Montrose; and Mr George Lawson, our Assistant Secretary and Curator; Messrs G. C. Bell, H. M. Birdwood, E. W. Cropper, G. S. Lawson, James Miller, David Ross, M. J. Soubki, and J. G. Whitehead. We left Edinburgh by rail on Tuesday 8th August, 1854, at 9.45 A.M., and reached Aberdeen at 5.30 P.M., and we were accompanied as far as that city by

Messrs Katib and Badre, who contented themselves with examining the botany of that neighbourhood. We proceeded at seven P.M., to Banchory. Here we found that the extension of railway communication had materially interfered with our comfort, for there was not a bed to be had in the hotel. The party accordingly were dispersed in all directions, some being accommodated in lodgings, others in a sort of barn, others paying exorbitant prices for beds in a second class inn, called the Douglas Arms. The adventure taught us a lesson in regard to Banchory in future, and at the same time it initiated some into the discomforts often attendant on botanical trips.

"On Wednesday, 9th August, we rose more or less refreshed, but all eager for our work. Sending on our baggage, boards, paper, &c. by cart, we started after breakfast for Aboyne, which we reached in the afternoon. The chief plants of interest collected were Rubus cordifolius, Plantago maritima far from the sea, Goodyera repens, and Trientalis europæa. After lunching at Aboyne, we proceeded by the suspension bridge over the Dee, and walked along the southern bank of the River to Ballater, which place we reached in the evening after a very wet walk, the annoyance of which was soon dispelled by the comfortable arrangements at the inn. On our way we visited Pannanich chalybeate wells, and found in the neighbourhood, abundance of Mimulus luteus, a Chilian plant now naturalized in various parts of Britain. Near Ballater, Melampyrum sylvaticum was gathered in abundance.

"Thursday 10th August. After sending our baggage by cart to Castleton, Braemar, we started on foot at eight in the morning, and walked along the northern banks of the Dee, as far as the Balmoral Suspension Bridge, visiting on the way the singular rope bridge across the Dee at Abergeldie, and gathering a few of the rarer subalpine species of plants.

"On reaching Balmoral we were allowed to visit all the grounds, through the kindness of Dr Robertson, and we were accompanied by the intelligent gardener, Mr Paterson. The new Palace at Balmoral is being built of white granite from Glen Gelder, and is a chaste and elegant building. The flower garden is well kept, and the beautiful private walks in the neighbourhood furnish admirable views of the surrounding mountains and valleys. In the woods of Balmoral we gathered Melampyrum sylvaticum, Neottia Nidus-avis, Pyrola secunda, Vaccinium Vitis-Idæa, and abundance of Lycopodium clavatum. Wreaths of the latter we were informed were often collected to grace the Royal table. After spending a considerable time under the guidance of Mr Paterson, in seeing all the objects of interest in the vicinity of our Queen's Highland Home, we bent our steps towards the dark Loch-na-gar, full of energy and zeal, and invigorated by the alpine air. Before reaching the lake in the Corrie we found specimens of Polypodium alpestre, a Fern which extended up to the cliffs above the tarn, unaccompanied here by Athyrium Filix-foemina. We also gathered Drosera anglica. We proceeded along the cliffs of the mountains towards the deep ravine by which there is an ascent, a difficult and laborious one, to the summit. The plants observed were Lastræa dilatata in various states, Saxifraga rivularis, Poa laxa, P. alpina vivipara, Cerastium alpinum, Cornus suecica, Hieracium alpinum very hairy, Phleum alpinum, Luzula spicata, Lycopodium annotinum, Equisetum umbrosum, and Allosorus crispus, besides all the ordinary alpine species of plants. The party did not visit the cliff where Mulgedium alpinum grows. On reaching the summit of the mountain a partial mist came on, and as the day was now far spent it was necessary to make a hasty descent towards the Ballochbuy side of the hill. On the way Splachnum mnioides and Betula nana were seen. On reaching the woods we had some difficulty in finding our road, and as darkness was coming on there was no small anxiety as to some of the party who had lingered on the way. After various adventures, all the party joined the high road, and reached Castleton Braemar at half-past nine P.M., after a very long and fatiguing walk, which fully tried the powers of the party as regards endurance. All were more or less knocked up by their exertions, and it was curious to contrast the buoyancy of the morning with the complete prostration of the evening. Tea and bed at Mr Clark's excellent inn, the "Invercauld Arms," however, worked a marvellous change, and on the 11th, we started at ten for a hill called Little Craigindal, in the vicinity of Ben Avon and Ben-na-Bourd. On this mountain we were rewarded with specimens of Astragalus alpinus (very sparingly in flower), Carex capillaris, Saussurea alpina, Dryas octopetala, Potentilla alpestris, Silene acaulis, Pyrola secunda, P. minor (small state), Vicia cracca *var.* angustifolia, and many other alpines. In the wet places also many Diatoms were picked by Mr Lawson and myself.

"On the 12th August, we took a conveyance to the foot of Loch Callater, and then walked to the high cliffs in the glen, gathering Carex atrata, rupestris, stictocarpa, Saussurea alpina, Thalictrum alpinum (abundantly in flower and fruit), Salix reticulata, arbutifolia, venulosa, Lapponum, &c., many Hieracia, Lobelia Dortmanna, and Subularia aquatica, the two last in Loch Callater; also numerous Diatomaceæ, and Desmidieæ in the pools and streams. Rain and wind interrupted our progress in the after part of the day, and we were compelled to walk back to Castleton without examining the high rocks above Loch Ceandlich.

"Sunday the 13th was a day of rest alike for body and mind. We heard the Rev. Dr Cumming of London preach in the morning, and the Rev. Mr Cookson in the afternoon.

"On Monday 14th we proceeded in a large car to the back of the Caenlochan Mountains, the rocks of which we visited, gathering Carex vitilis, aquatilis, rariflora, capillaris, atrata, Erigeron alpinus, Gentiana nivalis, Sibbaldia procumbens (very large specimens), Mulgedium alpinum, Saxifraga nivalis, Veronica alpina and saxatilis, Draba incana, Dryas octopetala, Polystichum Lonchitis, Polypodium alpestre in large quantity, Poa alpina, P. nemoralis (alpine var.), P. Balfourii, Pyrola rotundifolia, Asplenium viride, Cerastium alpinum, and many other alpines. After examining the rocks in this quarter, we proceeded to the summit of a high mountain called Glass-Meal, whence we had a splendid view of all the surrounding mountains and glens. The afternoon was particularly clear, and we were enabled to see the Lomonds in Fife, and even the Pentland Hills near Edinburgh. The mountain was very stony, bare, and yielded no plant of interest. We reached the road about 3 miles from the Spittle of Glenshee, and returned to Castleton in the evening.

"Tuesday, 16th August.---The morning being fine, we purposed to visit Ben-na-Muic-Dhui, and the mountains in its vicinity. Accordingly, we started at 7 A.M., taking a conveyance as far as the Linn of Dee. Our party this day consisted of 15, having been joined by Mr Esson and Mr Rattray. After viewing the Linn, we proceeded by Glen Lui, gathering in the bed of the river fine specimens of Arabis petræa. In passing through this glen and Glen Derry, we remarked many old Fir trees, dead and deprived of their bark, and showing a beautiful spiral arrangement of their wood. We ascended the hill by Loch Etichan, which is the point reached by ponies on the way to the Shelter Stone. We got to the summit of Ben-na-Muic-Dhui between 1 and 2 o'clock, and had a splendid view of the surrounding alpine scenery. The plants gathered on the summit were---Carex rigida, Luzula spicata, L. arcuata, Silene acaulis, Salix herbacea, Gnaphalium supinum, Festuca ovina, var. vivipara, Lycopodium Selago, Dicranum nigro-viride, Polytrichum alpinum, Andræa rupestris, Trichostomum lanuginosum, Lecidea geographica, Cetraria islandica and nivalis, Cladonia rangiferina and furcata, and species of Gyrophora. In the vallies round Ben-na-Mac-Dhui many moraines were observed, more particularly in Glen Derry and Glen Dee. Similar moraines were seen also near Cairntoul, near Lochnagar, and in the glens leading to Ben-na-bourd and to Craigindal. On leaving the summit we descended towards the Shelter Stone and Loch Aven, gathering Carex leporina on the side of a stream which flows into the Loch, not far from large patches of snow. Here also Stellaria cerastoides and other rare alpine plants were picked. Polypodium alpestre was found in large quantity on the ascent to Loch Etichan; also in the descent to Loch Aven. After a wet walk we reached the Shelter Stone, where we intended to take up our quarters for the night, having previously sent a pony with some provisions and plaids for our comfort. The stone is a large mass of granite which has fallen from the cliffs in the vicinity. Its average length is 40 feet: it is 20 feet broad, and about 16 or 18 feet high. Its cubic contents were estimated at 500 cubic yards and its weight was calculated by Mr Birdwood at 1000 tons. Under it there is a large space which afforded good shelter for all of the party who chose to avail themselves of it. Mr Rattray, afraid of exposure, left us at 7 P.M., and reached Castleton at about 2 in the morning. The rest of the party occupied themselves in pulling abundance of the dwarf Juniper, with the view of making a fire. From the moderate allowance of viands the Commissariat required to be put under careful management. After tea *sud jove frigido*, most of the party endeavoured to get what repose they could by lying down under the stone. Some sat up all night beside the fire, fuel having been gathered in sufficient abundance to keep it burning till breakfast time.

"On Wednesday 16th August, after making a hearty breakfast in a very rustic style we ascended Cairngorm, gathering abundance of Polypodium alpestre, Luzula arcuata and other alpines. On reaching the summit at half-past nine A.M., our view was but transient, owing to the sudden coming on of mist. We descended to the cliffs which look towards the Spey. These seem to be worthy of a more complete examination, and it is probable that the best way of reaching them would be from the Aviemreo district. It would be of great importance to have accommodation on the Spey side of this mountain mass. We walked by the back of Ben-na-Muic-Dhui collecting snow mud with Diatoms, as well as numerous confervoid plants. Finally, we descended by a very steep side of Ben-na-Muic-Dhui into the valley of the Dee, visited the Wells of Dee in the valley, and found plenty of Polypodium alpestre very large, and in fine fructification. On the descent from Ben-na-Muic-Dhui, Mr Lawson found Asplenium Filix-fœmina considerably above the station for P. alpestre. Among other plants gathered were Stellaria cerastoides, Veronica alpina, Phleum alpinum and Hieracium alpinum. Rain came on in the evening, and finding it impossible to visit Cairn Toul and its Corrie, we proceeded directly by the valley of the Dee to the Linn, and thence to Castleton, which we reached about 7 in the evening.

"Thursday, August 17. Left Castleton by a conveyance which took us as far as two or three miles beyond the Linn of Dee, and along the banks of that river. Thence we walked to the upper part of Glen Tilt, and proceeded through the glen to the Bridge of Tilt. At the upper part of the glen we gathered Epilobium angustifolium, some alpine Saxifrages, Polystichum Lonchitis, Rubus saxatilis, Asplenium viride; and in the woods at the lower part of it, Melampyrum sylvaticum and Campanula latifolia. Our party were not interrupted in their progress. The road, however, through the glen is in one place interrupted by the breaking down of a bridge, and the stream is so large and rapid that it is no easy matter to ford it. We took the trouble to trace out the old road which leads to the Bridge of Tilt, and which has been so dovetailed into new roads in some places as to render it difficult of detection.

"Friday, 18th August. Leaving the Bridge of Tilt Inn, where we had been accommodated for the night, we proceeded by the Pass of Killicrankie to Dunkeld. In the Pass we found that the old road along the banks of the river had been shut up, and a padlocked gate forbade the entrance of any one without a guide. We gathered in the Pass, Lathyrus niger in fruit. At Dunkeld, we met the cart which had conveyed our baggage from Castleton, and we at once proceeded by train to Edinburgh. Thus ended a very pleasant trip, which occupied ten days, and the expense of which amounted to between L.4 and L.5 each."

The paper was illustrated throughout by specimens of the plants mentioned, and by a plan of the Flora of the districts examined.

Mr Lawson has prepared the following list of some of the more interesting Mosses observed during the trip:—

Conostomum boreale, on several spots on the Cairngorm summits, both barren and fruitful. Polytrichum septentrionale, in similar places as the preceding, near snow. P. alpinum. P. urnigerum, Balmoral. Hedwigia æstiva, Glen Callater; capsules not ripe. Hookeria lucens, Glen Callater. Hypnum rufescens H. uncinatum, Glen Callater. H. lycopodioides. H. loreum. H. rivulare, Bruch. H. Crista-castrensis, Glen Callater. We were too late in the season to get this in perfection; most of the capsules were fallen. Zygodon lapponicus, Glen Callater. Weissia acuta, Glen Callater, in great abundance, and in a fine state. Didymodon capillaceus, Glen Callater. Fissidens adiantoides, Callater. Dicranum squarrosum. Orthotrichum anomalum. O. Drummondii and O. leiocarpum, Birch trees in the Palace grounds, Balmoral Splachnum mnioides, very abundant on the footpath leading through Glen Dee, and on footpath leading from Glen Derry to Ben-na-Muic-Dhui. Andræa alpina. A. rupestris. Fontinalis antipyretica, slender form; Lochnagar. Bartramia pomiformis, var. crispa. B. gracilis, Glen Callater. B. fontana, in fruit, and, with antheridia, very abundant in the glen leading to Craigindall. Bryum pallens, Glen Callater. B. cuspidatum. B. crudum, Glen Callater. B. ventricosum, margins of streams in the glen, going to Craigindal. B. Zierii, Glen Callater. B. nutans. B. subglobosum (?), barren. B. obconicum, found on the way between Castleton and Craigindal. Only one station is given for this species in the Bryologia Britannica—viz., near Barnard Castle; but it has also been found by Mr Wilson in Wales.

2.—*Report on the Diatomaceæ* collected in Braemar in the autumn of 1854 by Professor Balfour and Mr George Lawson. By Dr Greville.

The author of this paper observed:—

"Individuals are still alive who remember the excitement produced by the discoveries of that indefatigable naturalist, George Don—discoveries of which he so long retained the exclusive distinction that it began to be doubted whether he had made any discoveries at all. In due time, however, when Scottish botany revived under the influence of the late Professor Graham and his pupils, and still more under the enthusiastic leadership of our present Professor, not only have most of the phænogamous plants added to the British Flora by George Don been again found, and in considerable abundance, but many others of equal interest. At the same time, several of the Cellulosæ attracted corresponding attention, especially the Mosses, Hepaticæ, and Algæ, and a host of new or rare species have been the result. The Lichens have been comparatively neglected; and a wide field is open to any ardent young botanist willing to enter upon it.

"It cannot be expected, that year after year botanical excursions into the Highlands should be rewarded by new acquisitions. The most lynx eyed of Dr Balfour's followers can scarcely now hope to do more than add a new station now and then for some of the rarer plants; still it is something to think of, and will always remain a source of delight to collect for one's self, plants peculiar to remote districts, and amidst the grandest scenery. Nor is this pleasure at all diminished by our having to penetrate into regions not particularly prolific in what the delicately nurtured consider essential comforts; where we must be prepared on occasions to pass the night under a stone, or to be initiated in the right construction of a Heather bed; to learn the mystery of brewing tea at the bottom of a kail-pot, and to assemble 4000 feet nearer the sun, by the time many a man, who fancies himself an early riser, is taking his breakfast in our large cities.

"Within the last few years a new field of inquiry has been opened to the botanist. Recent investigations have led to the separation of a large number of those minute organisms which Ehrenberg included in his magnificent work on infusorial animals. Kutzing and other continental writers regard them as unquestionably of a vegetable nature; and the subject has been taken up in the same point of view by the Rev. William Smith, now Professor of Natural History in the Cork College, who has published the first volume of an admirable work on the British species. His figures—far more accurate than any which had previously appeared, render the investigation of those microscopic forms comparatively easy, and the Diatomaceæ, as the family is called—are likely to become as popular as any others in the vegetable kingdom. They can be collected with the greatest facility by the travelling naturalist, a supply of small bottles, and a spoon for skimming the surface of wet mud, being the whole apparatus required. It is true that he cannot ascertain the value of his collections, or gatherings as they are generally called, unless he can enjoy the leisurely use of a good microscope; but he has the comfort of knowing that his siliceous treasures are indestructible; that he is almost certain to secure something good if not new; and he enters upon the examination of them at any future time, with much the same feeling that the collector of marine productions overhauls the mass which his dredge has brought up from the mysterious depths of the sea. In this department, then, the active botanist may hope to be rewarded by the discovery of novelties for some years to come.

"During his excursion to Braemar in the course of last autumn, Professor Balfour did not neglect the Diatomaceæ. He and Mr Lawson filled a goodly array of bottles with materials collected at a high elevation, where patches of snow are always to be found on the higher Grampians, down to the valleys of Braemar, Glen Callater and Glen Tilt, and I may here mention as a proof how easily such things may be preserved, that, when their supply of bottles ran short, they made use of linen rag; and it happened that several of the gatherings so brought home—looking nothing better to the naked and unlearned eye than coarse black mud—contained some of the most interesting forms.

"In Mr Smith's work, some very interesting species are mentioned as having been found at a high elevation on the Grampians, and some of them in the mud deposited by the melting of the snow on Ben-na-Mac-Dhui. Dr Balfour was kind enough to collect some of this mud, but it proved entirely unproductive.

"After cleaning and preparing the gatherings placed in my hands, I sent a portion of each to the Rev. William Smith, in order to obtain from him an authoritative determination of the new and more dubious forms, which he very kindly communicated to me. As an illustration of the care required in the examination of collections of this kind, I may mention that at the last, I observed a form which both of us had overlooked, and which proved to be an additional new species.

"The following is a general list of the species collected. It is not so extensive as might have been expected, but it is rich in interesting forms. The novelties, whether new species or otherwise, are printed in italics—

Epithemia alpestris, W. Sm.
.. rupestris, W. Sm.
... gibba, (Ehr.)
... turgida, (Ehr.)
Eunotia Arcus, (Ehr.)
... incisa, Greg.
... gracilis, W. Sm
... monodon, Ehr.
... diodon, Ehr., 3 forms.
... *Camelus*, Ehr.
... triodon, Ehr. 2 forms.
tridentula, Ehr.
... tetraodon, Ehr.

Eunotia *quaternaria*, Ehr.
Cymbella cuspidata, Kutz.
... affinis, Kutz.
... ventricosa, Kutz.
... Scotica, W. Sm.
... Helvetica, Kutz.
... *limata*, W. Sm.
... *æqualis*, W. Sm.
Amphora ovalis, Kutz.
Cocconeis Pediculus, Ehr.
Cyclotella operculata, Kutz.
Surirella linearis, W. Sm.
... biseriata, Breb.

Cymatopleura Solea, (Kuts.)
Navicula *cocconeiformis*, Greg-
... rhomboides, Ehr.
... crassinervia, Breb.
... serians, Kutz.
... firma, Kutz.
... ovalis, W. Sm.
... angustata, W. Sm.
... gibberula, Kutz.
... cryptocephala, Kutz.
Pinnularia major, (Kutz.
... viridis, (Ehr.)
... hemiptera, Breb.
... acuminata, W. Sm.
... lata, (Breb.)
... alpina, W. Sm.
... late-striata, Greg.
... radiosa, (Kutz.)
... acuta, W. Sm.
... tenuis
... divergens, W. Sm.
... stauroneiformis, W. Sm.
Stauroneis Phoenicenteron, Ehr.
... gracilis, Ehr.
... anceps, Ehr.
Synedra lunaris, Ehr.
... radians, W. Sm., with var. *b* and *c*
Cocconema lanceolatum, Ehr.
... Cistula, Ehr.
Gomphonema acuminatum, Ehr. with var. *c*
Gomphonema dichotomum, Kutz.
... tenellum, W. Sm.
... capitatum, Ehr. with var. *b*
.. olivaceum, (Lyngb.)
... intricatum, Kutz.
Meridion circulare, Ag.
... constrictum, Ralfs.
Himantidium Arcus, Ehr.
... majus, W. Sm.
... pectinale, (Dillw.)
... undulatum, W. Sm.
Odontidium hyemale, Lyngb.
... mesodon, (Ehr.)
... anomalum, W. Sm.
... Tabellaria, W. Sm.
... ? Harrisonii, var. *b* W. Sm.
Denticula tenuis, Kutz.
... obtusa, (Lyngb.)
... sinuata, W. Sm.
Fragilaria virescens, Ralfs.
Achnanthidium, flexellum, Breb.
... lanceolatum, Breb.
Diatoma tenue, (Ag.)
Diatomella Balfouriana, W. Sm.
Tabellaria flocculosa, (Roth.)
.. fenestrata, (Lyngb.)
Melosira nivalis, W. Sm.
... distans, Kuts.
Orthosira *spinosa*, W. Sm.
... orichalcea, (Mert.)

Dr Greville proceeded to notice in detail the new species, those which were added for the first time to the British Flora, and one or two others of interest.

The paper will appear at length in the Annals of Natural History, and the Society's Transactions.

3.—*On the Geological Relations of some rare Alpine plants.* By Dr GILCHRIST.

The author remarked:—

"In August, 1853, I formed one of the party which now annually employs itself, in Botanical pursuits, under the auspices of Professor Balfour. Our ground for that year was the now classic one, botanically, of Clova. While there, we had an opportunity of gathering a few of those plants, which, from their rarity and isolation, would almost warrant the inference, either that they are new creations which have not yet had time to secure possession of a wider extent of surface, or that they are aged plants which have lived their time, and, yielding to the universal law of created life, are abuot to disappear for ever from this scene of things. Not being well satisfied with either of those theories, it occurred to me that some approximation, at least, to the solution of the problem, might be obtained by an ascertainment of the nature and relations of each individual plant—a problem, no doubt, very difficult of solution, from its extreme complexity, involving, as it does, not only an accurate knowledge of the plant itself, in its living and its dead state, its anatomy, its physiology, its chemistry, but also its entire relation to whatever can modify its growth—to the soil on which it grows, to the air which it breathes, to the sun which gives it light, to the rain, dew, or snow which afford it moisture, to the electrical conditions which influence its chemico-vital affinities; in short, its relations to fire, air, earth, and water.

"I had not the presumption to attempt the solution of such difficulties, but applied myself to the more modest task (which was more in accordance with my geological tastes), of ascertaining the relations of the plants to the soil on which they grew, and my success or failure will be indicated by the following illustrations:—

"The first plant thus examined was the Oxytropis campestris, a plant, as botanists well know, rare in Britain, and confined to a single isolated locality in Clova. There it grows on a cliff facing the south in Glen Fiadh. The cliff is somewhat isolated from the surrounding rocks, by two perpendicular indentations running along the entire face of the rocks, which, as they are not the result of water, but of weathering, would indicate some change in the structure or composition of the rocks. This is at once confirmed by an examination of the rocks themselves. That on which the plant grows, and to which it is limited, is a Micaceous Schist, extremely rich in mica, of a dark colour, and rapidly undergoing decomposition. The immediately surrounding rocks are of the same general character; but the mica is greatly less in proportion to the other materials, and lighter in colour.

"The next plant which came under my notice, was the Lychnis alpina, a plant also confined to a few isolated localities. It grows on the summit of a hill, called Little Gilrannoch, at about equal distances from Glens Isla and Dole. It seems limited to about half an acre of surface. The rock is a tabular mass of compound felspar, apparently capable of resisting decomposition. While in many places, it is bare and flag-like, other portions of it present a singularly rough and irregular surface, as if the rocks had undergone fusion, previous to expulsion, small portions of it bearing a distinct resemblance to similar specimens from the so called 'vitrified forts.' The relations of this plant to the rock on which it grows, are well seen, many of the specimens growing in little crevices of the bare rock, where there is not the slightest vestige of soil, ordinarily so called. The rock coextensive with the limits of the plant, is unvaried in character. Its relations to those around could not be ascertained.

"Enjoying a similar trip to Braemar this season, (1854), I had further opportunities of pursuing the enquiry. The Astragalus alpinus, another of the class of plants of which I have been speaking, crowns the summit of Craigindal, a hill about 3000 feet in height. To the east of Braemar, we gathered specimens of this elegant little plant, in two separate localities, at considerable distances from each other, but the rocks, on which both grew, were the same, a very pure compact felspar, of which the entire hill seems to be formed.

"The Gentiana nivalis, found in Glen Isla, was also examined as to its geological relations; but, from the varying character of the rock, and the difficulty of finding the plant, so as to ascertain its exact limits, the examination was not satisfactory. A porphyritic granite, rich in felspar, associated with a dark syenite, abounding in hornblende, was the prevailing rock.

"With reference to the plants examined, two facts seem to have been ascertained: first, that each plant was limited in its range to a rock of the same specific character: second, that, in one case, at least,—the only one in which the examination could be completed—the limits of the plants' distribution, and of the rock possessing such character was identical. On the ascertainment of these two facts, the writer would base the propriety of these remarks, as well as of the question he has now to ask, whether a farther and more minute examination is not justifiable and desirable.

"It is obvious that this brings us only to the threshhold of the enquiry, for the relations of a plant to the soil cannot be determined by the external characters alone of the rock on which it grows. They may serve as indicators, as we think we have proved they do. If they do this, it is well. If they do not, it may still be well. For example, a plant may require, at least for its healthy and continued existence, a small quantity of some specific salt. One portion of an ordinary granite rock might yield this salt, or the materials for its formation, merely by undergoing a slight change in the composition of its mica, so slight as not to alter the external characters of the rock; while another portion of it, with the same external characters, might be destitute of it; and consequently, unable to sustain the plant. Again, the same plant might be found growing upon rocks specifically different, simply because the pabulum which the plant required was to be found in both, yet not in such quantity as to modify the external character of either. To conclude, in either case, that the plant had no relation to the rock on which it grew, would be manifestly erroneous.

"What we want, therefore, is not the geologist merely, but also an accomplished mineralogist. To complete the inquiry, there should be added a meteorologist and analytical chemist. Surely at our next autumnal trip Edinburgh might supply these materials.

"The botanical trips of Professor Balfour are well known; but we are afraid they are viewed by many rather as holiday rambles than as a means of bringing most important contributions to practical science. Should some such definite inquiry as that indicated form an item in the next bill of fare, it might inspire with new enthusiasm the whole party, and justify its leader in setting up a new claim to the gratitude of the scientific public."

4. *Descriptions of some New Coniferous Trees, recently introduced into this country by Mr William Murray of San Francisco.* By ANDREW MURRAY, Esq.

The expedition in which they had been procured left San Francisco under Mr W. Murray's direction last autumn, and explored a considerable part of the range of mountains which runs between the coast range and the Rocky Mountains, lat. 40°, 41°, &c., N. The new Pines which Mr Murray described were the following, viz.:—

Pinus Beardsleyi.—From the description given, it would appear that this tree has more affinity with Benthamiana than any other described species; but the cone of Benthamiana is 5 inches long, while that of Beardsleyi is only 3 inches. Its leaves are 11 inches in length, while in Beardsleyi they are only 6 inches. The sheath of the leaf in Benthamiana is an inch long, while in Beardsleyi it is short, being only an eighth of an inch. The wing of the seed in Benthamiana is much longer and larger than in Beardsleyi, and the seed itself is nearly twice as large, The timber of Beardsleyi is homogenous all through; the heart of Benthamiana is redder than the sap wood, and the sap wood runs a long way into the stem. The tree is of great beauty and size; one which was cut down measured 123 feet in height, and 44 inches in diameter at the stump. Another tree next it measured 17 feet 4 inches in circumference three feet from the ground. The stem was a very handsome column, about thirty feet to the first branch; timber good and clear. It was found on the top of the mountain same altitude as P. Jeffreyi, Monticola, and grandis, and higher than Benthamiana or Lambertiana. The Pine has been named in honour of A. F. Beardsley, Esq., who accompanied Mr Murray in his expedition.

Pinus Craigana. This is a tree which also has some resemblance to Benthamiana, as well to the preceding species (Beardsleyi). It differs from it in having the prickle of the scale pointing towards the tip instead of the base. The prickle too is strong and firm in Craigana; in Beardsleyi, it is small and weak. The apophysis or excrescence on the exposed part of the scale is much more developed in Craigana than in Beardsleyi, which has the exposed part somewhat flat, while in Craigana the upper part projects considerably over the lower. The wing of the seed of Craigana is shorter and relatively broader—the seed is nearly twice the size of that of Beardsleyi, although the cones are about the same size. The leaf of Craigana is also very distinct from that of Beardsleyi. It is much finer and not so long, while its sheath is considerably longer and more delicate. This species was found in the same mountains as Beardsleyi, but one-fourth of a mile further down, and higher up than Benthamiana. It spreads its branches wider from the stems than Benthamiana, and sheds its seed a month later. This Pine has been dedicated to Sir William Gibson-Craig, who has done so much for the introduction and cultivation of this valuable family.

Abies Hookeriana. This species is closely allied to Pattoniana introduced by Jeffrey, and figured by the Oregon Committee, but may be readily distinguished from it by the following characteristics. Both trees are of exceeding beauty; but Pattoniana is described by Jeffrey as being 150 feet in height and towering over the rest of the forest: the height of Hookeriana was only about 50 feet. The cones of Pattoniana are uniformly of a dark brown colour, while those of Hookeriana are of a light fawn, somewhat of the hue of our common Larch cone. The scales of Pattoniana are at least a third less than those of Hookeriana, they are deeply and firmly crenulated, while those of Hookeriana are not crenulated. The bract of Pattoniana is quite differently formed from Hookeriana; in the latter it commences to contract near the top, which it does not in the former. The seed and the wing of Pattoniana are both about one-third shorter than in Hookeriana, and the wing of the former has a purplish brown tinge at the top and back, while the latter is entirely fawn coloured. This species was found high up the Californian mountains, about lat. 41° N., where the ground was already covered with snow on the 16th of October.

Cupressus Lawsoniana. This was the handsomest tree seen in the whole expedition. It was found on the banks of a stream in a valley on the mountains; is about 100 feet high, and 2 feet in diameter; the foliage is most delicate and graceful. The branches spread upwards like a Spruce, and hang down at the tips like an ostrich feather—the top shoots droop like a Deodar. The timber is good, clear, and workable.

Cupressus Macnabiana. This is the same species as one sent home by Jeffrey, without a name, and distributed by the Oregon Committee in 1852. The cone is about the size of a Hazel nut, with hard scales, having a projecting umbo in the centre. It is of small growth, and fitted for shrubbery.

Taxus Lindleyana. This tree was found growing on the banks of a creek, under the shade of lofty trees. It was of considerable size; the trunk of one which was measured being 50 inches in circumference at 5 feet from the ground. The branches are exceedingly long and pendulous, and the wood extremely elastic. It is used by the savages for their bows. The berry is red, and grows on the under side of the branches. It is exactly like the berry of the Irish yew, and has one seed in each.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR MARCH, 1855.

The Society met at 6, York Place, on Thursday, 8th March, 1855. Professor Balfour, President, in the Chair.

The following candidates were balloted for and duly elected Ordinary Resident Fellows, viz.:—

William Armstrong, Esq., 5, Saunders Street.

Andrew Murray, Esq., of Conland, W.S., 1, Scotland Street.

The following donations were announced to the Society's Library and Herbarium, viz.:—Proceedings of the Berwickshire Naturalists' Club, from the Club; American Plants from Mr David Philip Maclagan.

Professor Balfour exhibited the following Donations to the Museum of Economic Botany, made since the last meeting of the Society:—

From William Rashleigh, Esq., younger of Mannibilly, Cornwall, Peculiar Fasciated Stem from Brazil, probably a species of Bannisteria; Stem of Bannisteria scandens, shewing the effect of compression; Fruit from the West Indies.

From Mrs Murray of Philiphaugh, Selkirk, Broom made from Bamboo and Palm fibres.

From Mrs Spottiswoode, section of Ægle Marmelos, Bela or Bel of India, a remedy in dysentery.

From George Keith, Esq., Northumberland Street, section of a Cedar of Lebanon from Lebanon; of an Olive from Gethsemane; and of Abraham's Oak from Hebron.

From Miss Yule, Inverleith Row, Legume, of a species of Dolichos; two specimens of the fruit of the Sand Box Tree (Hura crepitans); Whip formed from a branching Alga from South America, (Lessonia sp.)

From Charles Jenner, Esq., Preparation of the Leaf of Buxbaumia aphylla in the microscope.

From Robert Daw, Esq., three specimens of Fordel Coal, with peculiar organic bodies.

From Professor Christison, a new "Ground-nut" (Voandesia) from Bambadra, near Timbuctoo; pods of the Bambadra Tobacco plant, &c.

The following papers were read:—

1. *A Comparative View of the more important stages of development of some of the higher Cryptogamia and the Phanerogamia.* By Charles Jenner, Esq.

This paper will appear in the Annals of Natural History, and in the Society's Transactions. The following Table indicates the views taken by the author of the analogies of the various processes of reproduction in the Musci, Filices, and Phanerogamia:—

COMPARATIVE TABLE.

MUSCI.	PHANEROGAMIA.	FILICES.
ARCHEGONIUM OR SPORANGIUM.	OVARIUM.	SPORANGIUM OR THECA.
Nucleal Germ.	Placental Bud.	Axile Bud or Spore. RESTING STAGE
Sporular Envelope.	Ovular Envelopes. { *Primine.* *Secundine.* *Embryo Sac.*	Pro-Embryo.
Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.
FECUNDATION	FECUNDATION	FECUNDATION
Fertilized Embryonal Cell or Spore. RESTING STAGE	Fertilized Germinal Vesicle	Fertilized Archegonial Cell.
Confervoid Pro-Embryo.	Confervoid Suspensor.	Septate Cellular Process.
Plumular Bud.	Plumule. RESTING STAGE	Plumular Bud.
Phyllary Axis.	Phyllary Axis.	Phyllary Axis.

DESCRIPTIVE TABLE.

	MUSCI.	PHANEROGAMIA.	FILICES.
GENERAL INVESTING ORGAN.	Archegonium or Sporangium.	Ovarium.	Sporangium or Theca.
SPECIAL INVESTING ORGAN.	Sporular Membrane.	Ovular Envelopes. — Primine. Secundine. Embryo Sac.	Pro-Embryo.
GERMINAL BODY.	Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.

2. *Notes of a Botanical Tour in the Channel Islands in August*, 1854—By Mr C. BAXTER—Communicated by Mr JAMES RAE.

On arriving at St Heliers, the author first searched for Asplenium lanceolatum, which he found so abundant as to render it unnecessary to mention localities; it was growing on banks everywhere, and readily distinguished from A. Adiantum-nigrum, not only by its lanceolate fronds, but by the pinnæ being all reflexed as if by drought, a circumstance which does not occur with its kindred species.

On the grassy slopes close to St Heliers, he found Silene anglica, Brassica Cheiranthus, Delphinium Consolida. Near the second Martello tower, by the roadside, Allium sphærocephalum, A vineale, Arenaria plantaginea, Silene conica. On a sandy flat near the centre of the bay, Centaurea Calcitrapa, and Matthiola sinuata, the latter but sparingly west of the tower above Mautinel. By the roadside near St Aubins is a piece of marshy ground, producing Cicendia filiformis, Anagalis tenella Herniaria, glabra, Lotus angustissimus, Trifolium suffocatum, Samolus Valerandi, Sparganium simplex, and Alisma ranunculoides.

The locality given for Gymnogramma leptophylla, is a lane leading to "La Quart," on the St Aubins side of the bay. He found it but sparingly distributed, and not likely to hold a prominent place long, owing to so many coarse plants growing on the banks. The principal habitat of this plant is a lane leading from the bay a mile from St Heliers. The situation is dry, and the soil a light loam. Of the dried remains of fronds, very little was visible, but the stipes were very numerous, showing that the plants had been plentiful.

In a moist lane near St Aubins, he found two interesting plants, Sibthorpia europea and Isolepis gracilis. Beyond St Aubins he gathered Papaver hybridum, Linaria minor, Antirrhinum Orontium, Polycarpon tetraphyllum, Mercurialis ambigua, Centaurea solstitialis, Trifolium strictum, and Festuca glauca.

Betwixt "La Moye Point" and the "Corbierre," Mr B. met with Lythrum hyssopifolium, Peplis portula, Helianthemum guttatum, Sium augustifolium, and Scilla autumnalis. On the cliffs were Rubia peregrina, Asperula cynanchica and Asparagus officinalis. Near this was found Inula crithmoides, not in salt marshes, its assigned locality, but on the most inaccessible cliffs, and always accompanying Crithmum maritimum.

St Ouen's Bay, 7 miles from St Heliers, the most southern part of the British Isles, has rather a peculiar Flora; it is a large piece of land, apparently formed by accumulated sands, containing a piece of brackish water. The rare Centaurea Isnardi is said to grow here, but is now almost extinct. (C. Salmantica and C. paniculata have lately been discovered in the island). Orchis laxiflora, Bartsia viscosa, Erythræa pulchella, Centunculus minimus, Anthemis maritima, Euphorbia Paralias, Bupleurum aristatum, Linaria Peleserina, Orobanche cærulea, and Ranunculus ophioglossifolius, constitute the rarer plants found in this neighbourhood.

In the mild climate of Jersey very little frost is felt, consequently many of our ordinary greenhouse plants have stood for years unprotected. In the nursery grounds of Mr Saunders are fine specimens of Metrosideros, Araucaria Cunninghami, and masses of Camellias; but Mr Curtis, in his garden at Rozel, has surpassed all others in testing the hardiness of plants. The situation is a rock, with a southern aspect, overlooking the little harbour of Rozel. This has been terraced throughout, and now forms a miniature Botanic Garden of the most romantic description; numerous species of Mesembryanthemum form a grand feature in the more exposed and overhanging crags, many of them now forming immense pendant masses.

In this neighbourhood was discovered what was considered an approach to Asplenium acutum. It is not such a well marked plant as that recently discovered by Dr Allman, in Ireland. The Jersey plant is more like the Madeira form, the fronds recurved pendulous, slender, and the pinnæ acute. We may look upon it as another link between A. acutum and A. Adiantum nigrum.

Mr Rae stated that Mr Stark had received living plants of all the more interesting species found by Mr Baxter.

3 *On some gall-like appearances on the leaves of a species of Chrysophyllum from the Rio-Negro collected by* Mr Spruce. By Mr James Hardy, Penmanshiel.

These productions consist of a considerable number of deep brown, polygonal or sub-oblong spots, situated near each other on the under surface of the leaf, and occupying slight depressions. They are about one line in diameter, and are only slightly raised above the level of the leaf, and are very densely covered with a short, closely intertwined, crisp hair. From each of these, when perfect, arises a small sub-globular wart, about three-fourths of a line in diameter. These are of a pale chestnut, and are also densely pubescent, but the hair is longer, and nearly straight. The upper surface of the leaves opposite to these spots is slightly protuberant, and sometimes withered. Occasionally there is a small depression corresponding to the centre of the gall; but this is never pierced. The gall-formed portions are hollow in the centre, and in one of the largest was traced something like the smooth walls of a cell, although it was not quite free from the hairs that occupy the interior as well as the outside. Externally they appear to be closed at the apex, but this is owing to a dense coating of these hairs overlying the orifice. They appear to have been the habitation of some insect, but at present are mere empty cenotaphs. They have probably not attained their full growth, and this will account for the want of a definite nucleus. The substratum reminds one of the agency of Mites, while the central elevation is more like the work of a Gall-midge. There is a minute immature yellow scale near one of the patches, allied to *Coccus Hesperidium*, but its presence appears to be accidental.

Specimens of the leaves were shown by Professor Balfour.

4. *Extracts from a letter from* Dr CLEGHORN, *on the discovery by* Major COTTON *of the Gutta Percha plant in Malabar.* Communicated by Professor BALFOUR. In his letter, dated 13th January, 1855, Dr Cleghorn remarks:—"Three days ago Major Frederick Cotton of the Madras Engineers, made a discovery which will win for his name almost as much notoriety as that which waits on his distinguished brother. Riding through the Wynaad district a week or two since, and intent as usual on making the most of his opportunities, he discovered the Gutta Percha tree, and forwarded a specimen of the gum with a branch of the plant to me, from which it appears to be a true Isonandra. It is believed that the tree grows abundantly in the jungles of Malabar, but that is a point which can only be ascertained by diligent search. The importance of the discovery can hardly be over-rated, now that the forests of Singapore have been almost entirely exhausted. The Government will no doubt take measures to prevent the wholesale destruction of trees in the present instance, by placing them under a strict conservancy. We await further intelligence from the jungle with very deep interest."

5. *On some Plants which have recently Flowered in the Royal Botanic Garden.* By Professor BALFOUR. These plants were Tricyrtis pilosa, Boucerosia Munbyana—noticed by Munby in his Flora of Algiers, and Erianthus japonicus. The last had been sent to the Garden under the name of Nepal Sugar Cane. In regard to it Major Madden writes—"E. japonicus occurs all along the Himalaya from Assam up to Simla, growing on the northern sides of the mountains, in damp woods, and generally near rivulets, up to 7000 feet, or perhaps 7500, and is a fine species That in the Garden is as yet small. I sent the seeds to Glasnevin from Kemaon some years since, and this, I suspect, is some of their produce. It has only recently been identified as the Japan plant, and you will find it frequently noted in Griffith's Journals as Saccharum rubrum. It has, however, no saccharine qualities, and dees not merit the name of Nepal Sugar Cane."

Mr M'NAB laid before the meeting the following table of observations of the Lowest Temperatures indicated by the Register Thermometer kept at the Botanic Garden during January and February 1855—

Average lowest temperature for January 31° Fah.
Average lowest temperature for February 23°.
Average lowest temperature from 15th January to 28th February 23°.

Jan. 1	... 37°	Jan. 16	... 31°	Jan. 31	... 30°	Feb. 15	... 5°
... 2	.. 43°	... 17	... 23°	Feb. 1	... 15°	... 16	... 10°
... 3	... 43°	... 18	... 33°	.. 2	... 33°	.. 17	... 25°
... 4	... 45°	... 19	... 32°	.. 3	... 32°	... 18	... 15°
... 5	... 43°	... 20	... 29°	... 4	.. 35°	... 19	... 24°
... 6	... 44°	... 21	... 34°	... 5	... 33°	... 20	... 15°
... 7	... 46°	... 22	... 22°	... 6	... 31°	... 21	... 18°
... 8	... 33°	... 23	... 28°	... 7	... 26°	... 22	... 21°
... 9	... 22°	... 24	... 32°	... 8	... 27°	... 23	... 22°
... 10	... 33°	.. 25	.. 29°	... 9	... 28°	... 24	... 30°
... 11	... 39°	... 26	... 30°	... 10	... 29°	... 25	... 31°
... 12	... 27°	... 27	... 21°	... 11	.. 22°	... 26	... 26°
... 13	... 30°	... 28	... 23°	.. 12	... 16°	... 27	... 31°
... 14	... 28°	... 29	... 19°	.. 13	... 17°	... 28	... 35°
... 15	... 34°	... 30	... 22°	... 14	... 14°		

Mr M'Nab also called attention to the following table, forwarded to him by Mr John Reid, Orton Hall, Peterborough, Yorkshire, for the purpose of showing the severity of the frost during the 40 days storm, as noted at 7 a.m. daily.

Jan. 15	... 4°	Jan. 27	... 6°	Feb. 7	... 4°	Feb. 18	... 26°
... 16	... 6°	... 28	... 0°	... 8	... drift all day	... 19	... 22°
... 17	... 12°	... 29	... 4°			... 20	... 8°
... 18	... 4°	... 30	... 1°	... 9	... 6°	... 21	... 8°
... 19	... 14°	... 31	... 2°	... 10	... 13°	... 22	... 20°
... 20	... 6°	Feb. 1	... 4°	... 11	... 18°	... 23	... 5°
... 21	... 4°	... 2	... 12°	... 12	... 2°	... 24	... 14°
... 22	... 4°	... 3	... thaw	... 13	... 7°	... 25	...change
... 23	... 2°	... 4	... cold east wind	... 14	... 10°	... 26	... 0°
... 24	... 4°			... 15	... 18°	... 27	... 4°
... 25	... 1°	... 5	... 1°	... 16	... 16°	... 28	... 0°
... 26	... 0°	... 6	... 12°	... 17	... 12°		

Average lowest temperature from 15th Jan. t 28th Feb. 1855, 8°.
Average lowest temperarure for Feb. 1855 10°.

Register of the flowering of the first spring plants in the Royal Botanic Garden, since the breaking up of the storm, as compared with the four previous years, by Mr M'Nab:—

	1855	1854	1853	1852	1851
Galanthus nivalis	March 2	Jan. 24	Jan. 24	Jan. 28	Jan. 17
Eranthis hyemalis	,, 2	,, 26	Feb. 1	,, 31	,, 15
Knappia agrostidea	,, 2	Feb 28	,, 1	,, 31	,, 28
Leucojum vernum	,, 3	,, 15	March 21	Feb. 21	,, 20
Crocus susianus	,, 5	,, 14	,, 8	,, 3	,, 26
Sisyrinchium grandiflorum ...	,, 5	,, 14	,, 3	,, 3	,, 27
Erica herbacea	,, 5	,, 20	Jan. 28	Jan. 24	,, 16
Crocus vernus vars.	,, 6	,, 4	March 15	Feb. 18	Feb. 3
Hepatica triloba	,, 7	Jan. 20	Feb. 2		

During the middle of January, the following plants were in flower, but injured by the late storm:—Helleborus odorus; H. olympicus; H. viridis; H. atrorubens; H. niger; Tussilago fragrans.

Dr T. Bell Salter sent the following Meteorological Observations taken during the month of February, 1855, at Ryde, Isle of Wight, by Mr Barrow, and lists of plants in flower at the same place, during the months of January and February last, as observed by himself.

Barometer Readings Corrected.			Temperature of Air.							Mean temperature of dew point.	Rain.	
Mean.	Highest.	Lowest.	Mean.	Highest.	Lowest.	Range.	Mean of all highest.	Mean of all lowest.	Mean daily range.		Amount collected	No. of days it fell.
in. 29.647	in. 29.981	in. 29.231	° 31.7	° 60.0	° 18.0	° 32.0	° 37.8	° 25.9	° 11.9	° 30.8	in. 0.23	2

The mean elastic force of vapour, or that portion of the reading of the barometer due to the pressure of water mixed with the air in the invisible shape of vapour, was 0.189 inch; therefore the pressure of dry air was 29.983 inches. The weight of vapour, in a cubic foot of air, was 2.22 grains. The degree of humidity, considering complete saturation to be represented by 100, was 0.768, and the weight of a cubic foot of air, under the mean pressure of temperature and humidity, was 554.7 grains

Summary of direction of wind for the same month.

N.	N.E	E.	S.E	.	S.W.	W.	N.W.
4	12	8			2		2

Monthly List of some of the Plants flowering in the open Air in Ryde and the Neighbourhood, as showing the Character of the Climate and Season, for January, 1855.

The area comprised is bounded on the west by Wottom Creek and stream, on the south by the highest line of the Downs, and on the north and east by the sea. All bedded-out plants which have not lived through one winter in the open ground, are excluded from the list or else enclosed in brackets.

In the Wild State.—Ranunculus repens; Fumaria micrantha; Capsella Bursa-pastoris; Nasturium officinale; Sisymbrium officinale, Sinapis arvensis; Erysimum Alliaria; Viola tricolor; Lychnis dioica; Stellaria media; Cerastium triviale; Malva sylvestris; Hypericum calycinum; Ulex europæus, U. nanus; Geum urbanum; Potentilla reptans; Fragaria vesca; Hedera Helix; Æthusa Cynapium; Silaus pratensis; Daucus Carota; Scabiosa succisa; Helminthia echioides; Picris hieracioides; Apargia autumnalis; Sonchus oleraceus; Crepis virens; Taraxacum officinale; Lapsana communis; Centaurea nigra; Senecio aquaticus, S. vulgaris; Bellis perennis; Pyrethrum inodorum, P. Parthenium; Achillæa Millefolium; Veronica arvensis, V. agrestis, V. polita, V. Buxbaumii; Linaria vulgaris; Ballota nigra; Lamium album, L. purpureum; Stachys sylvatica, S. arvensis; Prunella vulgaris; Primula vulgaris; Anagallis arvensis; Beta maritima; Euphorbia—several species; Mercurialis annua; Urtica urens; Corylus Avellana; Avena fatua; Holcus lanatus; Bracypodium pinnatum; Linum perenne, &c.

In the Garden.—Larkspur; Black Hellebore or Christmas Rose; Chimonanthes fragrans; Eschscholtzia; Erysimum Perofskianum; Alyssum; candytuft, German, tenweek, and Virginian stock; Wall-flower; Cabbage; Radish; Mignonette; Violet and Pansy; Carnation and Picotee; St John's Wort; pencilled Geranium; Coronilla glauca; Bean; double Furze; Medicago arborea; Geum; Potentilla; Strawberry and Hautboy; Roses of the China group; Kerria japonica; Escallonia macrantha and E. rubra; Laurestinus; Vallerianella; Hawkweed; Coreopsis; Chrysanthemum; double Daisy; Centaurea; [Ageratum conyzoides]; Margarite or everlasting; sweet Colt's foot; Marygold; Aster; Scabious or Sweet-Sultan; Campanula; Gillia, capitata; Arbutus; Jasminum revolutum; large and small Periwinkle; Gentianella; Veronica Lindleyana; Linaria Cymbalaria; Antirrhinum; Pentstemon and Cuphea; Hybrid Verbena: Salvia Grahami; [heliotrope;]

true Forget-me-not; Omphalodes verna or vernal Forget-me-not; Auricula, Polyanthus, and single and double Primroses; Mezereum and scented Daphne; Filbert; Cypress and arbor-vitæ; Tradescantia; Tritoma aurea; quaking grass, &c.

Remarks.—The weather, during the month just closed, has been variable. In the former part of the month it was mild, and vegetation was beginning to start into activity. Timely frosts, which set in about the 20th, have proved a salutary check, and they have not been sufficiently severe to produce any damage. They have, however, materially lessened the number of plants which would otherwise have been in bloom, and the number flowering at the close of the month is far less than at the commencement.

Monthly List of some of the Plants flowering in the open air in Ryde and the neighbourhood, as shewing the character of the climate and season, for February, 1855.

In the Wild State.—Capsella Bursa-pastoris, Stellaria media; Cerastium triviale; Ulex enropæus; Potentilla Fragariastrum; Hedera Helix; Taraxacum officinale; Senecio vulgaris; Bellis perennis; Pyrethrum inodorum; Veronica hederifolia; V. arvensis; V. agrestis; V. polita; V. Buxbaumii; Lamium purpureum; Primula vulgaris; Mercurialis annua; Corylus Avellana, &c.

In the Garden.—Black hellebore or Christmas Rose; Chimonanthes fragrans or Japan chimonanthes; white Alyssum; German, tenweek, common double and single stock; single and double wall flower; Cistus salvæfolius single and double purple violet, and Neapolitan double violet, and double and single pansy; Coronilla glauca; double furze; Medicago arborea, or moon-trefoil; roses of the China and perpetual groups; Kerria japonica or Pyrus japonica; laurustinus; double daisy; sweet colt's-foot; arbutus; Jasminum nudiflorum; large and small periwinkle; gentianella; Omphalodes verna; auricula, polyanthus, single and double primroses, and cowslip; Mezereum and scented Daphne; Garrya elliptica; filbert; Virginian cedar; Juniperus chinensis; Cupressus goveniana and common cypress; Thuja occidentalis or American arbor-vitæ; yellow crocus and purple-and-white striped crocus; double and single snowdrops; Yucca gloriosa; Tritoma aurea; &c.

Remarks.—The month just closed has been for the Isle of Wight one of unusual severity; yet, when compared with other places, it appears that we have only had about half the degrees of frost which have been recorded by the average of English observers. It has been before remarked in these monthly observations, that of all months in the year, February, in the Isle of Wight, is that which produces fewest flowers in the open air; and, for the present year, this is remarkably evident. How far the more tender plants and shrubs, which in other parts of England do not grow in the open ground, will have suffered by the frost it is yet too early to say. The perfectly dormant state of the buds, owing to the previous dry weather, is much in their favour Vegetation has now been so long in a state of repose, the drought of last summer and autumn having early checked further growth, and the season being already late, that probably, the spring will be very rapid. Indeed the impatience of vegetation to be again on the move was evinced by the buds of trees and shrubs generally, swelling, even while sharp frost lasted, and it was curious to observe that even while the ground was hard frozen, the tender leaves of the wild Arum, or lords-and-ladies, found their way through. Immediately the thaw set in, every thing at once began to start.

The publication of the following papers, read at previous meetings, was unavoidably postponed at the time:—

1. *Notes of a Tour in Switzerland.* By John Sibbald, M.D., Perth. On the 15th of August of last year, our fellow-member, Mr Blackie, and myself started from Bonn, on the Rhine, to go up that river and walk for a short time among the Alps. The first part of our journey lay between verdant terraces, rising abruptly from the banks of the river, and covered with the Vitis vinifera, bearing on its branches the raw material for the famous Hockheimer and Johannisberger but meanwhile adorning the path for the passage of "Old Father Rhine," the banks being studded now and then with pretty German villages and legend-telling

castles, the footprints of a time less favoured than our own. After reaching Maintz, we diverged from the river many times, in order to see the many interesting towns which lie scattered near its course, but still managed to reach Basel by the 31st of the month, when we commenced the, strictly speaking, pedestrian part of the tour.

We walked along the right or German bank of the Rhine from Basel to Schaffhausen, with very little worthy of note occurring except, perhaps, a few adventures in unfrequented villages, with our passports, but which can scarcely be said to be botanically interesting. By this time, however, we had ascended sufficiently high (about 700 feet) to become sensible of a coolness and harshness of climate, easily distinguished from the warmth of the sunny vales we had left. We passed through a portion of the Black Forest, with its ancient oaks, and observed numerous pine-clad hills on the Swiss side of the river. Amongst other things, near Schaffhausen, we collected the Cirsium acaule and the Dianthus superbus. Here, also, we saw the Rhine falls, the most remarkable of their kind in Europe—the river, when about 300 feet broad, rushing over a precipice 100 feet high. And here, also, an intelligent gendarme, mis-reading my passport, proceeded to insert my description in the police-office record as George Frederick William, Earl of Clarendon, Medical Student, travelling for pleasure. From Schaffhausen we went on to Constance, on the lake of its name (or the Boden See), seeing on our road the labourers pruning their Vines, and carefully nourishing them with bucketfuls of liquid manure, all done with the simplest instruments and much manual labour. We then sailed up to Rorshach, and in continuous wet weather we dragged ourselves on, still keeping by the banks of the Rhine, which here flows between the Tyrol and the north-eastern corner of the Swiss Alps. Here we saw, as we had often remarked before quantities of Colchicum autumnale and, less abundantly, Gentiana Asclepiadea.

On reaching Sargans we struck off from the Rhine, which we had followed pretty closely till then, not to approach it again till we reached Mount St. Gotthard. where it rises; and when we left it here we had seen no reason to controvert the beautifully expressed passage in Longfellow's "Hyperion," that "of all the rivers of this beautiful earth there is none so beautiful as the Rhine. There is hardly a league of its whole course, from its cradle in the snowy Alps to its grave in the sands of Holland, which boasts not its peculiar charms." From Sargans we went on to Lake Wallenstadt and then to Zurich, and while there the weather cleared up again. We now sailed to Horgen, and, gathering Chlora perfoliata and the elegant Gentiana Pneumonanthe by the way, we walked by Lake Zug to Art, at the foot of Mount Righi, where we considered ourselves as on the threshold of the most interesting part of our tour—"nature's palaces, the Alps."

Early next morning we began to ascend Mount Righi, the Pisgah from whose top we were to behold the colossal wonders of the land beyond. As the morning was very fine, we had a good view of that part of the Alps usually called the Berner Oberland, which includes the well-known names of the Jungfrau, Finsteraarhorn, Shreckhorn, and others. And truly no more advantageous position could we have had for forming high ideas of the grandeur of those mighty hills, than the summit of the Righi Kulm. The enormous mass of immense peaks, white with eternal snow, and obscured by scarce a single cloud, is one of those sights, the seeing of which brings no disappointment with it. The sun shone bright, but a fresh breeze kept the air sufficiently cool. At our feet lay the celebrated and lovely Lake of Lucerne, its blue depths reflecting the pure sky above, its wooded and rocky banks glowing with all the varied tints of a warm southern summer, and studded with the pretty town of Lucerne, and several sweetly-lying villages and hamlets; while, glancing upwards, the eye changed its gaze to the colossal masses covered with the snows of an everlasting winter, suggestive of nothing but bleak magnificence and unchanging desolation. During our ascent, we gathered that graceful little fern, Asplenium viride, and near the summit, the Gentiana acaulis in fruit, and the Gentiana germanica abundantly in flower, and the very highest point afforded numerous specimens of Ranunculus alpestris. While scrambling along the precipitous side of the hill, we came upon Hedysarum obscurum, Dryas octopetala, Geum montanum, Potentilla aurea, Sibbaldia procumbens, Epilobium alpinum, Saxifraga Aizoon, stellaris, and oppositifolia, Myosotis alpestris, Veronica bellidioides, Globularia nudicaulis, and others.

After descending the Righi, we amused ourselves by visiting the spots rendered romantic by their association with Schiller's "Wilhelm Tell," saw Thorwaldsen's famous sculpture of the dying lion at Lucerne, and then by steamer, reached Altdorff, the town noted as the scene of the story of the hat, and Gessler's insolence, and Tell's proud patriotism. We now began the ascent of the St Gotthard road, reaching Hospental, near the summit of the pass, by the evening of the same day.

The road is remarkable for the savage sublimity of the greater part of it, passing, as it does, up the valley of the roaring Reuss, and shut in laterally by bleak, majestic, and precipitous mountains, it can easily be imagined to be one of the grand est pathways in Europe. Here, among other things, we picked up the Lycopo dium denticulatum, and passed abundance of the Allosorus crispus. I may also mention that almost the only person we met on the road, besides beggars at the occasional hamlets, was Professor J. D. Forbes of this University, who was driv ving down to Altdorff on his way from Italy.

In the mountain which we had now reached are cradled the two infant rivers of the Rhone and Rhine, which though pursuing such dissimilar courses, are born of the same parent. The one spends its youth amid the pestilential vapours of the Vallais—a muddy stream, flowing along a desultory track, till it debouches into the Lake of Geneva, where it is cleansed; then, having caught somewhat of the heavenly hue of the beautiful lake, it rushes joyously on by a happier path into the wide ocean of the Mediterranean.

Longer and more equable is the course of the Rhine. Spending more of its youth among its native mountains, its path is at first more rugged and stormy, but its stream is purer. When at Schaffhausen, it has gained sufficient strength and has passed through its time of tutelage, it tosses itself boldly and with the vigorous enthusiasm of youth, down from its lofty seclusion, to take part in the labour of men, and contribute to their sustenance and enjoyment. Now, it bears along its load of timber from the Black Forest, and then it moistens the tender roots of the springing Maize, and the struggling Vine—flowing steadily onward on its even way, while merchants thank it for its benefits, poets sing its praises, and the peasant dweller on its banks prays for a blessing on the Rhine. When at last the aged veteran's step becomes feeble, and it " lays itself down to rest in the sand ;" its func tion does not stop, but changes and becomes exalted, as it glides out of sight to take part with its fluvial brethern in contributing to the greater glories of the boundless sea.

But to return to the tour. From Hospental we ascended the hill leading to the Furca pass picking up Campanula barbata on our way; and here for the first time we trod the ground where winter reigns supreme. After crossing the summit of the pass, between two mountain peaks, we came in sight of the glacier of the Rhone, out of which that river pours by several channels which quickly unite and roll down the ravine which commences the valley of the Rhone. One of these tributaries commences in a fine waterfall which rushes from the summit of the glacier, dashing without a break into an icy cavern about 150 feet below. The stream then forms a passage for itself under the glacier, and issues forth from a cavern at its foot. Longfellow well describes this glacier as "a frozen cataract, more than two thousand feet in height, and many miles broad at its base. It fills the whole valley between two mountains, stretching back till it is found commencing in the snow which covers their summits. At the base it is arched like a dome, and above it is jagged and rough, and resembles a mass of gigantic crystals of a pale emerald tint mingled with white. A snowy crust covers its surface, but at every rent and crevice the pale green ice shines clear in the sun. Its shape is that of a glove, lying with the palm downwards, and the fingers crooked and close together. It is a guantlet of ice which centuries ago, Winter, the king of these mountains, threw down in defiance to the sun: and year by year the sun strives in vain to lift it from the ground on the point of his glittering spear."

Before descending upon the glacier we gathered Ranunculus aconitifolius, Cardamine alpina, Trifolium alpinum, Sempervirum arachnoideum, Saxifraga mus coides and bryoides, Achillæa Clavennae and moschata, Erigeron alpinus, Gentiana Thomasii and nivalis, and Thesium alpinum. The Rhododendrons, hirsutum and ferrugineum, covered the entire side of one of the hills, and although we were not fortunate enough to see them in their prime, still several bushes were in full bloom, and readily suggested to our minds the beauty which a number of these alpine Roses must, when in season, bestow on those generally bleak hillsides. While on the glacier itself, we were fortunate enough to come on a patch of that interesting though humble member of the vegetable kingdom—the Haematococcus nivalis, or Red Snow plant. These microscopic vesicles were so plentiful as to form a thin layer, covering a large portion of the surface of the glacier, giving it a pale pink tinge, and on scraping a little of the surface snow together, it became of a blood red from the greater aggregation of these minute organisms.

Leaving the Rhone glacier, we crossed, by the Mayenward and the dark waters of the Lake of the Dead, to the Grimsel Hospice, where we dined, partially on what was said to be Chamois, but which was more probably a piece of one of the goats which are common on the hills. From the Grimsel we went down the

Hasli Thal to Meyringen, passing Veratrum album, Vaccinium uliginosum, and Vitis Idæa, and again abundance of Allosorus Crispus, which is there as common as the Pteris usually is here.

From Meyringen we crossed the Scheideck pass to Grindelwald, seeing on our way the falls of Reichenbach and the Rosenlaui glacier. The pass lies over a comparatively low hill, separated by a narrow valley from the majestic row of giants, formed by the Wetterhorn, Eiger, Moench, and Jungfrau, whose lofty summits we were fortunate enough to see freed from clouds, and which, as the day wore on, and the sun's rays became more powerful, rolled down their acres of snow in thundering avalanches into the valley beneath. During our walk we passed the two Grindelwald glaciers, which stretch down like arms of that frozen ocean which lies in the middle of these hills, and which covers an uninterrupted surface of 115 square miles. Among the plants gathered were Arabis alpina; Trifolium badicum; Silene alpina; Pyrethrumi alpinum; Gentiana ciliata, nivalis, and acaulis; Androsace Chamejasme; Tofieldia calyculata; Poa alpina; Cystopteris montana; and, down in the valley, beside where we had seen a small avalanche fall, we gathered Epipactus latifolia and Botrychium Lunaria. From Grindelwald we had an excursion upon the larger of the glaciers of the same name, but saw nothing of a remarkable interest botanically. The glacier itself is a convenient one for studying the developement of glaciers, if I may use the term; the scenery was very wild, especially when we had penetrated so far into the midst that we appeared shut in on an immense and desolate sea of ice, surrounded by apparently impassable precipices.

Leaving Grindelwald and walking over the Wengern Alp and down the valley of Lauterbrunnen we passed the famous Staubbach,—a beautiful cascade which is formed by a small stream shooting gracefully over the summit of a precipice 900 feet high, and breaking entirely into spray before it reaches the bottom. Staying a day or two at the pretty English town of Interlacken we went on by the lake of Thun, and Frutigen to the Gemmi pass. On the road to Frutigen we picked up amongst other things Campanula pusilla, and Cuscuta Europea. When ascending the hill south of Frutigen we again came on tufts of Cystopteris montana.

A few miles south of Frutigen the traveller has to make the tedious ascent of a hill, at the top of which he comes to a table land of several square miles in extent, and in which lies the Dauben Sea; a small lake, "supplied not by springs, but by snow which often swells it so as to cover the path: for three months of the year it is frozen. Nothing can exceed the seared and naked appearance of the limestone rocks which form the summit of the pass; they seem too barren for even the hardiest lichens." Reaching the top of the southern descent, one of the finest views presented itself which it ever was our lot to witness. From the precipice on whose edge we stood, we looked down the dark valley of the Leuk to that of the Rhone, here widened out to a considerable extent, and which is entered by the Leuk valley at right angles. Behind the mountains, rising directly from the side of the Rhone valley opposite, stood the majestic snowy range of the Pennine Alps, which includes among its peaks those of Mount Rosa and Mount Blanc, though neither of these formed part of our view, the former being hid by the graceful summit of the Weisshorn and the latter being at the extreme right of the range was shut off by the shoulder of a rock close by us. We had, however, many summits not far behind them in grandeur.

It was about seven o'clock when we came in sight of them, and the sky had acquired a pink hue from the rays of the retiring sun. The pure white of the mountain tops was not yet affected, so that the outline of the range had an extraordinary distinctness as it stood boldly in relief against the glowing heavens. Gradually however, the mountains became tinged with the fiery tint, and the cold peaks seemed to blaze with a lambent flame; and we became sensible of a soft, red light which tinged every object in the landscape with a strange unusual colour. Notwithstanding these signs of approaching night, we were constrained to wait and watch the dissolving beauties which were thus disclosed. The whole landscape had a quiet sublimity about it which filled the mind with that awe which the grand in nature never fails to awaken in those who contemplate an expression of it for the first time. A gradual change soon came over the view;—the tops of the hills which before glowed with pink now lighted up into a fiery purple, and as the colour became more intense, it seemed to condense itself into smaller compass; then some of the less lofty peaks regained their natural whiteness, and at last, the highest peaks lost their colouring also. The sky, too, began to lose the appearance, and a pale green, spreading from the eastward, slowly took its place The shades of evening were now closing rapidly around us, and after a short twilight, the curtain of night dropped on one of the grandest spectacles which the eye could witness.

The latter part of the Gemmi pass, forming the descent from the table-land, is one of the most wonderful in Europe. The path leads in zig-zags down an almost perpendicular face of rock. Murray's Guide describes it as "a mere shelf—in some parts a mere groove cut in the face of the huge cliff, just wide enough for a mule to pass, and at the turns of the zig-zags you constantly overhang a depth of more than 500 feet. . . . In many places the rocks overhang the path, and an upper terrace projects further out than the one immediately below it." At the bottom is the village of Lenkerbad, famous as a watering place, at which we slept.

The next morning we ascended the Torrenthorn, a mountain 10,000 feet above the level of the sea, from the top of which we had a view of our old friends of the Berner Oberland, and a most complete one of the Pennine range, not excluding Mount Blanc and Mount Rosa. On the road up we gathered Gentiana imbricata: it was growing near the summit, and close to a small field of snow which our guide told us had been gradually accumulating for several years, and which was the foundation of a future glacier. It certainly appeared to have hardened considerably, and to be acquiring that consistence which glacier ice usually possesses. After this, we travelled down the Rhone valley to Martigny, and over the Col de Baline to Chaumouni. From the latter place we had some excursions on the Mer de Glace and Mount Blanc, but without much new, botanically. From Chaumouni we went to Geneva, where we separated, and I left Switzerland, Mr Blackie going north to Bonn.

Before sitting down, I may perhaps be allowed to say a few words in favour of such excursions as that I have just detailed. Besides the mere fact that health, pleasure, and instruction are all obtained at once, there are many other reasons which might be urged in their favour.

The Alpine Flora is of a kind quite distinct from that known to the dweller in plains, and neither books nor dried specimens will ever give him an adequate idea of it. To those who love botany for its own sake, the study of dried or cultivated specimens is always a very second-rate pleasure. One-half of the beauty and character of a plant is destroyed when it is taken out of its natural place on the earth. Take the beautiful Gentiana imbricata from its place among the scanty herbage on the bleak summit of the Torrenthorn, and plant it ever so artistically in the flower beds of a Botanic Garden, or glue its withered remains on a sheet of Herbarium paper, and who will think it worth his while to spend a glance on the modest blue flower, half hid among the more gaudy, though not more beautiful blossoms gathered from a milder climate, or find anything for enjoyment in the Herbarium specimen. But ascend the Alp on which it grows: As you approach the summit, the cold and biting wind that plays around it reminds you with its sting of the ungenial nature of the region which you have now reached, and the common mountain grasses struggle for a bare subsistence. But here, the little Gentian meets your eye; the individuals are not perhaps so large, or planted so symmetrically as its garden brother, but you feel the beauty of its clear blue eye, as it enlivens the pale verdure of the mountain carpet with its sprinkling of blue flowers—you recognise its fitness for the place, and wonder at the wisdom and goodness of its Creator.

Plants can only be properly understood when seen in their normal localities, and with reference to this subject I may, before concluding, quote the eloquent words of Mr Ruskin:—

"The first time I saw the Soldanella alpina it was growing of magnificent size, on a sunny Alpine pasture, among bleating of sheep and lowing of cattle, associated with a profusion of Geum montanum and Ranunculus pyrenæus. I noticed it only because new to me, nor perceived any peculiar beauty in its cloven flower. Some days after, I found it alone, among the rack of the higher clouds and howling of glacier winds, piercing through an edge of avalanche, which in its retiring had left the new ground brown and lifeless, as if burned by recent fire. The plant was poor and feeble, and seemingly exhausted with its efforts; but it was then that I comprehended its ideal character, and saw its noble function and order of glory among the constellations of the earth.

"The Ranunculus glacialis might perhaps be blanched from its wan and corpse-like paleness to purer white, and won to more branched and lofty development of its ragged leaves; but the ideal of the plant is to be found only in the last loose stones of the moraine, alone there, wet with the cold unkindly drip of the glacier water, and trembling as the loose dust to which it clings, yields ever and anon, and shudders and crumbles away from about its roots."

Specimens of the plants named in the communication were exhibited.

On Lichens collected on the Breadalbane Mountains and Woods. By HUGH MACMILLAN, Esq.

The author remarked—"While botanizing last summer among the hills and woods of Breadalbane, Perthshire, I was fortunate enough to meet with a few rather rare

Lichens in localities where, I believe, they had not been previously noticed. I found, for instance, several specimens of the very rare Sticta crocata of Acharius, growing in company with the S. sylvatica, and Nephroma resupinata on the perpendicular rocks, beside the second fall of Moness, near Aberfeldy. Mr Borrer of Henfield Hall informs me in a letter that he gathered this Lichen only in two places—on trees by the river Aray, where it crosses the road from Inverary to Dalmally, and on rocks on Dartmoor, Devonshire. I am inclined to think, however, that it is much more common in mountainous woods than is generally supposed: and were Lichenology to become a more favourite study with botanists than to all appearance it is at present, I am quite sure that the general distribution of this tropical Lichen, as well as of other obscure species, over Britain, would be better ascertained I have myself gathered it in all the situations indicated in the English Flora of Hooker, on trees in the Duke of Argyle's grounds, and on the Beech trees of Glenmoriston ; and have, besides, noticed it on rocks in various situations in my wanderings through the Highlands of Perthshire, but always in tufts consisting of two or three individuals growing among its relative, the S. sylvatica. It seems to have been noticed by the older botanists, for Lightfoot, in his Flora Scotica, evidently alludes to it when he says, " In one specimen we observed these tubercles, and the little holes (cyphellæ) among the down, of a bright yellow colour." I observed one specimen, and one only, in fructification, and this I have unfortunately mislaid, otherwise, I should have sent it with the rest. The scutella, I thought, resembled very much those of the S. limbata, only they were not so deeply embedded in the thallus, and the border seemed thicker and more entire. I gathered all the Stictas, with the exception of the S. macrophylla and S. aurata, which can scarcely be regarded as natives of Britain, in a very wild and beautiful spot, the Coill Dhu, or Black Wood, near the pass or entrance of Glenlyon—a shady valley lying in the heart of the Grampians, about nine miles from Aberfeldy, easily accessible to the botanical tourist from Ben Lawers, and pretty well known as the best habitat in Britain for the Meum athamanticum. As far as I am aware, this wood and the hills that tower high above it have not been much frequented by the botanical explorer since the days of the Rev. Mr Stuart of Killin (afterwards Dr Stuart of Luss), Lightfoot's accomplished correspondent and fellow traveller, and Mr Menzies of London, the learned prototype of the Menziesies, who very successfully explored this remote scene, as well as the other localities around his native place (Styx, a small hamlet between Kenmore and Aberfeldy). I am quite sure, however, that the botanist, and especially the Lichenist, would find it worth his while to spend a summer day among its recesses, for I, at least, never saw a place more favourable for the growth of Mosses and Lichens, or where such a number of rare and beautiful species can be procured. Lest you may think that I am exaggerating, I subjoin a short list of the rarer and more beautiful Lichens which I myself gathered during my last visit to it :—Parmelia glomulifera, in great abundance, and beautiful perfection in the rocks and trees ; P. herbacea, associated with above, and fructifying abundantly ; P. caperata ; P. conspersa ; P. perlata ; P. stellaris ; P. Fahlunensis, on rocks above the wood, and fructifying ; P. aleurites ; P. physodes, in fructification. Sticta crocata ; S. pulmonaria, on almost every tree, and producing fruit in abundance ; S. scrobiculata ; S. limbata, S. fuliginosa, on the wet rocks, among mosses ; S. sylvatica. Collema cheileum ; C. plicatile ; C. fasciculare ; C. saturmium ; C. nigrescens ; C lacerum, in fructification on the old rotten trees. Peltidea apthosa, on the moist rocks, in fructification. Nephroma resupinata, always fertile. Gyrohora polyphylla ; G. cylindrica ; G. pellita, crowded with apothecia on rocks above the woods. Cornicularia tristis ; C. lanata, in fructification ; C. bicolor ; C. aculeata. Borrera ciliaris, B. furfuracea, on the rocks in the forest. Cetraria glauca, C. sepincola, in the forest. Lecanora Hæmatomma, (this species grows in the greatest abundance on the perpendicular cliffs in the Birks of Aberfeldy, and occasions that hoary appearance which Burns notices. " The hoary cliffs ascend like wa's." Placodium plumbeum, this lichen occurs in great abundance, and in fine condition on Ash trees above the second fall, Birks of Aberfeldy. Squamaria affinis ; S. gelida, in fructification. This lichen I also noticed on micaceous boulders, built into the wall, by the roadside between Aberfeldy and Kenmore, and also near the summit of Ben Lawers, on the north side as you descend to Loch-an-na-cat.

I may also add for the benefit of those botanists who may be induced next summer to pay a visit to the localities I am indicating, that the Lemania fluviatilis of Agardh occurs in abundance attached to the rocky bottom of the Moness burn, Birks of Aberfeldy, two or three hundred yards down from the heather house, about the months of June and July, disappearing early in Autumn. The mycologist may also find nice specimens of the rare Geoglossum viride, and the Leotia lubrica in the same wood, beside the railing of the first fall, on the damp earth."

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR APRIL.

The Society met at 6, York Place, on Thursday, 12th April, 1855. Prof. Balfour, President, in the Chair.

The following candidates were balloted for, and duly elected :—

I. As Ordinary Resident Fellows.

1. Alexander Grigor, Esq., 38, Broughton Street.
2. Charles John Burnett, Esq., 8, Walker Street.

II. As Ordinary Non-Resident Fellow.

William Mudd, Esq., Cleveland Lodge, Great Ayton, Stokesley.

III. As Foreign Member.

Cavalliere Tineo, Direttore dell' Orto Botanico, Palermo.

The Council reported that they had made arrangements with Mr Guthrie, the Proprietor of the *Scottish Gardener*, for the regular publication of the Society's Monthly Proceedings, in an official form in that Journal.

Donations were announced to the Society's Library and Herbarium, as follows:—

From Dr Hugh F. C. Cleghorn, H.E.I.C.S., Madras, his paper on Ægle Marmelos.

From Col. Macadam, per Robert Daw, Esq., H. M. Customs, Leith, a packet of Cornish plants.

From Hugh Macmillan, Esq., specimens of several rare Scotch Lichens.

Professor Balfour stated that the following donations had been presented to the Museum of Economic Botany, at the Botanic Garden, since the last meeting of the Botanical Society :—

From Colonel Yule, Inverleith Row, thirty sections of named woods from the West Indies.

From Mr J. B. Davies, models in Papier Mache of orthotropal, campylotropal and anatropal ovules; also, a model illustrating the parts of the anatropal ovule.

From Robert Girdwood, Esq., specimen of the Black Stone Turnip.

From Captain Grange, Ayr, two sheets of wove paper, made of Bamboo cane.

From John Shaw, Esq., Elm Row, two fresh specimens of the Mango fruit (Mangfera indica), from the West Indies.

From Mrs Dr Smith, India Street, specimen of the fruit of Solanum angulatum (Ruiz and Pavon), the Naranjo de Quito, covered with silver wire and glass ornaments, as used by the natives of the Andes for birth-day presents, &c.; also, fruit of the Arnotto, Bixa Orellana.

From Robert Daw, Esq., a specimen of Fordel coal, containing peculiar organic bodies.

From J. F. Dewar, Esq., seeds of the Indian Shot (Canna indica), collected by the late Dr Shortt, from a specimen planted by Buonaparte at St Helena.

From Dr Cleghorn, Madras, Lump of Cattimandoo Gum, procured from the Euphorbia Cattimandoo; four specimens of Fossil Woods from Pegu; Section of the Pterocarpus santolinus, from the Gaggery Hills, Madras: Circinate Thorns, from the Hugonia Mystax, &c.

From Lieutenant-Colonel Fraser, C.B., Royal Engineers, a Burmese musical instrument, made of graduated pieces of the Bamboo cane connected with cords; a Burmese water pitcher, manufactured from a large joint of the Bamboo cane; two cloth brushes (each 6 inches long, by 4½ inches wide), made apparently from the bristly receptacle of some plant, also from Burmah.

From Neil M'Lean, Esq., Oakfield, Geelong, Australia, a South Sea Island paddle.

From James Hector, Esq., specimen of Stigmaria ficoides, from St Andrews.

From Charles Burnett, Esq., specimen of the Quandang Nut of Australia, (Fusanus acuminatus).

Mr M'Nab exhibited a specimen of a white flowered variety of Sisyrinchium grandiflorum, raised from seed, by Mr P. Loney, gardener at Fingask Castle, Errol.

The following papers were read:—

1. *On Placentation*, by John Cleland, Esq. Communicated by Professor Balfour. In this paper the author endeavoured to show that in some cases of supposed axile placentation, the ovules were attached to the reflected margin of an inner row of carpels. The paper will appear in the Annals of Natural History, and the Society's Transactions.

2. *Notes on the Flora of the neighbourhood of Castle Taylor, in the County of Galway.* By A. G. More, Trinity College, Cambridge.

The following short sketch from the pen of a beginner, by no means professes to give a complete account of the peculiarities of this interesting district, which is so well known already for several rarities. It is offered as a small contribution towards what has hitherto been so little explored—the geographical statistics of West of Ireland Botany.

Being far removed from the different centres of migration, and without a single prominent example of the Asturian plants so remarkably prevalent in Connemara, the poverty of the Flora is, perhaps, its most striking feature. This deficiency is in part redeemed by the beautiful and interesting limestone and Alpine plants.

The results now laid before the Society are derived almost exclusively from the analysis of about 70 species, while the whole number noticed only amounts to 416 flowering plants, and 16 Ferns: and, allowing that 50 were overlooked, the whole Flora can scarcely be estimated at above 500 species.

The great bulk of the vegetation is naturally made of such as belong to Watson's "British Type," and it is most curious that many of these generally common plants could not be found.

The district alluded to is of no great extent, comprising the immediate neighbourhood of Castle Taylor, and what little could be accomplished during an occasional excursion to Garryland and Kilmacduagh, which lie about 8 or 9 miles further south. All three places are on the western verge of the great limestone tract, and beyond the direct influence of the sea, from which they are distant some 5 or 6 miles. The surface is broken and rocky, not much above sea level, and affords by numerous subterranean hollows a ready drainage. It is thus, for Ireland, very deficient in water and peat, to which cause may probably be referred the apparent absence of a large number of plants partial to moorish and watery localities. These will be noticed at length under the second head.

It is a difficult thing to account for certain Alpine species ranging to a lower level in Ireland than in Britain under the same latitude, especially when we know how much fewer they are both in number of species and individuals. Still more so when we find the Alpine hare at sea-level. Can this be ascribed simply to the humid and equable climate, resembling that of the northern Scottish Isles, where the same thing takes place? or is there a deeper cause dependent on some complication of geological changes and conditions?

Division First.

To begin with the positive features—

A. 1. There are 9 Subalpine species belonging to Watson's Highland Type.

Ranunculus Flammula, var. reptans.
Dryas octopetala, var. pilosa (Bab)......South limit in York.
Saxifraga hypnoides.
Hieracium cerinthoides......................South limit in York.
Arbutus Uva-ursi... ....South limit in York.

Gentiana verna.................................South limit in York.
Sesleria cœrulea ....South limit in York.
Juniperus nana.
Plantago maritima (occurring 7 miles inland).

Five of these find their south limit in York as regards Britain, and hence range further south in Ireland, while the occurrence of the whole number at little above the sea level (50.110 feet) is well worth notice.

2. Nine species are northern plants, appertaining to Watson's Scottish Type.

Thalictrum minus	Galium pusillum	Vaccinium Oxycoccus
Rubus saxatilis	Galium boreale	Cystopteris fragilis
Rosa villosa	Antennaria dioica	Lycopodium selaginoides

These two sections, numbering 18 species, include all that can be called northern plants.

B. Of the Atlantic Type we find but 6 species—fewer than might have been anticipated.

Coronopus didyma (Corofin also Kinvarra)	Cotyledon Umbilicus	Pinguicula Lusitanica
Hypericum Androsæmum	Rubia peregrina	Drosera intermedia

I may here be allowed to remark that from the paucity of "Atlantic" species in Ireland, Forbes' term of "French Type" is more appropriate for these, and also for the majority of the plants at present referred to the so-called "Atlantic Type."

C. Of English Type or southern species there is comparatively a large number, viz. 44, and most of them are rare in Ireland.

Thalictrum flavum	Thrincia hirta	Euphorbia exigua
Papaver hybridum	Carduus nutans	Spiranthes autumnalis
Viola stagnina	... tenuiflorus	Epipactis media
Hypericum dubium	... pratensis	Orchis pyramidalis
Geranium columbinum	Carlina vulgaris	Iris fœtidissima
Euonymus Europæus	Artemisia Absinthium	Potamogeton lanceolatus
Rhamnus catharticus	Erigeron acris	Arum maculatum
... Frangula	Anthemis Cotula	Cladium Mariscus
Spiræa Filipendula	Monotropa Hypopitys	Carex stricta
Rosa arvensis	Chlora perfoliata	Alopecurus agrestis
Poterium Sanguisorba	Verbascum Thapsus	Lolium italicum
Œnanthe Phellandrium	Linaria Elatine	Avena flavescens
Asperula cynanchica	Verbena officinalis	Bromus erectus
Fedia dentata	Chenopodium Bonus Henricus	Ceterach officinarum
... Auricula		Lastræa Thelypteris

N.B.—Veronica Buxbaumii, first introduced with turnip seed in 1851, is gradually becoming established as a weed.

The following are not marked as Irish in the 3d Edition of Babington's Manual. Those marked T, G, and K occur respectively at Castle Taylor, Garryland, and Kilmacduagh.

Cardamine sylvatica T	Myriophyllum alterniflorum T	Potamogeton lanceolatus K
Viola stagnina G	Hieracium cerinthoides T	Alopecurus agrestis T
Spiræa Filipendula G	Epipactis media G	Lolium italicum
Geum intermedium G		

Nearly one-third of the southern plants are peculiarly partial to a calcareous soil.

Geranium columbinum	Monotropa Hypopitys	Bromus erectus
Spiræa Filipendula	Chlora perfoliata	Ceterach officinarum
Poterium Sanguisorba	Linaria Elatine	Ophrys apifera
Asperula cynanchica. (I have also gathered it on sandhills).	Epipactis media	Ophrys muscifera
	Orchis pyramidalis	

Only the two Ophrides represent the Germanic or South-eastern Type, and they are inserted amongst the "limestone plants," in the belief that their range in Great Britain is more affected by the distribution of calcareous soils than any geographical reason. Their occurrence at the western extremity of the great limestone plain of Ireland would seem to favour this hypothesis, and they probably ought to be transferred to the English Type.

Other species found at Castle Taylor which are said by Lecoq, "Etudes sur la Geographie des Plantes," to prefer a calcareous soil. 19 species.

Thalictrum minus	Rosa arvensis	Fedia Auricula
Papaver hybridum	Pimpinella Saxifraga	Carduus crispus
... dubium	Pastinaca sativa	Centaurea Scabiosa
Sinapis alba	Daucus Carota	Tragopogon major (?)
Geranium pratense	Sambucus Ebulus	Euphorbia exigua
Lathyrus tuberosus	Rubia peregrina	Sesleria cærulea
Rubus cæsius		

Other uncommon plants observed growing near Castle Taylor, which are more or less generally distributed. 35 species.

Ranunculus Lingua	Primula veris	Avena pubescens
Barbarea arcuata	Utricularia minor	Catabrosa aquatica
Arabis hirsuta	Littorella lacustris	Glyceria plicata
Sinapis alba	Rumex sauguineus (red veined)	Festuca bromoides
Viola canina (flavicornis)	Habenaria chlorantha	... arundinacea
Geranium lucidum	... viridis	... loliacea
... sanguineum	Potamogeton plantaginens	Bromus commutatus
Geum intermedium	... perfoliatus	Lolium temulentum
Pyrus Aria	Sparganium minimum	... var. arvense
Myriophyllum alterniflorum	Carex intermedia	Botrychium Lunaria
Tragopogon pratensis	... acuta	Ophioglossum vulgatum
Carduus crispus, var. acanthoides	... fulva (much rarer than var. Hornshuchiana	

On drawing a comparison between our district and Yorkshire (one degree further north, and where the Teesdale limestone affords many of the same species), it is interesting to notice the very great difference of numbers—premising, of course, that considerable allowance should be made for the restricted nature of the Irish district, when balanced against the largest English county—

Yorkshire has		Castle Taylor.	Proportion.
Total,	... 1001	432	7 : 3
Atlantic,	... 10	5	2 : 1
Northern,	... 91	18	5 : 1
Southern,	... 277	44	6 : 1

From this we may see how great a thinning cut there is of species as we advance westward. Of all the 432, only 3 are not found in Yorkshire, and these three are eminently western species, viz.—Coronopus didyma, Rubia peregrina, and Pinguicula Lusitanica.

The occurrence of the Bee and Fly Orchis, characteristic of the Inferagrarian zone, among such alpine plants as Sesleria, Gentiana verna, Juniperus nana, and Arbutus Uva-ursi, strictly belonging to the (infer-) arctic is perhaps the most remarkable feature of the district, and presents a combination of characters probably nowhere else to be met with by the explorator of British botany.

N.B.—To render these remarks as far as possible complete, it may be as well to mention three plants which were observed on the same strata in the north of Clare. They are introduced to show that their range extends as far as Castle Taylor. They are scarce plants in Ireland.

Orobanche rubra, on Festuca rubra, and on Thymus Serpyllum.

Nepeta Cataria.

Marrubium vulgare.

The first a northern, the two latter southern plants.

Division Second.

We now proceed to consider the negative characteristics. This attempt is confessedly imperfect; and, indeed, it would be extremely difficult, and would require longer experience than I have enjoyed, to arrive at a correct estimate on this point. Still, it is too interesting to be passed over.

The species here employed as a standard are those omitted in the New Botanist's Guide as being of too common occurrence, deducting, however, those whose range has since been ascertained not to exceed 14 of Watson's provinces. It will also be safer to neglect 38 of these which, though not checked with certainty, were either doubtfully noticed or reported, or, most probably, only overlooked. This will leave 107 species to represent the deficit, and of course there are several others of more restricted range belonging either to the English or Atlantic (French) type that might also be reasonably expected to occur, as well as some ascertained to be more common since the "Remarks" were published.

Out of these 107 absentees, some are to be ascribed to the physical aspect of the country, combined, perhaps, with geographical causes; for instance, those that effect water, hedge banks, and especially wood and copse, there being no vestige of aboriginal forest.

A second class evince a sort of repugnance to the soil. I have never seen them on limestone. This is a curious point, because it is well known that very few plants are really confined to any one class of soils.

For example, the following "Sand Plants":—

Arenaria rubra	Trifolium arvense	Myosotis versicolor
Cerastium semidecandrum	Ornithopus perpusillus	... collina
Erodium cicutarium	Scleranthus annuus	Aira præcox
Cytisus Scoparius	Filago minima	Plantago Coronopus
Vicia augustifolia	Lycopsis arvensis	

Those of sandy or moorish ground—

Spergula arvensis	Chrysanthemum segetum	Digitalis purpurea
Galium saxatile	Senecio sylvaticus	

Those of moorish soil not found—

Viola palustris	Juncus squarrosus	Lastræa dilatata
Jasione montana	Aira flexuosa	Athyrium Filix femina

I cannot quote any plant whose absence can, strictly speaking, be ascribed to the want of clay.

Table of negative results obtained from the apparent absence of the following species, which are none of them rare or wanting under similar latitude in England:—

(1) Belonging to Watson's British Type, and rated at from 18 to 16 provinces—

Anemone nemorosa	Œnanthe crocata	Alnus glutinosa
Ranunculus sceleratus	Anthriscus vulgaris	Salix (species plures)
... hirsutus	Adoxa Moschatellina	Allium ursinum
Papaver Argemone	Galium cruciatum	Sparganium simplex
Draba verna	Hieracium boreale	Zannichellia palustris
Thlaspi arvense	... vulgatum	Luzula pilosa
Erysimum Alliaria	... umbellatum	Scirpus sylvaticus
Raphanus Raphanistrum	... murorum	... fluitans
Lychnis dioica	... cæsium	... pauciflorus
Stellaria Holostea	Centaurea Cyanus	Carex vulpina
... uliginosa	Cichorium Intybus	... paniculata
Mœhringia trinervis	Tanacetum vulgare	... curta
Geranium pratense (too near an orchard to be admitted)	Gnaphalium sylvaticum	... remota
Ononis arvensis	Solanum Dulcamara	... ovalis
Trifolium medium	Veronica montana	... pallescens
Lotus major	Lamium amplexicaule	... pilulifera
Vicia sylvatica	Lycopus Europæus	... paludosa
... hirsuta	Echium vulgare	.. vesicaria
Myriophyllum spicatum	Hyoscyamus niger	Milium effusum
Peplis Portula	Stachys arvensis	Alopecurus pratensis
Sedum Telephium	Chenopodium album	Holcus mollis
Ægopodium Podagraria	Polygonum Bistorta	Poa nemoralis
	Mercurialis perennis	Avena pratensis

(2) Species absent (British Type, but 15 provinces)—14 species.

Ranunculus auricomus	Hypericum hirsutum	Listera Nidus-avis
Lepidium campestre	Lychnis vespertina	Potamogeton pectinatus
Sisymbrium Sophia	Trifolium filiforme	... heterophyllus
Helianthemum vulgare (not Irish.)	Calamintha Clinopodium	Carex muricata
	Galeopsis versicolor	... pendula

(3) Of Watson's English Type, and rated at 16 provinces—5 species.

Malva moschata	Pyrus Malus	Linaria vulgaris
Ononis antiquorum	Bidens tripartita	

(4) English Type, and 15 Provinces—11 species.

Papaver Rhæas	Valeriana dioica	Paris quadrifolia
Viola odorata	Dipsacus sylvestris	Poa compressa
Rosa rubiginosa	Apargia hispida	Symphytum officinale (common in gardens.
Œnanthe fistulosa	Stachys Betonica	

We have thus enumerated 123 plants of general occurrence in England but not known at Castle Taylor. This shows sufficiently the deficiency of species. There are many others such as Polypodium calcareum, which we should expect under similar circumstances on the other side of the Irish Sea.

3. *Notes on the Flora of the Bass Rock.* By Professor Balfour.

The Bass Rock is an object of so much interest both in a historical and in a natural history point of view, as to have called for a separate publication, in which its Civil and Ecclesiastical History are given by the Rev. Dr M'Crie, its geology by Hugh Miller, its Martyrology by the Rev. James Anderson, its Zoology by Dr Fleming, and its Botany by myself.

The Bass is one of the numerous rocky islands which are met with in the Firth of Forth. N ear it we find others, such as Fidra, Leith, and Lamb, islands all of the same nature. It consists of trap rock assuming the character of greenstone in some places, and of clinkstone in others, but it does not exhibit any of the tufaceous appearance observed in the rocks on the shore at Tantallan.

I visited the Bass several times in the month of August and September, 1854, and I made full notes regarding its Flora. I also was fortunate enough to get a good opportunity of entering the great cavern by which the island is perforated. In speaking of this cave Hugh Miller remarks, "One of those slicken-sided lines of division so common in the trap rocks runs across the island from east to west, cutting it into two unseparated parts, immediately under the foundation of the old chapel. As is not uncommon along those lines, whether occasioned by the escape of vapours, or the introduction of moisture from above, the rock on both sides, so firm and unwasted elsewhere, is considerably decomposed; and the sea by incessantly charging direct on this softened line from the stormy east, has, in the lapse of ages, hollowed a passage for itself through. A fine natural niche, a full 100 feet in height, forms the opening of the cavern, the roof bristling high overhead with minute tufts of vegetation, the basement course, if I may so speak, roughened with brown Algæ, and having the dark green sea for its floor. The height of the tunnel is about 30 feet throughout, and its length about 170 yards. Not far from its western opening, there occurs a beach of gravel, which, save when the waves run high during the flood of stream tides, is rarely covered. Its middle space contains a dark pool filled even at low ebb, with 3 or 4 feet of water; and an accumulation of rude boulders occupies the remaining portion of its length, a little within the eastern entrance. It is a dark and dreary recess, full of chill airs and dripping damps."

On the 12th September, 1854, I landed at the western side of the cavern, as being the calmest on the day of my visit, and after scrambling over some boulders reached the dark part of the cavern, where the bottom rises considerably so as to form an elevated beach, the highest part of which seems to be generally untouched by the tide. About the middle of the cave I had to descend into a pool containing water to the depth of 2 or 3 feet, the passage at this place being narrow, and its sides formed by slippery rocks inclined at a very acute angle, so that it is impossible to get a footing on them. After emerging from this dark pool I had to climb up some steep rocks at the eastern side, and then had the benefit of the light from the other entrance. I now encountered some large boulders, which being surmounted, I reached the eastern entrance. Here, to our surprise, we found a sea otter of large size, which made the best of its way through the cave to the western side, passing the boat and causing no small alarm to the men who were waiting in it. They struck its tail with the oar, but were disabled by fear from doing more. The otter seemed to have established itself in the cave for some time. It had been seen on several occasions by the men who visit the Bass for the purpose of taking the Solan geese. At the eastern end of the cave there were beautiful Actiniæ on the rocks.

The Flora of the island is very limited. In some places there is a rank and luxuriant vegetation, from the action of the guano. Lychnis dioica, Rumex Acetosa and crispus and Cochlearia officinalis in such places attain a large size. In the case of the latter plant leaves were seen of a very fleshy nature, nearly three inches in diameter. The grass in the island is sufficient to afford pasture to 15 sheep, and the mutton they furnish is prized. I found the sheep at the time of my visit on the northern side of the island, as the grass at the other part had been parched by the long continued dry weather. The pasture on the northern side seems to consist chiefly of Holcus lanatus with a small admixture of Festuca ovina. On the sheltered rocks at this part of the island I found Lastrea dilatata and several mosses. At low water I observed the sea weeds indicative of the Laminarian Zone, such as Laminaria digitata, L. saccharina, Alaria esculenta, Chondrus mammillosus; in brackish water in a pool on the island, Enteromorpha intestinalis was collected, and Callithamnion Rothii grows abundantly in damp shaded spots on the walls and steps of the old buildings; while Prasola orbicularis, Kutz. (Ulva terrestris Lyngb. not of Lightfoot) was gathered on some of the rocks on the northern side.

I have appended a list of the species which I observed, and was able to identify. I have no doubt there are others, especially among the Cryptogamic orders which will probably be noticed by future observers :—

List of the Flora of the Bass Rock.

Phanerogamous Plants.

Ranunculus repens
Crambe maritima ?
Cochlearia officinalis
Silene maritima
Lychnis diurna
Cerastium tetrandrum
... semidecandrum
Lavatera arborea
Geranium molle
Vicia lathyroides
Montia fontana
Sonchus oleraceus
Hieracium Pilosella

Leontodon Taraxacum
Carduus tenuiflorus
... lanceolatus
... palustris
Hyoscyamus niger
Armeria maritima
Atriplex rosea
Beta maritima
Rumex crispus
... Acetosa
Urtica dioica
Narcissus Pseudo-narcissus (old garden)

Narcissus biflorus. In site of the old garden
Agrostis canina
... vulgaris
Holcus lanatus
Poa trivialis
... pratensis
... annua
Sclerochloa maritima
Dactylis glomerata
Festuca ovina
... duriuscula
Serrafalcus mollis

Cryptogamous Plants.

Lastrea dilatata
Hypnum, 3 species?
Parmelia parietina
... aquila
... saxatilis
Ramalina scopulorum
Placodium canescens
Squamaria murorum

Prasola orbicularis
Enteromorpha intestinalis
Laminaria digitata
... saccharina
Alaria esculenta
Callithamnion Rothii
Chondrus crispus
... mammillosus

Rhodymenia palmata
Delesseria sanguinea, besides other Algae, which were not seen by me during my visit.
Agaricus personatus
... amethystinus

The total number of species observed by me, were:—

Phanerogamous, ...	38
Cryptogamous, ...	22
	60

4. *Notice of Plants collected during a trip to Loch Lomond, in July.* By Professor BALFOUR.

On the 26th July, 1854, a party of 45, conducted by the late Professor Edward Forbes and myself, left Edinburgh for Glasgow, where they remained for the night. On the 27th we proceeded to Loch Lomond, and reached Inverarnan, at the head of the loch, about 11½ A.M., and were comfortably accommodated in Mr M'Lellan's Inn.

The trip was partly botanical and partly geological, Prof. Forbes taking charge of the latter department, and myself of the former. The first day we visited Glen Falloch, and gathered specimens of Quercus sessiliflora and pedunculata, in various states, and then ascended one of the lower hills, which furnished specimens of Hymenophyllum Wilsoni, Saxifraga aizoides, S. stellaris, Oxyria reniformis, and Sedum Rhodiola. We returned by Glen Cunn, where we collected a number of sub-alpine plants.

On the 28th we started early, with the view of visiting some of the higher summits. The botanical and geological parties separated, and we were thus enabled to visit Ben Oss and Ben Duchray, the latter occupied the attention of the botanists, fourteen of whom reached the top about 12½. A.M. The mountain seemed to be a promising one, but on examination it was not found to be so productive as might have been expected. Some of the plants collected were as follows:—The usual alpine Saxifrages, Arabis petræa, Silene acaulis, Gnaphalium supinum, Polystichum Lonchitis, Poa alpina, P. Balfourii, Thalictrum alpinum, Sibbaldia procumbens, Polytrichum viviparum, Saussurea alpina, Carex saxatilis, Juncus trifidus, J. triglumis, Epilobium alpinum, Armeria, Cochlearia, and Plantago, Botrychium Lunaria, Salix lapponica, S. herbacea, Asplenium viride, Oxyria reniformis, Rubus Chamæmorus, Vaccinium uliginosum, Luzula spicata, Carex capillaris, Malaxis paludosa, peculiar forms of Euphrasia, which Professor Forbes looked upon at being distinct, Polypodium Phegopteris, besides several other alpine and sub-alpine species. In addition to these, the geologists gathered on Ben Oss, Allosorus crispus. On returning from the mountain the geological party wandered from the direct path, and did not reach the hotel till late in the evening, after a very long and fatiguing walk. Their labours were, however, rewarded by the discovery of some interesting phenomena, in regard to the foliation of metamorphic rocks at Crianlarich, which supplied materials for a communication by Prof. Forbes at the meeting of the British Association at Liverpool

In his paper, on this subject, he stated that the question of the construction of rocks was a matter of considerable importance, but all that he had to say depended on a few minute observations. The distinctions between lamination, cleavage, and foliation were distinctions of great importance in geology. Lamination, in the sense which he would use it, was applied to the deposition of sediment; cleavage to the splitting up of a rock; and foliation, the separation of a rock into laminations which were of different characters. He remarked that those distinctions were confined to the geologists of Great Britain, and continental geology did not conform to this division. The causes of those structures were very different, and different opinions were held about them. Professor Sedgwick attributed cleavage to the result of electrical action, although many papers had been read showing that mechanical force had a great deal to do with rock cleavage, whilst others attributed it to the union of both forces. Foliation, as seen in the mica state, was a separation into thin layers. That structure had been attributed to various causes. One theory attributed it to a metamorphic change in the layers of sediment of different mineral matters. Others thought that foliation and cleavage passed into each other, whilst others thought that foliation was a superinduced structure quite distinct. He directed attention to a limestone quarry in the neighbourhood of Edinburgh, in which was a pale blue limestone, exhibiting curious mineral appearances, depending on the presence of decomposing iron, the lamination of colour running parallel with the bed of the lime-stone. He referred to several cases where a curious phenomenon was exhibited by foliation in metamorphic works, and noticed a remarkable quarry of metamorphic limestone passing into mica schist, near Crianlarich. In this quarry the mineral matter contained in the limestone are collected, some into coloured stripes and some into irregular foliated bands, all parallel to the bedding. But where the limestone is so charged with mica as to become a schistose rock, the foliations present the usual character, and exhibit contortions in various directions. The decision to which he had come was that, though in this case limited and local, there was a difference between foliation and cleavage, and that the foliation of the schist is a distinct phenomenon, both in time and as to cause from either cleavage or sedimentary lamination, and that the cause of the structure was probably of a chemical nature, induced by more agents than one.

On Saturday, 29th July, the united party proceeded along the banks of the Falloch, towards the head of Loch Lomond, with the view of ascending Ben Voirlich, but the fatigues of the previous day had so knocked up many (especially our geological friends), that only 14 ventured to ascend Ben Voirlich, the remainder walking along the shores of the Loch. The mountain visited is one which yields a number of good alpine plants. Nearly all those found on the previous day were gathered, with the exception of Arabis petræa and Allosorus. In addition, we collected Cerastium alpinum, Listera cordata, Lycopodium annotinum, Carex Persoonii, Isoetes lacustris. After reaching the summit, we descended by a very steep side of the mountain, to Loch Hoy, and reached the shores of Loch Lomond, whence we proceeded to Tarbet.

On the lower grounds some of the more interesting plants collected were—Lysimachia vulgaris, Hypericum Androsæmum, Carum verticillatum, Osmunda regalis, Corydalis claviculata, Crepis biennis—near Tarbet, Scutellaria galericulata, Sedum anglicum. At Tarbet the various members of the party reunited, and joining the steamboat at 4 P.M., reached Glasgow at 8, whence they proceeded to Edinburgh.

We all look back with pleasure to the trip, but our joy is mingled with sorrow when we reflect that he who conducted the geological department, and who contributed so much to the profit and to the happiness of the party, is no longer among us. We can hardly believe that he is gone, for his image comes before us fresh as ever, associated with many scenes of happiness and enjoyment.

Mr Hector then read the following account of the geological phenomena observed during the trip :—

The lower part of Lochlomond lies in Old Red Sandstone strata, and the islands which form such picturesque objects in that part of the loch are composed of portions of the beds which have either withstood or have been left untouched by the agencies which produced the rest of the valley. These islands are arranged in indistinct lines, which run from N.E. to S.W., and which direction is very probably that of the mean strike of the beds. In sailing up Lochlomond, after leaving the Old Red strata, the beds come upon next are those belonging to the thin series of Clay-slate formation, which runs right across the island in a N.E. direction, skirting the southern flank of the Grampians. These beds, on the west side of the loch at any rate, form many alternations with the Mica-schist, which lies immediately inferior to it, the one seeming gradually to merge into the other. The contortion of the strata, which is afterwards so well marked in the schist, makes its appearance in the lower beds of the clay-slate, those at Luss, which are quarried for economic purposes, being entirely free from it, although the late Professor Forbes, at a subsequent visit, thought he detected true cleavage, and distinguished it from lamination by its being at right angles to veins of calc spar, which intersect the beds, agreeing in its direction with those of quartz. This he reported at the meeting of the British Association.

After we arrived at Inverarnan, on the same day we ascended a height in the neighbourhood, situated to the N.W. It was composed of mica-shist beds, and had nothing peculiar about it. In walking over the moor behind it, roots of trees were found in a bog. The destruction of these trees was accounted for by supposing that the elevation of the country, which is otherwise proved to have taken place, had raised them into a zone of altitude in which they were not fitted to live. Walking in a south-west direction we came to a valley which presented the typical characters of a valley of this district. Narrow and gorge-like at its lower part, it widened into a strath towards its upper, ending in several smaller valleys which bear down the tributaries that go to form the principal stream. The valley lies in the strike of the beds, the S.E. side of it being formed by their surface, dipping to the N.E., at about 23 degrees, and being the least steep and abrupt of the two, while the opposite side is formed by the fractured section of the beds. Standing on the northern side, Professor Forbes' eye at once distinguished evidence of glacial action upon the opposite side of the valley, at about 150 feet above the level of the stream below. Upon examining, as we descended at the same level on the northern side, no such marks could be found. The reason of this was obviously explained by masses which were strewn about, removed from their places by the action of the weather, so that any traces which might have existed would long since have been destroyed.

On arriving at the level of the stream, and pretty near the outlet of the valley, where it assumed a narrow and almost gorge-like appearance, it was found, 1st, That the surface of the rocks were smoothed and striated in the direction of the length of the valley; 2d, That the sides of the gorge had a torn and fractured appearance; and 3d, That there were strewn about, and in the bed of the stream, large and small fragments, smoothed and polished, consisting of the mica-schist, and likewise of a red felspar porphyry, similar to that found at Inverary, none such being known to exist nearer than that place. In running over the rocks, which bore striated markings, it was noticed that the stream had cut to the depth of about five feet. As Professor Forbes hardly thought that the porphyritic fragments could have come from Inverary, it was determined that next day should be devoted to a search for a nearer source from which it might have been derived.

On the Friday we started for three hills situated to the N.W. by W., and the centre one was chosen for our destination. Having gained the moor upon which we were the day before, we struck across it in the direction before mentioned, and after descending a little and very slowly, and having walked about five miles, we at last began to ascend the hill. Like all the country for miles around, it was composed of mica-schist, the general dip of which, 50°, to the S., could only be recognized by an extensive view of the rock, owing to the confusion introduced by the foliation. In ascending the hill, the first thing marked was a great vein of quartz, having a lenticular section, the greatest thickness of which could not be less than 12 or 14 feet. Professor F. mentioned that it was in such veins among mica slate that gold was found in gold-bearing districts. Immediately below the quartz there was a stratum of thin grey beds, having black crystals in them. Above the quartz was a quantity of decomposed rock, of a bright ochre colour. A little higher up the hill we came upon a bed of mica-schist, filled with garnets, having met only with scattered specimens before. This bed was found to coincide with the true dip of the strata, which at that place was almost at right angles to the direction of the foliated structure. The foliation being 15 deg. N., and the dip of the strata 50 deg. S. It is to be remarked here that as the dip of the beds in the valley visited the day before, and which was situated to the south, was in an entirely opposite direction from that of the beds composing the hill, it seems probable that the moor over which we crossed forms the syncline of a great wave in the strata. On continuing to ascend, we came upon first fragments, and then a vein or dyke of the porphyry, of which we were in search, and which we traced passing right through the apex of the hill. Till we arrived at the top, we saw nothing more worthy of remark, excepting a few more of the garnet beds, and also the curious manner in which the mica schist weathered, forming large joints, which having become loose, lay strewn about the face of the hill, rendering walking rather difficult. This did not occur, however, until we had reached what might be likened to the cone of a volcanic hill. On gaining the summit, we found besides the vein of porphyry a vein of quartz, which had a more easterly direction than the porphyrite one, and we recognized it running up the face of the hill to the north of us. We likewise found a second dyke or vein, which passed through the hill a little to the south of the summit, and at right angles to the first one. It had a slightly different mineral appearance. The foliation of the beds on the back of the hill was now found to alter its direction, so that it almost coincided with the dip. The hill descended abruptly on its northern aspect, and a splendid specimen of a fault, on a large scale, was noticed on the back of the ridge which connected Ben Oss with Ben Duchray. The valley into which we now descended was much wider than that we were in the day before, and differed from it likewise in having its narrowest part at its upper end, and widening into a strath at its lower, which characters are the opposite of those of the other valley. Throughout its lower half, which was the portion we examined, there were numerous moraines irregularly dispersed. On gaining the high road, we found the road-metal to consist of greenstone, and on looking about, a mass of that rock was found, forming a portion of a dyke apparently, the direction of which could not be ascertained. About a mile from Crianlarich there is a limestone quarry. The limestone was seen to form a bed of no great thickness. It was of a bluish colour, and crystalline texture. Its dip was towards the north, and immediately above, it was overlaid by the mica schist, in the neighbourhood of which the limestone was interfoliated with mica, so as to render indistinct its boundary. In the limestone there were also nodules, which Professor Forbes said had quite the appearance of metamorphosed fossils. Also, I remember he hinted that garnets might have had a similar origin.

On the Saturday we walked down the side of the Loch, and on coming to a stream, which flowed into the head of the Loch, we found among the boulders in its bed, masses of syenite and hornblend slate. Three thin beds of limestone were met with in the course of our walk, all of which dipped to the south at angles varying from 5 deg. to 30 deg. The only sign of metamorphic action which they presented was their crystalline texture, and jointed structure, while the mica-schist on either side was greatly contorted. Professor Forbes mentioned how useful these might be in unravelling the structure of the country, by their giving the true dip, and in detecting faults and rollings of the strata. Several local deposits of a blue laminated clay were found at slight elevations above the level of the Loch, but we failed to discover any shells in them. An enormous boulder of Red Porphyry was seen on the shore opposite Inversnaid.

5. *Register of the Flowering of Spring Plants in the Royal Botanic Garden, as compared with the four previous years.* By Mr M'Nab,

	1855.	1854.	1853.	1852.	1851.
Tussilago alba	March 15	Feb. 14	March 1	Feb. 27	Jan. 26
Symplocarpus fœtidus	— 20	March 3	— 16	— 20	Feb. 4
Corylus Avellana	— 21	— 10	— 9	Jan. 25	Jan. 16
Narcissus pumilus	April 2	— 10	— 21	March 11	March 5
Scilla bifolia, alba	— 5	— 13	— 27	— 21	— 8
,, ,, rubra	— 6	— 14	— 30	— 28	— 17
Rhododendron atrovirens ...	— 6	Feb. 18	Feb. 1	Jan. 14	Jan. 2
Daphne Mezereon	— 6	— 18	— 1	— 21	— 28
Primula denticulata	— 7	— 27	March 25	Feb. 19	Feb. 15
Arabis albida	— 8	— 15	— 15	— 18	— 7
Aubretia grandiflora	— 8	— 17	Feb. 1	March 18	March 1
Nordmannia cordifolia	— 9	March 1	March 24	— 10	Feb. 20
Dondia Epipactis	— 9	— 11	— 25	— 8	Jan. 4
Primula nivalis	— 10	— 4	— 15	Feb. 20	March 16
Scilla bifolia, cærulea	— 10	— 15	— 27	March 20	— 6
Pulmonaria angustifolia ...	— 10	— 19	— 30	— 1	
Symphytum caucasicum	— 10	— 11	— 26	Feb. 2	— 23
Doronicum caucasicum	— 11	— 11	— 26		— 25
Draba aizoides	— 11	— 20	April 1	March 26	— 14
Erythronium Dens Canis ...	— 11	— 10	March 19	— 12	— 1
Anemone Pulsatilla	— 11	— 14	April 13	Feb. 21	April 15
Tussilago Farfara	— 11		— 4		Feb. 19

Note—Between 10th March and 12th April, 1854, 65 spring flowering species were recorded, and during the same period this year, only 22 of the species have come into bloom.

Mr Evans stated that the first expanded flowers of the Apricot were observed in the Experimental Garden on 24th March, being about three weeks later than last year.

Lowest Temperatures indicated by the Register Thermometer kept at the Botanic Garden during March 1855:—

		deg.			deg.			deg.			deg.
March	1 ...	37	March	9 ...	31	March	17 ...	34	March	25 ...	26
...	2 ...	30	...	10 ...	30	...	18 ...	29	...	26 ...	32
...	3 ...	31	...	11 ...	30	...	19 ...	32	...	27 ...	31
...	4 ...	38	...	12 ...	33	...	20 ...	34	...	28 ...	23
...	5 ...	31	...	13 ...	26	...	21 ...	31	...	29 ...	28
...	6 ...	27	...	14 ...	24	...	22 ...	31	...	30 ...	27
...	7 ...	28	...	15 ...	33	...	23 ...	25	...	31 ...	26
...	8 ...	25	...	16 ...	35	...	24 ...	24			

Average lowest temperature for March $29\frac{1}{2}^{\circ}$.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR MAY 1855.

The Society met at the Royal Botanic Garden, on Thursday, 10th May, 1855—Professor Balfour, President, in the chair.

The following candidates were ballotted for, and duly elected.

ORDINARY RESIDENT FELLOWS.

Dr WILLIAM GREGORY, Professor of Chemistry in the Edinburgh University.

WILLIAM TAYLOR, Esq., 22 Charles Street.

J. W. HADDEN, Esq., Register Place.

The following donations were announced to the Society's Library and Herbarium:—

From C. E. Parker, Esq., Torquay, a large parcel of English plants.

From Dr Adolph Senoner, Vienna, the Transactions of the Zoological and Botanical Society of Vienna, and several pamphlets.

Professor Balfour stated that the following donations had been presented to the Museum of Economic Botany, at the Botanic Garden, since the previous meeting of the Botanical Society:—

From Mrs A. P. Thompson, 4 Leopold Place, a large specimen in frame of Delesseria sanguinea, from Lismore, Ireland.

From Mr Stratton, Botanic Garden, Cambridge, a section, 8 feet in circumference, of the Dragon tree, from Teneriffe.

From Mr M'Kie, Genoch, section of a stem of Yucca gloriosa, 2 feet 3 inches in circumference. It was blown down in the garden at Genoch, Stranraer, during the past winter.

From Charles Murray, Esq., fruit of a Snake nut, Ophiocaryon paradoxum, from Demerara.

From J. B. Fleming, Esq , a bottle of Otto of Roses, procured from Northern India.

From Dr Horatio N. Storer, of Boston, specimen of the bark of the Slippery Elm, Ulmus fulva, from America, remarkable for the large per-centage of mucilage which it yields.

From Colonel Yule, Inverleith Row, three sections of West India woods.

From Dr Douglas Maclagan, specimen of the fruit of a Luffa, from the West Indies; also a bunch of the twigs of the Bitter Bush, stated to have been successfully used in the West Indies for Asiatic cholera.

From John Lowe, Esq., hazel nuts, and beechwood found imbedded in vegetable mould at Lochend.

Professor Balfour stated that, during the past month, plants, cuttings, and roots had been presented to the Botanic Garden, as follows:—

Professor Christison, tuber of the Vanderia.

Mrs Blackwood, tropical Orchids.

Messrs P. Lawson & Son, Daphne Fortuni, Roses, &c.

Mr Evans, 2 plants of Cupressus Macnabiana.

Mr Moore, Botanic Garden, Dublin, Erica mediterranea, hibernica, alba.

Mrs Haig, Viewpark, variegated Geraniums, of sorts.

Mr Jackson, Guernsey, Ophioglossum lusitanicum and Gymnogramma leptophylla.

Mr M'Intosh, Dalkeith, Pistia Stratiotes, &c.

Dr Knapp, Inverleith Row, Hindsia longiflora, alba, and Chrysanthemum Daphne.

Seeds have been presented to the Botanic Garden by the following individuals during the past month:—

Mrs Dr Smith, Edinburgh, Lima seeds.

Dr Christison, Bambadra Tobacco.

Mr Tod, Inverleith Row, select annual seeds.

Mrs Balfour, Indian seeds.
Mr Blythe, Hyde Park, London, Indian seeds.
Mr Laing, Dysart, Rhododendron seeds.
Dr Cleghorn, } Madras, Indian seeds.
Mr Jeffrey, }
Colonel Yule, Inverleith Row, West Indian seeds.
Mr Moore, Glasnevin, Dublin, seeds of Megacarpæa polyandra.
Mr Evans, annual seeds.
Miss Gibson-Craig, Hermiston, Indian seeds.
Mr Baxter, Riccarton, annual seeds.
Mr Jenner, Howard Place, seeds from Syria.
Mr Burnett, Indian seeds.
Lieut. Dodds, Indian seeds.

Mr P. S. Robertson exhibited from the Nurseries of Messrs P. Lawson and Son, germinating plants of the following species of new and rare Coniferæ, and called attention to the remarkable variation in the number of their cotyledonary leaves. :—

"Pinus nobilis; normal number of cotyledons 6, varying with 4, 5, and 7.

"Pinus Sabiniana; 14, 15, 16 prevailing numbers; variations 13, 17, 18, 19.

"Pinus Jeffreyi; prevailing numbers 9 and 10, varying with 7, 8, 11.

"Abies Hookeriana; usual number 4, varying from 3 to 5.

"Pinus Beardsleyi; prevailing numbers 6 and 7, varying with 3, 5, 8, 9, and 10. This species occasionally produces two perfect plants from one seed.

"Thuja Craigana (Libocedrus decurrens); usual number 4, varying from 1 to 4.

"Cryptomeria japonica; usual number 3, varying from 2 to 4.

"Pinus Lambertiana; usual numbers 14, varying with 10, 12, and 13.

"Pinus monticola; usual numbers 8, and 10, varying with 6, 7 ,9, 11.

The following papers were read :—

1. *On some New Species of British Fresh Water Diatomaceæ, with remarks on the value of certain specific characters.* By Professor Gregory.

The author described the new species under three heads, as follows :—

I. Species new to Britain, but known to foreign authors :—

1. Eunotia tridentula. Ehr.
2. Navicula Follis (or Trochus ?) Ehr.
3. ,, Bacillum. Ehr.
4. ,, dubia. Kutz
5. Pinnularia nodosa. Kutz.
6. ,, megaloptera. Ehr.
7. Pinnularia Dactylus. Ehr.
8. ,, pygmæa. Ehr.
9. Stauroneis Legumen. Kutz.
10. ,, ventricosa. Kutz.
11. Cocconema cornutum. Ehr.
12. Gomphonema subtile. Ehr.

II. Species not yet figured, but observed by other naturalists about the same time as by the author.

13. Navicula apiculata Sm.
14 ,, rostrata. Sm.
15. Navicula scutelloides. Sm.
16. Mastogloia Grevillii.

The last named species was first observed by Dr Greville.

III. Species, now first described.

17. Cymbella sinuata. W. G.
18. ,, turgida. W. G.
19. ,, obtusa. W. G.
20. ,, Arcus. W. G.
21. ,, Pisciculus. W. G.
22. Navicula cocconeiformis. W. G.
23. ,, lacustris. W. G.
24. ,, bacillaris. W. G
25. ,, lepida. W. G.
26. ,, incurva. W. G.
27. Pinnularia biceps. W. G.
28. ,, linearis. W. G.
29. Pinnularia subcapitata. W. G.
30. ,, digitoradiata. W. G.
31. ,, globiceps. W. G.
32. ,, Elginensis. W. G.
33. Stauroneis obliqua. W. G.
34. ,, dubia. W. G.
35 ovalis. W. G.
36. Surirella tenera. W. G.
37. Gomphonema insigne. W. G.
38. ,, ventricosum. W. G.
39. ,, Sarcophagus. W. G.
40. ,, æquale. W. G.

Figures of the whole of the above species were exhibited, drawn by Dr Greville, to a uniform scale of 10,000 times the actual linear dimensions.

After some remarks on the distribution of Fresh Water Diatoms, the author proceeded to consider the value of certain specific characters. We give this part of his paper fully, omitting any description of the new species above named, which will be figured in the Transactions of the Microscopical Society.

Species, among Diatoms, are generally distinguished by the following particulars, which are noted in the character attached to the specific name, viz., the form; the structure, where anything remarkable occurs; the length of the individual frustule, within the usual limits; the arrangement and number of the striæ, where these are visible, as well as their nature, whether moniliform or continuous, narrow or broad, close or distant, &c, and frequently the aspect of the median line, if present, and of the nodules at its centre and extremities.

I shall not here enter on the subject of the structure of the frustule, partly because this is rather a generic than a specific character, and partly because but little is known of it in reality.

But I propose to direct attention to some points which occur in almost every character of a species, namely, the form or outline; the number of the striæ in a given space, and the aspect of the median line and nodules, because it appears to me that these characters, at all events in some species, are subject to considerable variation, and cannot, therefore, be safely trusted to as specific characters.

First, as to form or outline. In a large number of species this varies so much that, if we were guided by it, we should make many species out of what certainly is but one, as is shown by the fact, that these forms pass by gentle gradations into each other. This kind of variation occurs in some of the forms here figured; as, for example, in Navicula lacustris, of which two very different forms occur. There is, however, a third, not figured, which is precisely intermediate. It is seen also in Navicula elliptica, of which four varieties are figured, only three of which are oval, but of different proportions, while the fourth is constricted. Navicula dubia is believed to belong to the same species as N. amphigomphus and N. dilatata, and by some, all three are united to N. firma. It is certain that all four agree in having the side lines, but they all differ in outline. Navicula lepida, one of the new species, exhibits three varieties, differing in form, only one of which is here figured. One of the others is very short and broad, nearly orbicular, while the other has straight sides. But the most remarkable example is found in a species which I have elsewhere described, and which has, although very frequent, been most unaccountably overlooked hitherto. I have named it Navicula varians, and I exhibit a proof of a plate, not yet published, in which I have figured a considerable number of the types of form in which it appears, along with many of the intermediate or transition forms which I always find to accompany them. It would require a second plate to show all the marked types, of different outline, observed in this species, and the connecting transition forms. Of all those figured in the plate, not more than three have ever been figured before, and these all as distinct species, namely, Navicula inflata. fig. 20, c, N. rhyncocephala, fig. 22, and N. scutelloides, fig. 16. But the first and the last of these are only doubtfully placed by me under N. varians. The former may be a distinct species, although the figures 20 b, and 20, seem to show that it also has a tendency to vary. As to the latter, the N. scutelloides of Smith would seem, according to Dr Greville, to be a Cocconeis, not a Navicula, but I have since found a form, of the same outline as fig. 16, which seems to be a true Navicula varians, but which I could not find in time for the plate. As it happens, fig. 16 resembles it almost exactly. Perhaps fig. 30, c, or fig. 30, d, may have been figured by others as Pinnularia gracilis, but in all the specimens of that species, marked and named by others, which I have, the striation is far less conspicuous. Some of the figures are like P. peregrina, but that is a form of salt and brackish water while the whole of these are from fresh water.

My reason for uniting nearly the whole of the forms in the plate, and a number of others, in one species are, first the similarity in the general aspect, and in the peculiar arrangement of the striæ. Secondly, In the gatherings where I find them, all, or most of them, occur together, with every degree of intermediate form. Yet, if several of those which differ most in form were to be found unmixed with others, they would certainly have been considered, indeed, so far as observed, they have been considered as distinct species, and some have even been placed in different genera.

It is plain that in describing this species, we cannot give any form as a specific character. And if our description or our figures are to be of use to observers, we must give, at least, figures of all the distinctly different types of form, adding that transition forms occur between any one of these types, and all the others. The same rule applies to all the species already noticed as varying in form. To these I may add the following, viz., Pinnularia divergens, Navicula rhomboides, Eunotia triodon, E. bigibba, Himantidium bidens, and others.

The next character is that of the number of striæ, which in this country are usually given for 1-1000th of an inch, on the continent for 1-100th of a line or 1-1200th of an inch. In some species, perhaps in many, this character is by no means constant. In Navicula varians, I find that in the smaller individuals there are often 24 to 26 striæ in 1-1000th of an inch, while in the larger there are only 14 to 16, and this in individuals of the same type of outline. Smith describes Pinnularia divergens with 11 striæ in 1-1000th inch, while I find it more frequently with from 22 to 26 in 1-1000th inch—the arrangement, which is peculiar, being the same in both.

A very striking example occurs in Navicula elliptica, which, as we have seen, also varies in form. The species, as described by Kutzing, has very coarse striæ, even coarser than appears by any of the figures. But in a variety to which I have directed attention, and which I regarded, on this account as a distinct species, till I found a gradual transition to the first named type, the striæ are so very much finer, being about three times more numerous, that the aspect of the frustule is totally changed. In comparing examples of the extreme types in regard to striation, I took individuals of equal size, and I found in one very coarse striæ, in the other, striæ so fine as not to be easily seen unless the valve were placed in the most favourable position with reference to the light. I might adduce other examples, but I shall pass on to another character.

This is the appearance of the median line and nodules. In the coarsely striated variety of N elliptica, there are lines on each side of the median line, forming a double cone, of which the bases meet near the centre. But in the finely striated variety, these lines are parallel to the median line; only bending outwards round the central nodule. This assists in giving a very different aspect to the two forms, which yet are connected by a graduated chain of transition forms.

Time will not allow me to dwell longer on this subject, but I may add that in the variety β of Navicula lepida, the character and aspect of the median line and nodules is quite different from those in the typical form α In this case the striation is also more conspicuous in β than in α.

We have then, if we consider only the three characters of form or outline, number of striæ, and aspect of medial line and nodules, evidence that great variations may occur in any one of them. Nay, in Navicula elliptica and N. lepida, variations occur in all three together. In such cases as these last, it is difficult to define the species by these characters in the usual way, and we have apparently no resource but to state the fact of the tendency to vary in one or more of these points, as one of the specific characters. In Navicula varians the arrangement of the striæ is always the same, as it is also in Pinnularia divergens, and many others, but in Navicula elliptica even this fails, for the striæ are highly radiate in the coarsely striated form, and nearly parallel in that with finer striæ.

In all such cases the definition should be accompanied by accurate figures, showing the way in which the species vary, and in regard to outline, as already remarked, giving all the marked types of form between which the transition forms will naturally find their place.

As to size, in some cases enormous variations occur, as may be seen in the plate of N. varians, even in the same type of form; also in N. elliptica, Eunotia triodon, Pinnularia divergens, and many others. If Pinnularia megaloptera be referred to P. lata, we have a variation in length from about 20 ten-thousandths of an inch to nearly 80.

The distribution of Diatoms over the world is one of the most remarkable points about their history. Not only do we find, if we examine a gathering from any part of the world, that most of the forms are identical with those of our own waters; but in tracing these minute organisms through the later to the earlier sedimentary rocks (and it is said that they occur in the lower Silurian strata, the oldest in which any organic remains occur), we find still the greater number of species to be those of the present day. This part of the subject well merits a close investigation.

Ehrenberg, in his last great work on the distribution of microscopic forms over the earth, both in the present period and in past geological times, has shown that in all soils in which plants grow, Diatoms are present, often in considerable quantity, and in great variety. He ascribes to them a great part in the formation of such soils, and it is probable that by their life and growth they extract much silica from the water in which they live, and transfer it at their death to the soil. The sediment of all rivers contains a considerable amount of Diatoms, as, for example, the mud of the Nile and that of the Ganges, which have formed the great Deltas of Egypt and Bengal.

I propose to lay before the Society, at a future meeting, the results of an examination of some small portions of earth taken from botanical specimens in herbaria from foreign, chiefly tropical, countries. In all of these Diatoms occur, so far as I have examined them, as is also reported by Ehrenberg in the work I have alluded to. If any member of the Society can supply me with such earth from exotic specimens, as in many cases a little earth adheres to them, I shall be very grateful, and they shall be carefully examined, and the results made known at the time referred to. If any plants should arrive from abroad, with earth adhering to them, such earth ought to be carefully preserved for examination. The results of the examination of the specimens of earth given to me by Professor Balfour are in several respects very interesting.

2. *Remarks on Specimens of Megacarpæa polyandra, Bentham.* By Dr Balfour.

Mr Moore having kindly sent from Glasnevin a specimen of the flowers and leaf of this plant, I think that it is of sufficient interest to call for notice at a meeting of the Botanical Society.

The seeds of the plant were sent by Colonel Madden to Dublin, and he gives the subjoined remarks in regard to the plant as seen by him in India:—

Colonel Madden states:—"The following notice of Megacarpæa polyandra, (Bentham) extracted from my Road Book, containing merely hurried remarks made on the spot on plants collected, and cursorily examined, at the end of a frequently fatiguing day's journey in a very difficult country, do not pretend to any minute accuracy, and are only calculated to afford a general idea of the plant and of the site and conditions under which it exists. A more scientific description of the plant will be supplied from specimens grown in the Botanic Garden, Glasnevin, Dublin, by Mr D. Moore, the curator, from seeds transmitted by me from Kumaon in 1849, and which, though speedily germinating, and attaining a great size, have only flowered this spring, for the first time in Europe; as Mr Moore thinks, in consequence of the past severe winter, which must closely resemble the extreme rigour of that proper to the locality where the Megacarpæa is indigenous.

"The interest of the plant consists in its possessing a number of stamens (from 12 to 15), quite abnormal in the order of Cruciferæ, to which it otherwise belongs; and which might seem, taken alone, to place it between that order and Papaveraceæ; but when these extra stamens are viewed as developements of the glands which are present in the Cruciferæ on the disc or torus, between the petals and the ovary and ordinary stamens, the plant may well be referred simply to that order.

"The Genus Megacarpæa was first discovered, I believe, by Fischer, in the salt Steppes and calcareous hills of Turkistan, in the neighbourhood of the Caspian Sea; and by Ledebour in Siberia; and was originally referred to Biscutella. Two species are described by De Candolle, (Prod. I., 183), but so imperfectly, that till further information is obtained, it is impossible to determine whether the plant before us, from the Himalaya, is identical with either of them, especially M. laciniata, from the Altai Mountains, or a new species which is to bear the name of M. polyandra.

"Megacarpæa (probably this very species) was next met with by Dr Hugh Falconer in the Highlands of Little Tibet, on the Husora river, an affluent of the Indus, and in the same country by the late Mr J. E. Winterbottom, who described it to me as growing 6 to 8 feet high on the Barzil Pass, upper glen of the Kishenganga River, between Kashmere and Astor; but neither of these botanists was, I believe, so fortunate as to obtain the flowers, which were first seen by Captain R. Strachey in 1848, on a visit to the glacier sources of the Pindar River in Kumaon, up to which date the existence of the plant in the British Himalaya was unknown; nor has it been discovered, so far as I am aware, in any other of our provinces—at least those south of the Sutlej River. Here it occurs in three localities, where the climate resembles or approximates to that of Little Tibet, Turkistan, and the other habitats, viz., extreme cold in winter, and extreme heat and aridity in summer, conditions which have proved favourable to the migration or presence of many other Thibetan and Siberian plants on the dry northern slope of the Himalayan range, where a system of vegetation is established in marked contrast with what prevails on the Indian face, which is annually for three months deluged with rain.*

"In Kumaon the plant occurs on the open sunny downs, at from 11,500 to 14,000 feet above the sea level, where all arboreous vegetation has ceased. It is well known to the mountaineers by the name of *Roogee*. They eat the pounded root as a condiment; it has like the whole plant a strong permanent

* A very instructive example of the manner in which plants are distributed in distant regions of similar physical character is afforded by Calligonum Pallasii. This, like the Megacarpæa, abounds in the Caspian province, and equally or much more, in the sandy deserts of Western India, between the Jumna and the Indus rivers. The heat for many months annually is extreme, and one is at first surprised to find a plant flourishing here, which is also indigenous to the steppes of the Caspian, where the winter cold is equally extreme. But, as is now well known, the Caspian and its deserts occupy a deep hollow at the western end of a plane descending from the sources of the Oxus and Jaxartes, and as a consequence of this low position on the earth's surface, possess a summer temperature as high as the winter one is low, and perhaps equal to that of the Indian desert above referred to. In the latter, during the months of April, May, and June, when everything else is burnt up, the Calligonum, with its innumerable green leafless twigs, covers the waste of sandhills with a mantle of verdure, yielding a favourite food to the camel, the proper beast of burden of the country. It is known to the people by the name of *Phoke*, and under this designation is first mentioned by Mr Elphinstone in his account of the kingdom of Caubul. A species of Ephedra likewise occurs, which is also called by the same name, but the true plant is the Calligonum, and neither Ephedra nor Ascelpias acida (the Soma plant) as some have supposed.

odour and flavour, something like horse radish. The localities in which it grows are—1. Champwa near the Kaphini glacier: 2. Near the Soondurdhoongee glacier,the heads of the Pindar River, and ; 3. At Ralim, on one of the spurs of the snowy Panch—Choola Range, which bounds the next great valley to the east. Here the Roogee flowers in May, June, and ripens its fruit in September, October. The root is fusiform, a foot or more in girth at the collar, and from 1 to 2 feet long, forked below ; internally of light cellular substance, externally exhibiting very numerous horizontal annular ridges. Several annual stems from 4 to 6 feet high. When young in winter protected by many erect, rectangular, straw-like scales. Radical leaves spreading from 2 to 2½ feet long, the exterior half occupied by 7 or 8 distant, distinct, sub-opposite or alternate pinnæ ; petiole dilated at the base; cauline leaves scattered, erect, pinnato-pinnatifid, about a foot long, with 10 to 12 segments, linear-lanceolate, acuminate, incised, the lower ones more or less separate, terminal more confluent. Flowers in dense terminal and axillary leafy corymbs, shorter than the leaves; small, white or yellowish white, with a sweet fragrance or strong odour of Horse Radish (according to taste), and much frequented by bees, flies, &c. Peduncles and pedicels villous, the latter long and one-flowered. Sepals 4, oblong, obtuse, coloured, from 1-5th to 1-4th inch long; petals alternate, oval, veined, half the height of the sepals; stamens 12 to 15, hypogynous, erect, as long as the calyx, and disposed in 2 or 4 sets. Ovary one, flat, obcordate, resembling the silicle of Capsella Bursa-Pastoris, with 2 auriculate, 1-seeded cells; stigmas 2 on a very short style. The silicle is about 1¾ inch by 1¼, one of the cells being abortive."

The following is a description of the plant taken from the specimen sent by Mr Moore :—

Megacarpæa polyandra, Benth.—Leaf sent by Mr Moore about a foot long—greatest breadth about 7 inches; deeply pinnatifid—lobes narrowish, tapering at the apex—toothed; upper surface dark green—under surface glaucous, covered with short hairs, many of which are glandular. Similar hairs occur on the petiole, which is thick, with ridges and grooves, flattened on the upper side and rounded below. Flowers in compact racemose clusters, of a yellowish white colour, and having a strongish odour. Sepals whitish, with a yellowish and purplish tinge in some places, rugose, deciduous, broadly obovate, and convex externally. Petals smaller than the sepals—obovate, tapering below—rugose. Stamens varying from 11 to 13, some longer than others, but not apparently in any definite number; filaments thick—broader below. Anthers innate, two-lobed, yellow; green circle of glands round the base of the stamens, attached to a broadish thick receptacle. Ovary transversely elliptical, with a short style and large stigma—two-celled. Fruit a silicula, with the replum across its narrow part. Seed brownish, about 1¼ inch in length, and about the same in breadth—winged; the wing nearly a quarter of an inch deep—veined; hilum straight or slightly curved about half an inch long.

3. *Lowest Temperature indicated by the Register Thermometer (Fahr.), kept at the Botanic Garden, during April*, 1855. By Mr M'NAB.

		deg.			deg.			deg.			deg.
April	1	27	April	9	35	April	17	30	April	24	31
...	2	25	...	10	36	...	18	39	...	25	40
...	3	25	...	11	39	...	19	37	...	26	29
...	4	30	...	12	33	...	20	24	...	27	39
...	5	45	...	13	36	...	21	25	...	28	32
...	6	37	...	14	42	...	22	29	...	29	29
...	7	33	...	15	46	...	23	32	...	30	37
...	8	39	...	16	33						

Average lowest temperature for April 33¼°.

4. *Register of the flowering of Spring Plants in the Royal Botanic Garden as compared with the four previous years.* By Mr M'Nab.

	1855.	1854.	1853.	1851.	1850.
Rhododendron Noblianum	April 13	March 2			
Narcissus moschatus	13	28	April 8	April 1	March 26
Anchusa sempervirens	13	25	12	Feb. 21	Feb. 14
Fritillaria imperialis	14	26	12	April 3	March 13
Hyacinthus botryoides	14	24	March 22	March 20	11
Tussilago nivea	14	18	April 1	Feb. 27	Jan. 28
Gagea lutea	14	23	12	April 6	March 2
Hyoscyamus physaloides	14	15	12	2	28
Corydalis cava	14	14	5		21
Holosteum umbellatum	15	20	March 30		April 17
Tussilago hybrida	15	14	April 4		March 5
Hyoscyamus Scopolia	15	14	4	March 25	Feb. 24
Puskenia scilloides	16	27	2	28	March 15
Sesleria cærulea	16	24	12		April 5
Vinca minor	16	7			
Orobus vernus	16	16	8	31	Feb. 17
Potentilla alba	16	16	12		March 28
Corydalis solida	16		8	28	29
Asarum europæum	18	16	March 28	29	Feb. 10
Ribes sanguineum, first flower seen open on standard plants	19	14	April 4	21	March 5
Orobus Fisheri	19	18	1		Jan. 27
Dalibarda geoides	19	25	12	April 2	March 30
Adonis vernalis	19	28	6	March 6	Feb. 18
Narcissus pseudo-narcissus	20	25	6	28	March 27
Doronicum Pardalianches	20	26	12		April 6
Cochlearia officinalis	20	28			
Anemone nemorosa	20	22	12		March 21
Carex montana	20	30			
Saxifraga crassifolia	21	20	March 27	March 27	20
Scilla siberica	21	30	April 10	April 1	26
Omphalodes verna	23	26	12	2	22
Ranunculus Ficaria	24	29	7	March 15	30
Hierochlœ borealis	27	30	March 7		April 7
Orobus cyaneus	29	17	28		Feb. 10
Anemone apennina	30	April 3	April 12		April 9
Phyllodoce cærulea	30	1			
Rhodothamnus Chamæcistus	May 1	4			
Alyssum saxatile	1	11			
Iberis sempervirens	1	11		28	Feb. 10
Sanguinaria canadensis	2	4			
Scilla italica	2	3			
Fritillaria Meleagris	2	5	April 12		March 13
Epigæa repens	2	3			
Jeffersonia diphylla	2	5			
Arctostaphylos Uva-Ursi	2	11			
Diclytra eximia	3	11			
Scilla amœna	4	10			
Leucojum æstivum	5	7			
Polemonium pulchellum	5	10			
Bryanthus erectus	6	3			

5. Professor Balfour called attention to a paper by Mr D. Moore on the effects produced by the intense frost of February, 1855, on the out door plants in the Royal Dublin Society's Garden, Glasnevin, from which the following is an extract:—

"I have not been able to obtain much relative information which could be depended on, to show at what previous periods any very intense frosts of long duration occurred in Ireland. It is said that the temperature has not been so low during the last forty years; but there may be some mistake in this. My own impression is, that I saw the thermometer as low as zero in 1831, at the south side of the city, when a greater fall of snow occurred than we have lately experienced. Plants suffered very much in consequence, though not nearly to the same extent they have this year, which may have resulted from the cold happening earlier in the winter, when they were in a more dormant state, or, probably, their wood had been better ripened during the previous autumn, thereby enabling them to withstand the effects of the frost. This year they were particularly liable to be injured, owing to the state of excitability many of them were in, arising from the remarkably mild weather which had prevailed during the months of November, December, and January. The Roses had young shoots, some of them several inches long, and were in full leaf, and other out-door plants were in a state of unnatural forwardness at that early period of the season. Scarcely any frost occurred during those three months to arrest vegetation, the thermometer not having fallen lower than to 28 degrees above zero, indicating 4 degs. of frost during November, and that only on one night. In December it also fell to 28° on one night, that being the lowest until the 28th of January, when it fell to 25 degrees, up to which period the temperature of the winter months was equable and mild; yet I do not find so great a difference as I expected, on comparing the average mean temperature of the months of November and December 1854, and January 1855, with the corresponding months of the year 1851, as given by Dr Lloyd for the locality of Dublin. In his table showing the mean temperature of each month of the years at the several registering stations through Ireland, Dublin is marked, for January, 43.3; February, 43.6; December, 43.3, which indicate a more than ordinary mild winter, since according to my calculations, taken from the readings of the thermometers at the Botanic Garden, registered once during 24 hours, the average mean temperature of the month of December, 1854, is 42 degrees, and that of January, 1855, 40 degrees, being rather under than over those of 1851. Those differences may, however, be owing in some degree, to several readings having been taken in one case during 24 hours, and only once in the other, as well as to the situations where the instruments were placed—the Botanic Garden being 65 feet above the level of the sea, and freely exposed, whereas the College garden is less than 10 feet, and, no doubt, influenced by the heat of the city. A very marked difference, however, occurs in February, the mean of that month having been 41.7 in 1851, whereas, in February, 1855, it was only 32 deg. at the Botanic Garden, which I believe is the lowest on record: besides, the minimum thermometer fell to 2 deg. above zero, indicating 30 degrees of frost on the night of the 15th, and, again, on the 18th it fell to 5 deg., and on the 19th to 10 deg., which alone go far to show the principal cause of so much destruction to our out-door plants; but when considered in connection with the state they were in at the time when these frosts occurred, and the severity of the weather during the present month, when they were recovering, fully account for all the damage.

"On the 6th inst., the thermometer marked 8 degrees of frost, followed by a bright sun next day; and on the 25th, 7 degrees, followed also by a bright sunshine, along with piercing frosty winds which prevailed during the month, circumstances which have been very injurious to plants in their present condition.

"I could not get any reliable registerings of the thermometer, indicative of the state of the weather during the early part of the present century, but Mr Yeates has kindly furnished me with notes of the lowest points to which his thermometer fell during the last twelve years, from which, I find, it did not mark lower than 10 degrees above zero during that period. I learn, also, from the same data, that the greatest colds during those years occurred between the 6th and 18th February, though, in some instances, in January.

"Before passing from this part of the subject, there is one other meterological circumstance I shall briefly notice, because I consider that many of our herbaceous as well as woody plants owe their partial safety to it—namely, the unusually small fall of rain which occurred during the autumnal and winter months. By referring to the meteorological tables published lately by the Dublin Society, it will be found that only 10¼ inches of rain fell from the 1st of July to the 31st of December, which is below the average quantity for that period in the neighbourhood of Dublin. The ground was, consequently, drier than it usually is in February; and although the smaller plants were snugly ensconced under a good covering of snow—which was, no doubt, the principal protecting medium—they would have suffered more had the ground been more saturated with moisture, as I find the same species has been more affected in wet parts of the garden than where the ground is drier."

6. *On the Disease of Finger and Toe in Root Crops.* By Sir JOHN S. FORBES.

The mortifying result in our green crops from unequal plants and early disease and decay, does not excite the inquiry and caution which it ought, but is too often attributed to vicissitudes of weather and other adventitious causes, though the actual loss, from the expense of money and trouble in rearing them, and the great inconvenience from disturbing our arrangements for feeding by their failure, ought to set our wits to work to hit upon some preventive plan, which it becomes the more necessary to discover, as the failure is scarcely ever uniform in a district, and our neighbour's exposure to ordinary vicissitudes is as great as ours.

The increase of the disease of fingers and toes has recently stimulated this inquiry, and two valuable papers have appeared upon the subject. The foundation of that by Professor Anderson was a remit from the chemical department of the Highland and Agricultural Society, and the answers he obtained from all parts of the country to a numerous list of queries circulated with this view. His results were chiefly negative. He found by analysis —1. That the chemical ingredients of the soils in which they were grown, and of the sound and diseased roots themselves, afforded no available explanation of the cause or character of the evil. Of other causes, the results of the inquiries give no uniform explanation; still, from the majority of the returns under each head, a proximate conclusion may be arrived at. The softer varieties seem most generally attacked, and the lighter soils, especially when weak and deaf, are most affected. Though the chemical character of the soil does not appear materially to influence it, its mechanical condition has a marked effect; land artificially compressed, and a sudden change of texture, or unseasonable working in bad weather, predispose to disease, but rotation and even frequent repetition of turnips, seem immaterial. Many observers attribute the disease to insects; but their appearance in conjunction with the disease may of course be the effect or concomitant, as well as the cause, and it is extremely difficult to discriminate between these two. The appearance of infection in the land where the disease has recently been prevalent may also arise from the natural connection of parasites with weak and unhealthy vegetation; but the beneficial effect of lime even upon soils where it is not deficient, or rather from frequent application is abundant, seems to favour the theory that animal ravages are partly its origin. At all events, the application of lime is the only specific which these reports suggest, and though not uniform in its action, when applied a year or two before, it has almost always been found beneficial. Salt is said also to have produced good effect; but the theory of its being the work of insects should be tested by applying other matters, such as tar, tar-oil, &c., which are injurious to them, and which might throw additional light upon this theory.

The other observer, to whose opinions we have referred (Professor Buckman), takes a different plan of investigation, proceeding on the supposition that the disease depends upon the effect of treatment in cultivation on the constitution of the plant. This is a very interesting view, and there is much that is plausible in his reasoning upon it. All our agricultural plants have their wild analogues, and as their properties are changed by the processes to which we subject them in forcing their produce, whether in succulent bulb or ripened seed, the means employed may be expected to have an important effect on their natural or normal condition and characteristics.

To test this, the seed of the wild Parsnip and Carrot, which grew abundantly in the neighbourhood of the place of experiment, was gathered and sown in cultivated ground. It is well known that in their wild state these plants have roots very much divided, similar to cultivated plants of the same families affected with Anbury. This was done from each season's produce for three years, and the progress of the experiment proved that by degrees the plant cast off its wild character, the leaves became smoother, losing their native hairy appearance, and of a more delicate green. Their tissues were increased, and the roots less forked during the first two years, but the result of the third year's cultivation was a cessation of their progress in improvement and even a disposition to retrograde. Now, the theory drawn from these experiments is, that the plant grown under the same circumstances which ripened the seeds will naturally in time degenerate towards their original type; and as the great change at first to the new position of cultivated garden plants improved the form and value of the roots as compared with the wild specimens, a continuance of the same circumstances immediately tended to produce a reversion to the old conditions, because the habits of the plant became accustomed to its condition, and its natural characteristics returned. Two points, then, are particularly observable as necessary to be attended to in practice—to surround your plants with circumstances as dissimilar as possible from those of its natural growth, and to select your seeds from plants possessing in strongest development the qualifications or characteristics which you wish to cultivate. This view of the case is materially corroborated by attention to the natural history of root crops in cultivation. The first general observation we make is, that every alteration in structure and habit of growth consequent upon cultivation is a departure from the normal state, and this constitutes a *derivative.* Now, changes from the wild state produce varieties, and no variety can ever be absolutely permanent. Hence we must be constantly at work with these varieties to keep the superinduced qualities, or on the stretch to find new types with properties equally valuable. It may be observed, by the by, that the very same process is going on in breeding stock, and the universal observation that the tendency of high proof animals to go to weeds is the development of the same natural law, that the departure from the normal type by artificial cultivation cannot be permanent in one strain. But to return to the root crops, one of the accidents of degeneracy to which they will always be liable is this very mischief of fingers and toes, and we may look for its casual appearance under the most careful efforts to keep up the freshness and progressive character of new varieties. The best chance for controlling its appearance among our crops is to study and avoid the exciting causes in their condition which appear to favour its development. Fingers and toes will always appear where the seed has been brought from a rich to a poor soil, and is likely to result from using the seed long raised in the same district. The reasons for these facts are obvious. The effect of rich culture being a rapid improvement in the character of the plant, the sudden change to a poorer soil naturally produces degeneracy and mal-formation. The want of variety in the stimulants for the constant advancement of the crop is the natural consequence of raising plants from the seed grown in the same district. The same reasoning applies in the case where the wild plant is a native of the district, as the conditions of its natural growth will of course in many respects prevail even under the altered circumstances of its cultivated position. In management, also, the selection of particular seed is of the utmost importance. The slovenly plan usually adopted of transporting wholesale the plants from two or three rigs of a turnip field to a seed bed, where good, bad, and indifferent are allowed to propagate their kind, cannot be defended, and it is to be hoped does not need to be exposed. The utmost care in selecting the parent roots should be conjoined with choice of a situation suited for maturing the seed, and free from the risk of admixture.

If this view of the subject be correct, fingers and toes is not to be regarded as a disease, but as the natural type returning, in spite of cultivation, where the conditions are not sufficiently removed from those incident to the wild plant, and degeneracy is consequently taking place. This arrives sooner or later, according to the treatment of the plant, and also according to its character, for it is found that, as the wild Parsnip more rapidly assumes the fair round form and succulent cellular tissue than the Carrot under cultivation, so the latter more gradually recedes from its civilised form, and returns to its wild condition.

7 Dr Balfour laid on the table the following notice of the origin of the name Chenopodium Bonus Henricus, contained in a letter from Mr Hardy, Penmanshiel:—

Lately, in turning over J. Bauhin's Historia plantarum, I met with the following, tom. ii., p. 965. "Dodon. Gall. et Lat. in fol. qui sub Tota Bona describit et depingit; ait Bonum Henricum a singulari quadam utili facultate vocari; veluti et perniciosam quandam plantam Malum Henricum appellant, de quo alibi dicendum." I have not the Latin copy of Dodonæus, but in the English translation of Lyte, 1st ed. 1578, p. 561, this explanation is not given: we have, however, the English "Good Henry," being a translation of the Dutch and German name. The term *Bonus Henricus* it appears from Mentzel (Index sub Lapath.) occurs in Brunsfel's Herbal, printed in 1532. I suspect, however, that it will be found in the Herbarius of 1484, or the Ortus Sanitatis, as in an early Herbal that I possess, without a date, but published by Egenolf, who is said to have given an improved edition of Cuba's work, I find the name *Gut Heinrich* over the figure of this plant. (This book of Egenolf has no text, being merely *coloured* figures.) The English names are attached in MS. in a very old hand. "Good *King* Harry" occurs for the first time in Gerard, who says it was so called in Cambridgeshire. (Johnson's edit. 1633, p. 329), *Malus Henricus* seems to have been *Lathræa squamaria*, J. Bauhin, ii., p. 785, compared with Parkinson's Theatrum, 1363.

8 The following plants were placed on the table, from the Royal Botanic Garden:—

Arum Dracunculus, and crinitum; Rhododendron glaucum, one of the branches producing snow white flowers; box of Seedling Ferns (Lastrea Filix mas, var. monstrosa). From 120 seedlings raised, all were observed to partake of the same fringed form of the fronds from which the spores were taken. The same peculiarity was observed in a box of Seedlings raised from spores of Scolopendrium vulgare, var. marginatum. There were also shown plants of Ophioglossum lusitanicum, Gymnogramma leptophylla, from Guernsey, Ranunculus alpestris, Calceolaria grandis, and violacea.

There were exhibited, from Messrs P. Lawson & Son, a plant of Daphne, Fortuni; and from Mr R. M. Stark, Edgehill Nursery, Primula capitata, and Viola palmata.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR JUNE, 1855.

The Society met at the Royal Botanic Garden, on Thursday, 14th June, 1855—Professor Balfour, President, in the chair.

The following donations were announced to the Society's library:—From the Horticultural Society of Prussia, their Transactions; and from the Warwickshire Natural History Society, their Nineteenth Annual Report (1855).

Dr Balfour intimated that a large and most valuable donation of Indian plants had been sent to the University Herbarium by Dr J. D. Hooker and Dr Thomson. Some of the specimens were exhibited, among which were the following species of Rhododendron:—

Rhododendron anthopogon, Don	Rhododendron Griffithsii, Wight, Aucklandii, H. f.
... arboreum, Sm.	... Hodgsoni, H. f.
... argenteum, Hook. fil.	... lepidotum, Wall.
... barbatum, Wall.	... ... elæagnoides
... camelliæflorum, H. f.	... ... obovatum
... campanulatum, Wall.	... ... salignum
... ... var. æruginosum	... Maddeni, H. f.
... campylocarpum, H. f.	... nivale, H. f.
... ciliatum, H. f.	... niveum, H. f.
... cinnabarinum, H. f.	... pendulum, H. f.
... Dalhousiæ H. f.	... pumilum, H. f.
... Edgeworthi, H. f.	... setosum, Don.
... Falconeri, H. f.	... Thomsoni, H. f.
... formosum, Wall.	... vaccinioides, H. f.
... fulgens, H. f.	... virgatum, H. f.
... glaucum, H. f.	... ... triflorum
... lanatum, H. f.	

Professor Balfour stated that the following donations had been presented to the Museum of Economic Botany, at the Botanic Garden, since the last meeting of the Botanical Society:—

From Mr Robert Hutchison, large rhizomes of Nuphar lutea, from Balkail, Stranraer.

From F. Lyon, Esq., specimens of Stigmaria in Torbanehill coal.

From Mr Dickson, calcareous deposit around a species of Moss, found on the banks of the Water of Leith, near Currie.

From W. Nichol, Esq., Calicium Bæomyces, from Ravelrig.

From Frederick Gourlay, Esq., specimen of fossil wood found in Yorkshire.

From Dr Geo. Wilson, Foorsa root, from Bombay, where it is used as a cure for the bite of the Cobra.

From Messrs P. Lawson & Son, three spikes of fruits of Magnolia grandiflora, from America.

From Mrs J. Millar, Edinburgh Castle, three pullicat boxes from the Madras Presidency, made of a species of Reed; also a basket made from strips of Bamboo.

From Capt. Grange, Newton, Ayr, a Socotra dish and Burmah box, made of strips of the Bamboo; also, two Burmese wooden combs, and six sections of Burmah woods—viz., Gaumar, Koromfala, Tilsur, Teak, Iron wood, and Parool (Lagerstrœmia reginæ).

From Mr J. B. Davies, piece of coal with Stigmaria impressions.

From Andrew Murray, Esq., cones of Pinus Craigana and P. Beardsleii—being the type specimens described and figured by him in the Edinburgh Philosophical Journal, 1855.

From Henry Paul, Esq., three carib cups from the West Indies, manufactured from various species of Gourds.

From Professor Fleming, New College, stem from Cuba, with internal partitions.

From Mr G. S. Blackie, specimens of Lecidea geographica from the Mer de Glace, and a specimen of Lecanora atra from the summit of Torrenthorn, 10,000 feet above the sea level.

Professor Balfour stated that the following donations of Plants and Seeds had been presented to the Royal Botanic Garden during the past month—

From Messrs P. Lawson & Son—Collection of Ornamental Trees, consisting of most of the recently introduced kinds.
From Mrs Colonel Spottiswoode—Collection of Indian Seeds.
From Mr Murray—Collection of Indian Seeds.
From M. Connal, Esq., Glasgow—Chinese Seeds.
From Miss Hope, Wardie Cottage—Seeds collected on the Missouri.
From J. C. Cox, Esq.—Australian Seeds.
From Miss Buckland—Seeds of Wellingtonia gigantea.
From Sir George Ballingall—Seeds collected on the Heights of Inkermann.
From Dr Traill—Seeds from Thibet.
From Mr Jeffrey, Madras—Collection of Indian Seeds.
From Captain Brown, R.N.—Seeds of the "Copique," a Chilian climber.

Dr Greville exhibited Specimens of the following Mosses, collected by him during the past month in the neighbourhood of Bridge of Allan—

Hypnum depressum (with pistillidia). Shady rocks, Allan Water.
Hypnum Swartzii. Banks of the Forth and Allan Water.
Hypnum piliferum, Keir.
Dicranum polycarpum—Near the summit of Dumyet.
Tortula papillosa—By the Forth above Stirling. (No fruit known.)
Tortula latifolia—By the Forth above Stirling. (Barren.)
Tortula Mulleri, Bry. Eur.—Menstrie Glen. (Only previously found by Drummond.)
Tortula lævipila, Brid. var—This species is usually found on trees, and is rare on walls, but near Bridge of Allan the variety is abundant on walls and rare on trees.

Professor Balfour called attention to some interesting plants placed on the table from the Botanic Garden. among which were—

Arnebia hispidissima, Punjaub, Mr Burnett.—A fragrant-flowered species of Prophet's Flower.
Horkelia congesta. Oregon.
Pentstemon (apparently) *acuminatum*. Do.
Dodecatheon integrifolium. Do.
Chrysobactryon Hookeri.
Eriogonium californicum. Oregon.

Isaac Anderson, Esq.. Maryfield, exhibited a number of new plants introduced by him from North-west America.

Mr Evans exhibited some interesting plants from the Experimental Garden, including *Eutoca sericea*, raised from seeds received from Jeffrey by the Oregon Association; Pinguicula grandiflora, Erinus alpinus, &c.

Professor Balfour stated that Pontederia elongata had been cultivated in the Botanic Garden of Edinburgh, and distributed under that name. It seems to be only a variety of Pontederia crassipes, produced by being grown in soil in place of water. The effect of this treatment is to cause the inflated petioles to elongate and lose their globular form. When the plants are put into deep water so as to float, the roots being unable to reach the soil, then they assume the proper form of P. crassipes. Specimens were shown illustrating this fact.

The following papers were read—

1. *Remarks on the Calamite and Sternbergia of the Carboniferous Epoch.* By Dr Fleming.

The author made some preliminary remarks regarding the study of vegetable palæontology. The specimens accessible for the illustration of the subject usually occur in a fragmentary form, macerated, rubbed, squeezed, and without indications of age or conditions of growth, so that the greatest sympathy should be extended to those who attempt to decipher in such circumstances. The investigation of these relics, he next observed, should be preceded by the study of the structure, functions and distribution of living plants, and hence he viewed with delight the formation of a collection of the remains of *extinct plants* within the walls of the Botanic Garden.

Dr Fleming then exhibited several examples of Calamites of different kinds, which he considered as justifying the following conclusions:—1. That many species have the original matter, now forming a thin film of coal, smooth on the outside, or not exhibiting externally any traces of joints or longitudinal ribs. 2. From the inside of their woody cylinders, now converted into coal, diaphragms proceeded at regular, but occasionally at irregular, intervals, dividing the inside of the hollow stem into a series of chambers.

These partitions appear to have possessed a very loose texture towards the centre, but become more dense in substance towards their junction with the stem, and usually leave traces of coaly matter at the sides. The jointed character of the casts of the inside, in general all that is noticed by the geologist, is thus referable to the dissepiments, and cannot be regarded as resembling the jointing of a Calamus. 3. The inside of the woody cylinder, although smooth on the outside, was grooved longitudinally in the spaces between the partitions or on the walls of the chambers, and hence the rubbed surfaces of the casts. 4. The stem, unlike Stigmaria and Lepidodendron, had no woody axis, nor dense medullary sheath.

The author next exhibited specimens of Sternbergia, displaying, like the Calamite, the external cylinder of coal with a smooth surface, and giving no indication of the internal arrangements. The inside exhibited diaphragms having the same origin as in the Calamite, but less regularly disposed, frequently wanting, and giving to the surface of the cast, not a distinctly jointed, but a transversely crumpled appearance. He concluded, by stating that, from the smooth surface, and thickness of the coaly matter into which the plant had been converted, joined to its independent or detached condition in the rocks, it could not be regarded as the remains of a discoid pith, but, like the Calamite, as a plant which had a hollow stalk, the cavity divided into chambers by transverse partitions, the remains of which give to the casts their characteristic appearance.

In reference to Dr Fleming's paper, Professor Balfour exhibited numerous specimens of rhizomes and stems of plants which seemed to illustrate in some measure the appearances presented by such coal plants as Stigmaria, Calamite, and Sternbergia. Dr B. agreed with Dr Fleming in his views regarding these plants, and referred particularly to the statements recently made by Dr F. in his paper on Stigmaria, in the Proceedings of the Royal Society, from which the following is a quotation: — "He stated that in the many examples of Stigmaria which he had examined, he had never observed these rootlets articulated to the stem by anything resembling a ball and socket joint, considering the appearance which had led to this notion as due to shrinkage and state of preservation. The views of Dr Hooker, as given in his valuable paper on Stigmaria in the "Memoirs of the Geological Survey," vol. ii., p. 437, were next considered. This acute observer, from an examination of a particular specimen, concluded that these rootlets, within the body of the stem, form obconical or flagon-shaped bases, the summits of which are on a level with the mouths of the cavities in which they are contained. In the two specimens which Dr Fleming exhibited from the Boghead parrot coal, it clearly appeared that the rootlets communicated directly with the body or trunk, which in this case had been filled from within, with the pulpy matter of the coal, and had thus entered the tubular rootlets which extended for some distance into the argillaceous matter on the outside. Hence he inferred that the flagon-shaped bodies noticed by Dr Hooker were the lower portions of the rootlets, not in the inside, but on the outside of the Stigmaria. Dr Fleming next exhibited examples of the different *quantities* of coal produced by Stigmaria, Sigillaria, Favularia, Calamite, Sternbergia, Lepidodendron, observing that as these plants can furnish coal-making materials separately, and as their remains exist in coal, it cannot be denied that, in the *aggregate*, they would be equally productive; nor, with these facts in view, could it be maintained that coal can only be formed from Fir or allied woods. The author then proceeded to observe that in ordinary household coals, such as caking, cherry, or splint, each bed is stratified, and the strata are separated at their partings by patches of fibrous anthracite, as if formed from broken portions of woody matter. These partings indicate a recurring intermittency of action, probably arising from season changes, during the accumulation of vegetable matter in a form analogous to peat. The parrot coals, on the other hand, by the absence of stratification (being merely laminated or slaty parallel with the plane of stratification of the neighbouring sedimentary rocks), indicate a more decidedly simultaneous origin, and appear to have been in the state of disintegrated vegetable matter, mixed more or less with earthy mud, and distributed like the beds of sandstone and clays. That these coals were originally clays into which bituminous matter was injected will not be countenanced by any one acquainted with their structural character, contents and relative position. There is no bitumen in the Boghead parrot, nor any substance analogous to what has been termed ozokerite from Binny Quarry, to which Dr Bennett has referred. The last substance, indeed, melts at a heat considerably below that of boiling water. The pulpy condition of the original material of the parrot coals, must have been favourable for molecular changes usually termed metamorphic, which may have so far modified the forms and structures of the vegetable tissues as to give them a segregated or concretionary character"

2. *On the Dyeing Properties of Lichens.* By Dr W. Lauder Lindsay.

In this paper the author endeavours to direct public attention specially to the two following facts, viz., First—that, in our own country, many native Lichens, which grow more or less abundantly, might, with advantage and economy, be substituted for the somewhat expensive and scarce foreign Roccellas and other dye-Lichens usually employed in the manufacture of orchil, cudbear and litmus; and, secondly—that, in our colonies, and foreign countries to which we have access, species valuable as dye Lichens probably grow in abundance—might be collected and transported easily and cheaply,—and thus become important and lucrative articles of commerce. He is desirous of bringing the subject under the notice of the following classes of persons or scientific bodies, to whom he leaves its practical or economical application, viz., Firstly,—chemists, orchil, cudbear and litmus manufacturers, importers and exporters of orchella weeds and other dye-Lichens, dyers, &c.: secondly, scientific societies, such as the Royal, Geographical and Botanical, and the Society of Arts;—public boards, such as the East India, Army and Admiralty Boards; industrial exhibitions, such as the Sydenham Crystal Palace and Paris Exhibition: scientific and exploring expeditions, &c.: and, thirdly, colonists, emigrants, travellers, officers of our commercial and royal navy, and of the army, and East India Company; residents abroad, and in our own Highlands and Islands, &c. He remarks:—"This is pre-eminently an age of discovery and enterprise in scientific matters; the strongest tendency everywhere exhibits itself to multiply the natural resources of our native country and its colonies,—to turn to practical account, for the improvement of our arts and manufactures, their hitherto valueless vegetable products. The efforts at present being made to introduce the fibre of the common Nettle, Thistle, and other native weeds, in the manufacture of textile fabrics and paper, as substitutes for flax, is only one limited example of this utilitarian tendency. Believing that this desire requires only to be led into suitable channels, my object is to submit to scientific and commercial enterprise, the importance of this particular field of inquiry, and the richness of the fruits it promises. The fact that manufacturers or importers might find it economical or remunerative to be supplied with substitutes for the Roccellas, which are fast becoming scarce, and consequently expensive, is the most limited view we can take of the advantages of such an investigation. Indirectly a multiplied trade in dye-Lichens might scatter the seeds of civilization, and place the means of a comfortable subsistence at the command of the miserable inhabitants of many a barren island or coast, at present far removed from the great centres of social advancement; for the dye-Lichens will probably be found luxuriant where no other vegetation can thrive, frequently attaining their highest degree of perfection on the most bleak rocky coasts, or on elevated mountain ranges. It is probable that many rocky isles in the broad Pacific and Atlantic,—many hundred miles of desolate sea-coast and vast extents of mountain districts in Africa, America, Asia, and Australasia, which at present yield no products to commerce, and are too barren to support higher vegetation, might furnish an unlimited supply of Lichens useful in dyeing. The vast continent of India and neighbouring countries and islands, for instance, already promise valuable results in this respect. In the Indian collection of raw vegetable products exhibited in the London Crystal Palace of 1851, several specimens of 'Orchella weeds' from India, Ceylon, Socotra, &c., were shown; and an explanatory note appended to some from the vicinity of Aden in Arabia, stated most suggestively 'Abundant, but unknown as an article of commerce.' Specimens of Roccella fuciformis were there exhibited from Ceylon, estimated as worth £380 per ton, and Parmelia perlata at £190 to £225. But the whole world may be said to be an open field; in every clime, in every soil, at almost every elevation, and in all seasons, tinctorial species grow, and even luxuriate. In Northern Europe, in Scandinavia, and even in our own Highlands and Islands, many such species are abundant, and might surely be collected at a rate so cheap as to render it remunerative for the manufacturer to employ our destitute Highlanders in gathering them. Moreover, in connection with the developement of the economical applications of Lichens, it is not unimportant to bear in mind that many species contain such an amount of starchy matter as to become, or to furnish excellent articles of food; many are used as fodder for cattle, some are eaten in Iceland and arctic countries, and one, at least, is frequently used in the making of jellies in this country. I need only here allude, in confirmation of this statement, to the Cetraria islandica, or 'Iceland moss' of our shops; the Gyrophora or 'tripe de roche' of the arctic regions, whereby the lives of many intrepid travellers have been preserved; the Lecanora esculenta, a kind of manna, peculiar to the steppes of Tartary, and the Cladonia rangiferina, or familiar 'Reindeer moss' of Lapland. On the mountains of Scotland, Ireland, and Wales, species of Lecanora, Gyrophora, Umbilicaria, and Isidium, capable of yielding fine qualities of orchil, cudbear, and litmus, are more or less abundant. While the cudbear manufacture flourished in Leith and Glasgow, the Lecanora tartarea, from which it was prepared, was collected to a great extent in our Western Highlands and Islands, but with the transference of this manufacture into the hands of English orchil makers, this source of remunerative employment to our poor Highlanders suddenly ceased, and this Lichen is now chiefly or wholly imported from Norway and Sweden for the London market. The value of this Lichen in Scotland is said to have averaged £10 per ton. Hooker states that, at Fort Augustus in 1807, a person could gain 14s per week by collecting it, estimating its market price at 3s 4d per stone of 22 lbs. Pennant records it as an article of commerce about Taymouth in Perthshire. Miss Roberts mentions its having been collected in North Wales at 1½d per lb for the London market; and it appears also to have been largely gathered in Derbyshire, the price there given to the collector, who could gather twenty to thirty lbs. per day, being 1d per lb. The re-introduction of this trade or means of employment might be a great boon to the Highlanders, who have, within the last few years, been deprived of another source of remunerative labour and comfortable sustenance,—the collection of 'kelp' or 'sea-wrack' on our rocky and stormy western coasts,—and whom dire necessity now compels to transfer their energies to foreign lands."

He then made observations on the mode of collecting Lichens, their mode of transport, and the mode of testing the colorific value, and of evolving the colouring matters. Finally, he gave tabular views showing the chief dye-Lichens applied by the peasants of various countries to the dyeing of stockings, yarn, woollen stuffs, &c., as well as showing the chief dye Lichens used in this and other countries in the preparation of orchil, cudbear, and litmus.

3. *On Diatomaceæ found in a Sub-fossil state in Dumfriesshire.* By ROBERT HARKNESS, Professor of Geology, Queen's College, Cork.

In this paper, the author remarked:—" While examining the boulder deposits which occur on the northern shore of the Solway Frith, last summer, my attention was directed to a locality about a mile west of the mouth of the river Annan, where there is an interesting association of indurated gravel beds, hill deposits, and peat-bog, overlaid by the vegetable soil of the district. The boulder gravel, which here is the lowest deposit exposed, consists of the ordinary Silurian sandstone, mixed with the carboniferous grits, and a few fragments of the Bunter sandstone of the neighbourhood. It had a hardened nature, and in this respect bore considerable affinity to many conglomerates. Above this bed of indurated boulder gravel there is seen a silty deposit, which consists of beds of fine drab-coloured sandy clay, having vegetable remains scattered through the mass. These vegetable remains, when in such a condition that they can be recognised, are, for the most part, fragments of Equiseta. The contents of this silty deposit are, however, not confined to such organisms as ordinary swampy vegetation. On submitting portions of the silt to microscopic examination this substance is found to afford many species of diatomaceæ, associated together in an interesting manner. Professor Gregory, who was kind enough to examine for me the contents of this deposit, states, that the following forms of Diatoms occur:—Epithemia Hyndmanni, Cymbella Scotica, C. maculata, Coscinodiscus radiatus, Cyclotella operculata, C. Kutzingiana, Campylodiscus cribrosus (?), Tryblionella acuminata, T. punctata, T. marginata, Surirella minuta, S. nobilis (or, biseriata?), Navicula didyma, N. ovalis, N. rhomboides var. (Gregory), N. varians (Gregory), Pinnularia major, P. viridis, P. acuta, P. tenuis (Gregory), Gomphonema tenellum, Doryphora amphiceros (fine), Synedra radians, Nitzschia (sp. ?), Grammatophora marina, Melosira sulcata, M. distans, Fragilaria virescens, Odontidium mesodon, Meridion circulare, Achnanthidium lanceolatum. This association of marine and fresh-water forms indicates the occurrence of conditions of an estuary nature, and leads to the inference that the circumstance under which the silt was deposited approached such as now prevails at the mouths of rivers.

" The occurrence of marine forms of Diatoms in silt, puts us in possession of another element, by means of which we are enabled to ascertain the changes which have taken place in the physical geography of the earth. It furnishes us with a means applicable in many instances where other and more perfect organisms have disappeared, the siliceous skeletons of these minute bodies being capable of resisting that agent by means of which the solid coverings of molluscs are dissolved. Many of the raised sea-beaches, now affording no shells, will probably be found to contain Diatoms, which will tell of the conditions under which these raised sea-beaches were originally deposited, and provide us with information concerning the circumstances which operated in the production of strata of this nature."

Dr Gregory alluded to the interesting fact that Diatoms had been found by Ehrenberg in all fossiliferous rocks as far down as the Silurian; and that while the higher organisms exhibited striking differences in the rocks of different epochs, there was, in the case of Diatoms, a striking similarity.

4. *Notice of the time of flowering of certain Trees and Shrubs in the Royal Botanic Garden during the past month.* By Mr M'Nab.

Name.	First flower observed open.	When in full flower.
Prunus Avium, ...	May 1	May 20
,, Cerasus, Double Flowered Cherry	5	23
Wistaria chinensis (on wall)	18	June 8
Prunus Padus, Bird Cherry	20	10
Azalea pontica	23	9
Sorbus domestica, Service tree	27	8
Cratægus coccinea	28	9
,, præcox	28	8
Pavia flava	28	7
Prunus Mahaleb	30	8
Æsculus Hippocastanum	June 1	12
Rhododendron Catawbiense	1	14
Syringa vulgaris (varieties)	2	12
Sorbus Aucuparia	3	10
Cytisus Laburnum	4	13
Cratægus Oxyacantha	8	20
Fraxinus ornus	9	20
Cratægus Oxyacantha rubra	12	20
Mespilus grandiflora	12	20
Cytisus alpinus, Scotch Laburnum	13	25

5. *Notes on the Effects of last winter upon plants in the Royal Botanic Garden, Belfast.* By Dr Dickie, Professor of Zoology and Botany, Queen's College, Belfast.

The following table shows the lowest point to which the thermometer fell during the month of February 1855. It is taken from a Register kept at Queen's College, Belfast—

Min. Thermometer for February 1855.

Date.	Min.	Date	Min.	Date.	Min.	Date.	Min.
1 ...	27.0 F.	8 ...	31.0 F.	15 ...	13.0 F.	22 ...	27.0 F.
2 ...	30.0	9 ...	30.0	16 ...	19.0	23 ...	30.0
3 ..	30.0	10 ...	29.0	17 ..	20.0	24 ...	24.4
4 ...	33.0	11 ...	22.0	18 ...	17.0	25 ...	34.0
5 ...	39.0	12 ...	30.0	19 ...	21.5	26 ...	34.0
6 ...	36.6	13 ...	23.0	20 ...	22.0	27 ...	34.0
7 ...	37.4	14 .	18.0	21 ...	27.0	28 ...	37.4

Mean temperature for the month.	Mean Maximum.	Mean Minimum.	Amount of Rain.
32.45	37.6	27.7	1.690

It will be observed that the absolute lowest temperature was on the 15th, viz., 13° F. In 1845, on March 5th, the thermometer in the Botanic Garden indicated 10° F., lower, than in 1855. The injury to the plants, however, in 1855, was greater, because in February last a generally low temperature, with east and north-east winds, prevailed during two weeks.

The following list of plants injured or killed in the Belfast Garden during last winter has been made out by the curator, Mr Ferguson—

Pinus macrophylla, much injured, 12 feet high.
,, apulcensis, killed, 8 feet high.
,, patula, much injured, 6 feet high.
,, pseudo-Strobus, slightly injured, 7 feet high.
,, Devoniana, much injured 2½ feet high.
,, Russelliana, browned.
,, palustris, killed.
Abies Brunoniana, killed.
,, Jezoensis, killed.
Cupressus funebris, north side killed.
,, Uhdeana, much injured.
,, elegans, killed.
,, Mexicana, killed.
,, torulosa, 1 killed, and the other much injured.
,, Lusitanica, killed.
Juniperus macrocarpa, slightly injured.
Fitzroya Patagonica, killed, 4 feet high.
Saxegothæa conspicua, killed, 4 feet high.
Cephalotaxus Fortuni, not injured in the least, whereas the large-leaved variety has suffered very much.
Erica arborea, killed, 10 feet high.

For the sake of comparison, it may be interesting to insert here the following report by the late Mr Templeton of Oranmore respecting the severe winter of 1813-14, as reported in the Belfast Magazine for that year:—

"Viburnum Tinus, Cistus ladaniferus, Cistus creticus, Erica arborea, E. australis, E. mediterranea, Ulex Europæus, the common and Portugal Laurels, in many places were killed to the ground, or had their young branches destroyed. Edwardsia microphylla and Coronilla glauca, which, trained against a wall, had stood the frost of several winters, are either killed to the ground, or have their branches of two or three years killed.

"Calycanthus præcox, Pyrus japonica, and Corchorus japonicus, have passed the winter in the open ground.

"Timber trees suffered greatly, especially the Oaks, which were split with great violence.

"Walnut, Ash, and other trees had their last year's shoots killed.

"The frost began in November—on December 29, the thermometer fell to 7° F."

6. *Account of the Origin and of some of the Contents of the Museum of Economic Botany attached to the Royal Botanic Garden of Edinburgh.* By Professor Balfour.

When I began to lecture on Botany in May, 1840, I found the need of a Botanical Museum to illustrate the various economical products brought under the notice of the student. Accordingly, I commenced the formation of such a collection; and on my being appointed to the Regius Chair of Botany in the University of Glasgow, I availed myself of the many opportunities presented by that large and flourishing commercial city to increase my museum. I was indebted much to the kind aid of many mercantile friends there, more especially to Mr Michael Connal and Mr William Gourlie. In Glasgow I took occasion to give a few separate lectures on economical vegetable products, such as Cotton, Coffee, Tea, Sugar, &c., illustrated by museum specimens. In such cities as Glasgow it seems to be of great importance that lectures of this nature should be delivered.

At the time of my return to Edinburgh in 1845, as Professor of Medicine and Botany, I had accumulated a large and valuable mass of materials, which

I used regularly for class purposes. The use of the collection, however, was confined almost entirely to my pupils, and it was not available for the public, as there was no room for arranging and displaying it.

In the year 1849, finding that the class-room in the Botanic Garden was too small, and that, moreover, in consequence of dry rot in the beams, extensive repairs required to be executed, I made application to her Majesty's Commissioners of Woods and Forests for an improvement and enlargement of the room. In doing so, I suggested the propriety of building an entirely new hall for the lectures, and of converting the old class-room into a room for a Museum of Economic Botany.

I was aided in no small degree in my application by Sir William Gibson-Craig, at that time member for the city, and one of the Lords of the Treasury, by whose exertions I had previously got the management of the garden transferred fiom the Treasury to the Department of Woods and Forests. Mr Alexander Milne, one of the Commissioners of Woods, was also much interested in the cause.

After some delay, I succeeded in my object, and, accordingly, a new class-room was built, under the able superintendence of Mr Matheson, and was opened on 1st May 1851; while the old one was at the same time appropriated for museum purposes.

The nucleus of the collection was formed:—1. By specimens collected by my predecessor and preceptor, Dr Graham. 2. By my own museum, which I handed over entirely to the public collection. 3. By specimens kindly contributed by Mr James M'Nab.

The museum, however, was not opened to the public until January 1852. Since that time numerous donations have been sent from all quarters. My pupils, now scattered over the world, have annually contributed specimens, and some of them have presented models and dissections prepared by them for prize competition. Among the pupils who have thus contributed, I may notice Dr Charles Murchison, Dr Lauder Lindsay, Dr Priestley, Mr John Maclaren, Mr Surenne, Mr Symons, and Mr Lowe. I am deeply indebted to the Directors of the East India Company, who, at the suggestion of Dr Royle, kindly presented specimens of products from the Great Exhibition of 1851. Visitors are constantly contributing to our riches. The donors from 1st May, 1852, to 31st December, 1854, have been 260. The collection is now so much increased that there is a demand for further accommodation, which, it is hoped, will be afforded by lighting the room from the roof—thus allowing cases to be fitted in the side windows.

The museum is open freely to the public at all times, and the number who avail themselves of the privilege is very large, as shown by the following statement:—

Visitors to Garden and Museum from 1st April, 1852, to 31st March, 1853,	34,224
Visitors to Garden and Museum from 1st April, 1853, to 31st March, 1854,	41,513
Visitors to Garden and Museum from 1st April, 1854, to 31st March, 1855,	39,885
Total,	115,622

The students of botany varying in number annually from 200 to 240, and those attending the popular class embracing 70 or 80 more, have also the means of studying in the Museum. The specimens are regularly used by me for the purpose of demonstration.

Thus, in addition to the extensive and valuable collection of plants in the garden, and the large herbarium of the University which is kept in cases partly in the Museum and partly in rooms contiguous to it, students have the means of seeing the vegetable products of various natural orders and of different climes, and are enabled to become acquainted with those which are valuable in medicine and in the arts and manufactures.

The importance of the Museum both to scientific and unscientific visitors can scarcely be over-estimated. The interest shown in it by all, and especially by the working classes during their holidays, shows its value as a means of useful instruction.

There is great need for an assistant curator in order to get all the arrangements carried out satisfactorily, but as no funds are allowed as yet for that purpose, I am compelled to attend to the whole myself, with the excellent aid given by Mr M'Nab and some of my class assistants.

I trust that ere long this want will be supplied, and that thus the collection will be kept up in such a condition as to do credit to our Scottish Metropolis.

Believing that it may be useful to bring under the notice of the Botanical Society, from time to time, some of the contents of the museum, classified and arranged according to the natural system, I commence this evening by enumerating some of the specimens.

Class I.—Dicotyledones, Exogenæ or Acramphibrya.

Sub-class I.—Thalamifloræ.

Natural Order—Ranunculaceæ.

Buttercup or Crow-foot Family.

This order contains many acrid and narcotic plants, some of which are used medicinally.

Aconitum ferox, Wall. Root, (E. I. Company.)—This constitutes the Indian poison called Bikh, Bish, or Nabee. The plant, according to Dr J. D. Hooker and Dr T. Thomson, is identical with Aconitum Napellus. Hooker states that the Ghoorkas employ the root to poison the waters, and to protect their country from an enemy.

Aconitum heterophyllum, Wall. Root called Butees.—Simla, (Colonel Madden.) Used in India as a tonic.

Aconitum Napellus, L. Common Monkshood.—Root and extract used in neuralgic affections. Of all the European Aconites it seems to be the only one which is of value as a medicine. (See Dr Fleming on Aconite.)

Aconita or *Aconitina*, the active Alkaloid of Monkshood.—(T. and H. Smith.)

Anemone patens, L., North America.—Achenes, with feathery styles attached.

Clematis Vitalba, L., Traveller's Joy.—Achenes, with feathery styles attached.

Coptis trifolia. Salisb.—Gold Thread. N. America. Root. Bitter and tonic.

Delphinium Staphisagria, L., Stavesacre Seeds, (Messrs Duncan & Flockhart.)—Used externally for destroying vermin. They contain an alkaloid called Delphinia. The seeds are used by the Affghans under the name of Siah dana for flavouring curries.

Helleborus niger, L., Christmas Rose, South of Europe.—A drastic purgative. It is imported into Britain from Hamburgh.

Nigella sativa, L., Fennel flower. Europe and Northern India. Seeds, (E. I. Company.)—The seeds are probably the Ketzach or Black Cumin of Scripture. They have pungent properties.

Pæonia officinalis, Retz.—Follicles open; also fecula or starch from the roots.

Podophyllum Emodi, Wall.—Succulent fruit.

Podophyllum peltatum, L., May Apple.—Succulent fruit and roots. The root is used as a purgative in North America. It is sometimes called Mandrake root.

Natural Order—Magnoliaceæ.

Magnolia Family.

The plants of this order have a luxuriant foliage and large showy odoriferous flowers. Their properties are bitter, tonic, and aromatic. Magnolia is the Pendre-kun of the Lepchas, and Hooker states that the Indian mountains and islands are the true centres of Magnolias.

Drimys Winteri D C. Winter's Bark. Bark, tonic and aromatic. The tree was discovered in the Straits of Magelhaens, by Captain Winter in 1578. It extends over no less than 86° of latitude, or 5160 geographical miles.

Drimys granatensis L. fil.—Wood and bark. (Dr G. Gardner.) In Brazil the bark is called Casca d'Anta. It seems to be only a variety of the Winter's bark.

Illicium anisatum L. Star Anise, so called on account of its flavour and the stellate arrangement of its carpels. (E. I. Company.) Japan and Cochin China. Aromatic and carminative. Used by the Chinese as a spice and in the manufacture of liqueurs.

Liriodendron tulipifera L.—Tulip Tree or White Wood. North America. Fruit. (Messrs Lawson & Son.)

Magnolia acuminata L.—Cucumber Tree, so called from its fruit resembling a young Cucumber. Alleghany Mountains. Wood and bark.

Magnolia glauca L.—Swamp Sassafras or Beaver Tree. New Jersey. Wood and bark. The latter is bitter and aromatic, and is used as a substitute for Cinchona.

Magnolia grandiflora L.—Spikes of carpels opening by their dorsal suture. (Messrs Lawson & Son.)

Talauma fragrantissima, Gardner.—Seed vessel. Brazil. (G. Gardner.)

Natural Order—Anonaceæ.

Custard Apple Family.

Trees or shrubs having aromatic fragrant qualities, and many of them yielding esculent fruits.

Anona muricata L.—Soursop or Rough Custard Apple. Fruit. West Indies. The fruit is large, and is covered with soft prickles. It has an acid taste.

Anona reticulata L.—Common or Netted Custard Apple. Bullock's Heart. Fruit. West Indies. The name of Coeur de Boeuf is given by the French colonists from the resemblance which the fruit has in form to an ox heart. The fruit has reticulations on the surface. It has a custard-like consistence, and is highly prized by many.

Anona squamosa, L., Sweetsop or Scaly-fruited Custard Apple. Fruit and seeds (Dr G. M'Nab, Jamaica); Wood (Major Yule). The fruit is eaten by the Creoles in the West Indies, but it is not relished by Europeans.

Duguetia quitarensis, (Schomb.) Wood, West Indies (Mr Hay). The lancewood of coachmakers; the yari-yari of Guiana.

Habzelia æthiopica (Alph. D.C.) Fruit. Africa. The fruit is aromatic, and is known in commerce under the name of Piper æthiopicum, Guinea Pepper or Negro-pepper.

Xylopia glabra, (L.), Bitterwood. Wood in the form of a cup (Miss Yule). West Indies. Water drunk out of the cup has a bitter taste.

Natural Order—Menispermaceæ.

Moonseed Family.

Trailing shrubby plants with drupaceous fruit, seeds and embryo in a lunate form, and having bitter narcotic qualities.

Anamirta paniculata, Miers, *Menispermum Cocculus*, L. Cocculus indicus. Fruit. The plant is found in Malabar and the Malay Islands. Its seeds are used for intoxicating fish, and have been sometimes illegally employed for imparting bitterness to malt liquor. They contain a crystalline narcotic principle, called Picrotoxine, and the pericap yields another poisonous alkaloid called Menispermine.

Cissampelos Pareira, L. Wild Vine or Velvet Leaf. Root. West Indies. The root is tonic and diuretic, and is known by the name of Pareira brava.

Cocculus macrocarpus, W. and Arn. Fruit. East Indies.

Coscinium fenestratum, Colebr. Root. (Dr Stenhouse). Ceylon. The root is called False Calumba, and it contains much Berberine.

Jateorrhiza palmata Miers. Calumba. Root. The plant is a native of Mozambique. The root constitutes the Calumba of the druggists, which is sold cut into slices. It is an excellent tonic, and contains a bitter principle called Calumbine.

CORRECTIONS ON MR MORE'S PAPER ON THE BOTANY OF GALWAY, published in the Botanical Society's Proceedings of April 1855 :—

Page 26, line 30—Instead of "made," read "made up."
27, line 12—Add to the northern plants "Drosera anglica," making them 10.
27, line 20—Instead of "Atlantic species in Ireland, Forbes' term of French type," it should have been "Atlantic species in *the West of* Ireland, Forbes' term of *Norman* type."
27, line 18—After Pinguicula lusitanica, add "and perhaps Viola stagnina."
27—Add Cerastium arvense to the Clare plants.
28, line 27—Add Euphrasia gracilis (Fries).
29, line 11—Instead of "French type," read "Norman type"

From the list of supposed absent species erase Scirpus pauciflorus.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR JULY, 1855.

The Society met at the Royal Botanic Garden, on Thursday 12th July, 1855. Professor Balfour, President, in the chair.

James Wardrop, Esq., Upper Grey Street, was elected an Ordinary Resident Fellow.

The following donations were announced to the Society's Herbarium:—

From Henry Paul, Esq., plants from Sicily.

From Alexander Cowan, Esq., a parcel of Scotch and Irish plants.

From Mr G. Lawson, Mosses collected on the Braemar and Clova Mountains, and West Lomond Hill, Fife.

Professor Balfour stated that the following donations had been presented to the Museum of Economic Botany, at the Botanic Garden, since the last meeting of the Botanical Society:—

From Charles Harmer, Esq., Philadelphia, section of the wood of Wellingtonia gigantea.

From Mr Mackenzie, cone of the Leucodendron argenteum, or Silver tree of the Cape of Good Hope.

From E Dubuc, Esq., fossil plants from Trias near Strasburg, also a specimen of Gyrogonites or fructification of Chara in millstone, from the Paris Basin.

From Dr James B. Balfour, Sigillaria stem in sandstone, from the neighbourhood of Kilsyth.

From Robert Daw, Esq., five pieces of Cuba wood, with peculiar internal partitions.

From Miss Marsh, Craigintinny, branch of a Poplar tree, exhibiting natural engrafting.

From Francis Lyon, Esq., Edinburgh and Leith Gas Company, piece of Arniston coal, having a flattened stem-like appearance.

From Andrew Kerr, Esq., a piece of opalized wood from Australia.

From Mr Pender, Melon from the Crimea, raised at Moredun, from seeds sent by Dr White.

From Mr Laing, Dysart House, flower of Rhododendron Maddeni preserved in brine.

From Mr Niven, Keir Gardens, Stirling, specimens of paper and rope manufactured from the stems of Hollyhock.

From James Wise, Esq., Lycium, as sold in the bazaars in India, probably from a species of Berberis, such as B. Lycium.

From W. M'Farlane, Esq., two specimens of Chew-stick Gouania domingensis from the West Indies, used as a dentifrice.

From Johnston Boyd, Esq., specimen of the wood of the Fortingall Yew.

From William Taylor, Esq., fruit of the Tea tree from China.

From Dr J. B. Balfour, gelatinous tincture of Kino; Kmeri-wood from Tunis; Rhizomes of Lastrea Filix-mas.

From Mr John Dawson, specimens of Stigmaria found on Steele Farm, Habbies How, Newhall.

From Dr M'Vitie, Dress made from vegetable fibre, worn by the inhabitants of the South Sea Islands.

From W. Cattlet, Esq., Secretary of the Botanical Society, Sydney, a packet of Sydney plants.

From Messrs Lawson, Branch with cones of Abies cephalonica.

Professor Balfour stated that the following Donations of plants, cuttings, and seeds had been presented to the Botanic Garden during the past month—

From Isaac Anderson, Esq., Maryfield, plants and cuttings of recently introduced plants.

From J. O. Mackenzie, Esq., seeds of a species of Cyperus from Constantinople.

From Miss M'Innes, Cape of Good Hope seeds.

From Mr Mackenzie, Cape of Good Hope seeds.

From Mr Baxter, Riccarton, collection of Phloxes.

From Mr M'Neill, seeds of a climber from Assam.

From Professor Christison, seeds from the Chadda.

From D. T. Murray, Esq., Australian seeds.

From D. P. Maclagan, Esq., Australian seeds.

From Messrs Sang & Sons, Kirkaldy, plant of Lysimachia Leschenaultii.

From Dr J. B. Balfour, Chinese seeds.

From William Taylor, Esq., seeds of the Oil Cabbage *(Brassica chinensis)* from China; also seeds of the Sappan wood from Penang.

The following papers were read, viz.—

1. *On the Introduction of the Cinchona Tree into India.* By THOMAS ANDERSON, M.D., H.E.I.C.S.

From the large extent of country composing the British Possessions in India, and the consequent variety of climate, a congenial spot may be found for the vegetable productions of many climes. As the acquisitions of territory made within the last few years, on the northern frontier, and our friendly relations with the hill tribes, have opened to us a large portion of the vast Himalaya range, this variety of climate is greatly increased. Within British India may now be experienced the cold of the snowy north, with all intermediate degrees of temperature up to that of the torrid zone. As the temperature varies, so does the face of nature. On the lofty mountain slope, the botanist gathers dry Lichens, Alpine Mosses, Grasses, Saxifrages, Gentians, and Primroses, analagous to those of the Arctic regions; further down the mountain side he finds himself under the shade of Oaks, Chestnuts, Planes, Firs and Cedars, reminding him of his native land and Central Europe; descending still more he reaches a vegetation somewhat like that of the south of Europe, but mingled with forms from the plains beneath; and at length passing through the thick jungle which skirts the base of most mountains of warm climates, he arrives in the level country among the Palms, Banyans, Figs, gigantic Grasses, and tropical fruit trees of the Indian forest.

Aware of this extensive range of climate, Roxburgh, Wallich, Royle, and others, during their residence in this country, endeavoured to introduce many plants of medicinal or commercial importance, and to extend the cultivation of many that are indigenous. The fruits of their philanthropic labours are numerous, and in many instances are the sources of considerable riches to the country. Among the plants of foreign growth introduced into India since its possession by the British, may be mentioned the Tea plant, succeeding admirably in Assam, and some parts of the Himalaya, Coffee, Cinnamon, Nutmeg, Breadfruit, Mahogany, Logwood, Alligator Pear, Cherimoyer, Litchee, Longan, Arrowroot, Mabolo; and among valuable vegetables the Potato, Carrot, and Turnip, and some English fruit trees. To these may be added a list of many ornamental trees and shrubs, and several indigenous plants, the cultivation of which has been greatly improved and extended.

Notwithstanding this long list, it must be confessed that too little has been done as regards the development of the resources of the country, especially when we consider the long and comparatively undisturbed tenure the British have had. Dr Royle, in his work on the Productive Resources of India, mentions many valuable plants likely to succeed in some part of the Honourable Company's possessions.

He says—"Among plants which seem worthy of introduction from America into India, the Cinchonas are particularly desirable, and would, no doubt, succeed in the Neilgherries; the different kinds of Ipecacuanha, Psychotria emetica, and herbacea would also thrive." He gives a catalogue of other medicinal and economic plants, which, however, it is foreign to my purpose at present to enumerate. The following remarks will be confined to the consideration of the introduction into India of the first of these plants, the Cinchona. In doing so it will be my endeavour to point out from resemblances in the climate and Flora of the Cinchona Forests of the Andes, and a portion of the Company's territories, reasons for the introduction being successful, and in addition to show, from a commercial point of view, the advantages likely to accrue to the country. The genus Cinchona belongs to the natural order, Cinchonaceæ, a family containing a large assemblage of valuable remedial agents, and numbering among its members the Coffee. The order is confined chiefly to the tropics of the Old and New World, abounding in the neighbourhood of the great mountain ranges of the Andes and Himalaya. The genus Cinchona, as now limited by many botanists, is found only on the slopes and in the valleys of the first of these chains, extending from the equator to 8° or 10° N. Lat., to 17° or 20° S. Lat., at elevations ranging from 4500 to 9000 feet, with a mean temperature from 50° to 60° Fah.—the temperatures of Florence and Madeira, but without the extremes of cold experienced in those places. It is principally on the eastern side of the Andes that the forests are found. On the western side, little or no rain falls, and consequently vegetation is there very scanty, but as a well known writer on Physical Geography, remarks—"excessive heat and moisture combine to cover the eastern side and its offsets, with tangled forests, of large trees and dense brushwood." In these moist valleys and thick forests the Cinchona trees delight, and, according to Humboldt, "their fever-healing bark is deemed the more salutary, the more frequently the trees are bathed and refreshed by the light mists which form the upper surface of the lowest stratum of clouds." Some travellers, however, refer the localities of this last named species of Cinchona to the dry mountain pastures, where they are exposed to considerable vicissitudes of temperature, but the weight of name and number is on the side of those who state that the most productive species are found in the moist mountain valleys. Weddell, the most recent writer on this subject, and whose comprehensive work is considered by all as an authority, records the difficulty he experienced in procuring the flowers of some of the well-known species for examination, from the trees he had felled, being sustained by the tropical climbers with which the Cinchona forests abound, products of moist and warm situations alone. In the lower portion of the zone of Cinchona forests, Maize, Coffee, and Pepper trees grow, and at its upper limit are found European fruit trees, Wheat, and grains, such as Lucerne, Medicago sativa, along with Daturas, Mimosas, Willows, Yews, and Oaks.

The rocks on which the Cinchona tree is found are formed of gneiss and micaceous schist, and the soil, from the humidity of the atmosphere, is always very moist.

Having thus briefly detailed the climatological conditions under which the Cinchona is found in its native land, and enumerated some of the characteristics of the Flora, I will now attempt to show that similar conditions are to be found in the Company's possessions, and that, favoured by them, plants of nearly allied, and, in some cases, of the same genera, form a leading feature of the vegetation.

As all the species of Peruvian bark trees require only a moderate temperature (59° to 68° mean temperature), in fixing on a spot for their cultivation we at once direct our attention to the Himalaya range. The western portion of that range being far removed from the influence of moisture brought up by the monsoon from the Bay of Bengal, and possessing what meteorologists denominate an "excessive" as well as a dry climate, is thus unsuited for a plant, the climate of whose habitat is marked by great humidity and no extremes. All the range, however, east of the longitude of Calcutta (88° E.) enjoys an equable climate, and rains are there abundant, and the atmosphere is always charged with moisture. In this part of the Himalayas, Darjeeling and the valleys near it seem to me with the exception of the Khasia hills the most eligible spots in India for attempting the cultivation of the Peruvian bark tree, and I shall now devote some space to the consideration of their climate and Flora. In so doing I must draw largely from Dr Hooker's very instructive work, the *Himalayan Journals.*

Sikkim, in which Darjeeling is situated, from no mountains intervening directly between it and the sea, is fully exposed to the moist south winds bringing up vapour from the Bay of Bengal. These striking against the outer portion of the Sikkim range deposit their moisture as rain, and suspend it as mists clouding the sun for nearly the entire year. As Dr Hooker says, "Sikkim is hence the dampest region of the whole Himalaya." These moist winds which give the damp character to the climate also contribute chiefly to render the temperature equable.

During the day the moisture-laden atmosphere precludes the entrance of the sun's rays to the deep and wet gorges, and the same cause acting by night prevents terrestrial radiation going on to any extent. Nor is the dampness of the climate confined to the rainy season alone. During the rest of the year, the heavy moist air of Bengal is attracted by the rarified atmosphere of the mountains of Sikkim, and blows as a moist southerly wind still, while the other parts of India are under the influence of the dry north-west monsoon of the winter season.

Darjeeling at the height of 7430 feet above the sea has a mean annual temperature of 50° Fahr., and a remarkably equable climate, the difference between the hottest and coldest months being 22° Fahr., showing one degree of mean temperature for every degree of latitude north of Calcutta, whose mean annual temperature according to the latest accounts is 78° Fahr. (Humboldt gives 82°), and one degree for every 300 feet of ascent, up to a certain altitude. We have the following scale of mean annual temperatures for the various heights. Of course they are only theoretical, and must vary according to northern or southern exposure, and the clearing of ground from forest; still they approximate nearly to the truth.

Feet.	Mean annual temperature, Fahr.	Feet.	Mean annual temperature, Fahr.
600... ...	72°	3600... ...	62°
1200... ..	70°	4200... ...	60°
1800... ...	68°	4800... ...	58°
2400 ...	66°	5400... ...	56°
3000... ...	64°	6000... ...	54°

I have already stated that the mean temperature of the Cinchona forest varies from 59° to 65°. According to this table, then, the region of the Sikkim Himalaya, where a climate much resembling this is to be found, will be between 2400 and 4800 feet, but 500 feet or more may be allowed, both above and below these limits. The botany of those portions of the Himalaya, near Darjeeling, is particularly interesting.

In the plains below, the usual features of a tropical vegetation are observed, especially in the Terai, or land jungle, which skirts the base of the mountains, where, however, forms from the high land begin to appear. At about 2000 feet of elevation, forests of gigantic trees of Magnolia, Cedrela, sub-tropical Oaks, mingled with Acanthaceæ, &c., occur. Dr Hooker remarks:—"The gullies are choked with vegetation, and bridged by fallen trees, whose trunks are richly clothed with Dendrobium Pierardi, and other epiphytal orchids, with pendulous Lycopodia, and many Ferns, Hoya, Scitamineæ, and similar types of the hottest and dampest climates. Convolvuli and Vines are very common, and those rope-like plants which I have already noticed as a feature in forests of the Andes, are here observed in great abundance, throwing their cable-like stems from branch to branch. They belong chiefly to the genera Bauhinia and Robinia, among the Leguminosæ. The diversity of this aspect of the Flora is increased by scandent trumpet-flowered Bignoniaceæ and slender Araliaceæ (Ivies), and Dioscoreas, nearly allied to the Smilacineæ; Peppers, wild Plantains, and many species of Bamboo, are common: the latter a useful article to the ingenious Lepchas. There is no climbing Bamboo among them analagous to the Chusquea scandens of Humboldt and Bonpland. Its place, however, is supplied by climbing Palms of the genera

Calamus and Plectocomia, which are found in the zone of the Sikkim Flora, along with the Phœnix acaulis, a species of Date-Palm. The other Palms of the Sikkim mountains are, Wallichia oblongifolia, Areca grandis, Caryota urens, and Licuala peltata. Here, too, grows the Tree-Fern, Alsophila gigantea, extending from 2000 feet to, in some cases, 6500 feet of elevation, on the mountains near Darjeeling, and probably indicating here, as its congener in the Andes does, the upper limit to which the cultivation of Cinchona might be carried with success."

To these may be added the Cinchona gratissima, and C. Pinceana, of Wallich, now made by some botanists a separate genus, under the name Luculia, twin natives of these mountains, whose forests are enlivened by the gorgeous colours of their flowers.

Above Darjeeling, Oaks and Chestnuts occur abundantly, with Rhododendrons, and the English Yew; Pines, however, from the humidity of the atmosphere, are rare on the outer range. English fruits, grains, and Potatoes are cultivated near Darjeeling, and in the valley below many varieties of Rice and Indian Corn.

The geological structure of the mountains of Sikkim is nearly uniform, the rocks being principally varieties of micaceous schist and gneiss.

The soil is generally formed by the disintegration of these rocks, and is deeply covered in some places with vegetable mould.

The causes of these resemblances in the Floras of districts so widely removed, is evidently to be sought for in the similarity of climate, a constantly moist one, in the identity of geological formation, and the proximity of the most stupendous mountain chains in the world. From this similarity we are entitled to expect that, if temperature be attended to, which can easily be done, by regulating the elevation above the sea, the Cinchona trees will be certain to succeed in the moist, warm valleys about Darjeeling.

There are many species of Cinchona bark trees, but all are not equally valuable, and those only which afford the greatest amount of Quinine should be introduced. Of these, the Cinchona Calisaya (two plants of which are growing at Darjeeling, and are succeeding well), a tall tree, requiring a higher temperature than most of the species, and yielding the largest amount of Quinine, C. condaminea, C. micrantha, C. cordifolia, and C. hirsuta, with some others, are the best to introduce, and from the difference in the temperatures they require, could cover the limits I have given.

As some of the Quinine-producing species are said to be found in much drier parts of the Andes than the Darjeeling valleys, they would be better adapted for the climate of the more inland regions of Sikkim than those I have particularly referred to. The trees in the Andes are subjected to no cultivation, but are found growing in the forests, where the Cascarilleros or bark-gatherers go out, and in a manner hunt for them among the other trees. This is done at all seasons except in the height of the rains, and is then discontinued from the inconvenience to which the gatherers would be exposed. The trees are generally felled before being peeled, but formerly this was neglected, the bark being removed from the lower portion of the trunk, a practice which, from the number of trees it sacrificed, greatly increased the scarcity of the bark. The outer coating of the bark or periderm is scraped off from the larger pieces, and beyond this and drying in the sun and slight pressure in order to render it more portable, it undergoes no preparation, but is considered ready for market. The tree is of very rapid growth, and, according to Humboldt is ready to be felled when 6 years old.

Were the trees to be introduced into the Sikkim mountains it would not be necessary nor desirable to clear the ground completely for their reception, as in their native country they seldom form entire forests; but grow in groups or singly under the shade of the loftier trees.

All that would be required would be a partial clearance of spots in the forests at heights ranging from 1500 to 5500 or even 6000 feet above the sea, and in the warmest and dampest valleys below Darjeeling, and in parts sheltered from the cold winds which sometimes blow from the snowy range behind. There the plants should be carefully observed in order to discover the most suitable elevation for them. In the course of 3 or 6 years a sufficiency of bark could be obtained from them in order to ascertain the amount of Quinine likely to be produced by a given quantity. Before this, young plants could be reared from the original stock. Cuttings easily take root (the *C. Calisaya* in the Greenhouses of the Edinburgh Botanic Gardens grows readily from cuttings), and thus in 2 or three years after the introduction of the original stock, the plants might be doubled if not trebled.

The expense of introducing the Peruvian bark tree into India, would depend more on the number of species brought than that of the plants. If several species were desired, much travelling in South America would be required; in some cases entailing a long journey to the interior, and the carriage of the plants over lofty mountain passes. Plants, however, of a species such as *C. Calisaya*, which in some parts grows at no great distance from a seaport, might be brought at little cost. The seeds might also be sown in Wardian cases, and allowed to germinate on the voyage. I find, after some enquiry, that 4000 plants might be imported for from £3000 to £4500, including all charges, and, of course, seeds at a much less expense.

As most of the Cinchonaceæ are remarkable for their seeds retaining their vitality for a short time only, it is probable that the Cinchonas are distinguished by the same features, and, therefore, it would be advisable to sow the seeds almost immediately on being gathered. But this is not the time to enter fully on such a question; if the scheme were seriously entertained, these details might easily be adjusted.

I will, therefore, devote the remainder of my space to the consideration of the advantages likely to accrue from the cultivation of so valuable a plant in India.

The South American States derive a considerable revenue from the forests of Cinchona. Recently the bark gathered amounted to two millions of dollars in value in one year, and the demand is on the increase. In Britain, the imports range from 225,500 to 556,000 lbs. annually. In 1850, we imported from France, 489 cwt. of bark, of the value of £6840, and in 1852, it had increased to 1128 cwt., costing £15,787. Sulphate of Quinine is, in addition, largely imported from France. The following is a table of the import for 4 years:—

1848	...	...	3856 ounces	...	L.5,398
1849	...	...	1114 ,,	...	1,560
1850	...	...	8978 ,,	...	12 566
1851	...	...	7605 ,,	...	10,647

In Paris alone, Quinine is manufactured annually to the amount of 120,000 ounces.

Certainly the range of territory in the Himalaya suited for the growth of the Peruvian bark trees is quite extensive enough to produce bark for the use of Europe, and even of the civilized world, independently of meeting the demand for the drug in India. Even supposing that the introduction was made only with the intention of supplying India with Quinine, that desire alone would justify the attempt being made. Were the plant a product of India, Quinine could be manufactured at an infinitely less expense than the present cost of the medicine, and the truth of this is apparent when we consider the original cost of Peruvian bark in America, the importation to England, and the revenue duties, the expense attending the preparation of Quinine in Britain, from the high rate of labour there, compared with India, and lastly, the charges for freight from England to India. Were so valuable and efficacious a remedy to become an article easily procurable in the bazaars, doubtless the health, both of Europeans and natives, would be improved.

Intermittent fever is common all over India, and the mortality from it considerably swells the number of deaths. But from its great cost, Quinine, the only specific for this disease, must be dealt out sparingly, and to the natives must be refused. As articles of export, Quinine and Cinchona bark would soon become of considerable importance, and the demand for them being universal, it would always exceed the supply.

With reference to this view of the subject, Darjeeling, from its proximity to the navigable portion of the Ganges, would be a most suitable spot for the introduction being made.

Memorandum from the East India Company's Dispensary, shewing the expenditure for Quinine and the different Cinchonas, from 1849 to 1853:—

Years.		lb. oz.	£ s. d.	C. Rupees.
	Quinæ disulphas.			
1849	From Jan. 1849 to December	512 0	4846 18 8	
1850	Do. 1850 to Do.	415 12	4226 15 10	
1851	Do. 1851 to Do.	700 0	8283 6 8	
1852	Do. 1852 to Do.	656 0	7500 5 4	
1853	Do. 1853 to Do.	664 0	6518 5 4	
		2947 12	31375 11 10	334,672 15 6
	Cinchona lancifolia, Bark.			
1849	From Jan. 1849 to December	996 0	217 17 6	
1850	Do. 1850 to Do.	1099 0	233 10 9	
1851	Do. 1851 to Do.	1149 0	236 19 7½	
1852	Do. 1852 to Do.	1694 0	342 6 7	
1853	Do. 1853 to Do.	835 0	165 7 2	
		5773 0	1196 1 7½	12,758 3 6
	Cinchona lancifolia, Powder.			
1849	From Jan. 1849 to December	1024 12	248 0 9	
1850	Do. 1850 to Do.	554 0	135 12 3½	
1851	Do. 1851 to Do.	1490 0	363 3 9	
1852	Do. 1852 to Do.	2600 0	622 13 4	
1853	Do. 1853 to Do.	1055 7	255 10 5½	
		6724 3	1625 10 6	17,338 14 11
	Cinchona cordifolia, Bark.			
1849	From Jan. 1849 to December	90 0	24 3 9	
1850	Do. 1850 to Do.	128 0	37 6 8	
1851	Do. 1851 to Do.	449 0	141 4 11½	
1852	Do. 1852 to Do.	308 0	96 19 8	
1853	Do. 1853 to Do.	100 0	33 12 11	
		1075 0	333 7 11½	3556 3 10
	Cinchona cordifolia, Powder.			
1849	From Jan. 1849 to December	338 8	101 18 1½	
1850	Do. 1850 to Do.	138 0	46 17 3	
1851	Do. 1851 to Do.	403 0	154 9 8	
1852	Do. 1852 to Do.	271 0	102 15 1	
1853	Do. 1853 to Do.	71 0	27 19 5	
		1221 0	433 19 5½	4629 0 8
	Cinchona oblongifolia, Powder.			
1849	From Jan. 1849 to December	None		
1850	Do. 1850 to Do.	0 0		
1851	Do. 1851 to Do.	0 0		
1852	Do. 1852 to Do.	9 0	4 1 9	43 0 0
1853	Do. 1853 to Do.	0 0		
		9 0	4 1 9	372,998 6 5

Statement shewing the amount expended and the cost of the undermentioned articles for 5 years in the Bombay Presidency.

	Quinine.						Cinchona Bark.					
	Quantity.			Amount.			Quantity.			Amount.		
	lbs.	oz.	d.	£	s.	d.	lbs.	oz.	d.	£	s.	d.
For 1849 50 ...	262	11	2	2470	0	0	575	12	6	163	0	0
,, 1850-51 ...	338	10	7	4230	0	0	417	0	0	100	0	0
,, 1851-52 ...	262	12	14	3296	0	0	543	10	13	127	0	0
,, 1852-53 ...	268	1	8	3308	0	0	685	4	0	161	0	0
,, 1853-54 ...	251	3	9	2412	0	0	367	15	0	90	0	0
Total.	1383	7	8	15,716	0	0	2589	10	3	641	0	0

Memorandum of Annual Expenditure and cost of Cinchona and Quinine, exclusive of carriage, freight, &c., in the Madras Presidency, for 1853-54:—

Medicines.	Quantity.		Valuation.		
	lbs.	oz.	£	s.	d.
Cinchona cordifolia, powder	551	8¾	245	0	0
,, ,, bark	70	2¼	27	0	0
,, lancifolia, powder	525	0	123	0	0
,, ,, bark	79	0	16	0	0
Quinæ Disulphas	179	2¾	2183	0	0
Total.	1404	13¾	2594	0	0

From these data it appears that 1094 lbs. of Quinine, and 4650 lbs. of Cinchona bark were consumed in India during the year 1853-54. The total cost of this valuable, but expensive drug, was no less than £9678.

According to the best authorities, from 2 lbs. of the bark of Cinchona Calisaya, 1 oz. of pure Quinine is procured; by this ratio, therefore, the amount of bark required to afford Quinine for the Indian market is 8752 lbs., giving, when added to the bark imported into India, a total sum of 12,405 lbs. Allowing 10 lbs. of bark as the produce of one tree, and this is certainly below the average, 1240 trees are required to furnish bark for the consumption in India. Were Government to devote, for the purpose of introducing this boon into India, the sum annually expended on the medicine in the Bombay Presidency alone, a favourable beginning would be made, such a beginning as would probably be sufficient, through time, and by efficient management, to supply the demands for Government purposes, at least in the whole of India. It should be borne in mind that the expenditure shown in these tables, is al most entirely devoted to the European servants of the Company, and the drug is too expensive to be dealt out even to them, to the extent considered necessary by some professional men. In addition to these sums exhibited above, large sums are expended in the three Presidencies, for Quinine for private use, as many Europeans, from the difficulty of procuring it in the interior, consider it absolutely necessary to have a small amount of it with them. But I fear I have extended these remarks already too far; my excuse for doing so must be my zeal for the development of what I feel is an important resource of the country, and my desire to present as far as in my power, a full view of so interesting a subject.

Appendix.

I am well aware that I am not the first to propose the cultivation of this genus in India. Dr Royle several times mentions the subject in his works. In one place he says:—"There would apparently be no difficulty in finding suitable localities for the several species of this very important genus (Cinchona). In India, where the seasons are similar, and the southern parts equally covered by mountains, as the Neilgherries, between 10° and 11° N. latitude, and 8000 feet high, with a range of the thermometer of 43°, a mean temperature of 53°, and where no snow falls, or perhaps on the mountains of Shittagong and Silhat as on Chirrapoonjee, in lat. 25°, elevated 4286, with a range of the thermometer of from 12° to 20° below that in the plains of Bengal, and where the Luculia (Cinchona, Wallich) gratissima is found in great luxuriance" Some years ago, Mr Piddington, author of *Handbook of Storms*, in a letter to the editor of the Calcutta newspaper, strongly advocated the same subject. His statements are so powerful that I cannot refrain from inserting his letter. He remarks:—"There is one tree, the introduction and the copious distribution of which within certain limited appropriate points of the sub-Himalayan range, would confer a greater blessing on the great body of the natives than any effort the Government has made, or can make, and that is the Cinchona bark tree. Without any reference to the greater or less force of medical theories as to the efficacy of Cinchona bark, I now only take an experienced and practical view, well knowing that the sufferings of many millions of poor and rich natives, especially in the jungle districts, are yearly very great, and the mortality quite enormous, from remittent and intermittent fevers, by far the greater part of which would be immensely relieved, or wholly cured by the free use of Cinchona bark. If by abundance the price be once brought within the poor native's reach, he will readily take to it, having no objections whatever on account of caste to anything of the nature of the bark of a tree. If the Cinchona tree were once growing in abundance, Quinine could be easily prepared in India from the facility of procuring and the cheapness of spirits of wine used in the process of its elimination. I take it that every 100 Sepoys ill of fever remaining in hospital off duty for 30 days drawing an average pay of 8 rupees each form a full monthly loss to Government of 800 rupees; while a free use of Quinine and bark would cure them in 10 days on the average, costing at present about 40 rupees, thus by the 20 days' service gained, Government would save nearly 500 rupees. But the Cinchona tree, once grown abundantly, Quinine would, of course, become infinitely cheaper. In Lord W. Bentinck's time, before there were steamers in or to India, seeing, the immense profit to be derived, I sent a proposition to procure young Cinchona plants from Vera Cruz, begging to be then permitted to proceed there on that account, and my proposition was civilly and then favourably received, but these were not the days to act on it."

Dr Balfour stated that some of the Cinchona plants now growing in India had been transmitted by him from the Botanic Garden in a Wardian case at the suggestion of Dr Royle, and that the seeds from which they had been originally raised were sent by Mr Pentland, who received them from Dr Weddell in Paris. These seeds seem to have retained vitality for a long time, and therefore it is probable that the Cinchona might be introduced successfully and with less expense into the cooler parts of India by means of seeds than by living plants.

2. *On the presence of Diatomaceæ, Phytolitharia, and Sponge Spicules, in Soils which support Vegetation.* By WILLIAM GREGORY, M.D., F.R.S.E., Professor of Chemistry.

Ehrenberg, in his late work, "*Mikrogeologie*," has stated that in specimens of soils from all parts of the world, he has found many microscopic organisms; he divides these into Siliceous and Calcareous, the former including Diatomaceæ, Phytolitharia, and Polycystina, as well as Sponge Spicules, the latter minute Mollusks and other shells. The present observations are confined to the silicious organisms, and among these, chiefly to the Diatomaceæ, with Phytolitharia, and Sponge Spicules, the soils examined being such as are connected with fresh water, in which the Polycystina do not occur.

Many of Ehrenberg's observations were made on the small portions of soil found adhering to dried plants in herbaria, and I requested Professor Balfour to supply me with such portions of soil if possible. By his kindness I obtained upwards of 60 such specimens, almost all of which were of very small bulk, on an average, not exceeding that of a pinch of snuff, and sometimes less. Of these a certain number consisted chiefly of earth, with some half decayed vegetable matter, and many contained hardly anything but decaying vegetable matter, with a mere trace of earth. Of course, the latter are not fair specimens of soil, but I have subjected all to the same treatment, namely, boiling with nitro-muriatic acid, washing, straining through gauze, and examining the fine insoluble residue. This, of course, contained all the siliceous matter present, but it also contained much organic matter, of a brown or red colour, insoluble in acids, which, if necessary, might be destroyed by ignition, when it would leave a trifling ash.

In every case I found Diatomaceæ in the residue, as well as Phytolitharia. Sponge spicules apparently of fresh water sponges, were less frequent, but occurred in many. In a few cases, where the acid caused effervescence, there was calcareous matter present, but in most, this was not the case.

Of course, in those cases in which the proportion of earth was small, the residue consisted chiefly of the insoluble organic matter, through which, however, Diatoms and Phytolitharia were scattered, in greater or smaller proportion.

In the cases where the proportion of earth was larger, the residue was much richer in Diatoms and Phytolitharia, but almost always contained also the dark insoluble organic matter. In several, the proportion of Diatoms in the residue was so large, that it had the appearance of a regular Diatomaceous gathering, after boiling with acids. The most remarkable soils in this respect were one from the Sandwich Islands, one from Lebanon, one from the roots of a German moss, and one from Ailsa Craig.

It is to be noticed, however, that Diatomaceæ were found in every case, without exception, and that in all, their proportion to the whole non-calcareous earthy residue was considerable, and often large. In many of those where the proportion of earth was smallest, there was no silicious matter in the residue, except Diatomaceæ and Phytolitharia.

The soils examined were from various and distant localities; there were about 20 from the Andes, several from Brazil and other parts of South America, a few from North America, a few from the West Indies, one from the Sandwich Islands, one from New Zealand, a few from India, one from Lebanon, a good many from Germany, some from France, a few from Spain, and some from Britain.

The great majority of the species of Diatoms in all these were found to coincide with our British forms, but a good many species occurred in the exotic soils which have not yet been found in Britain, and most of these not even in Europe, but which have been figured by Bailey, Ehrenberg, Kützing, Rabenhorst, &c.

A good many were observed, which, so far as I know at present, have not yet been figured or described. Lastly, a certain number of species, lately found by Smith, Greville, and others, as well as by myself in Britain, and some of which are scarce, have occurred in these exotic soils. Among these I may name here Navicula scutelloides, W. Sm. (Lebanon), Orthosira spinosa, W. Sm., Grev. (Andes, Germany), Cymbella turgida, W. G. (Sandwich Islands), and Navicula varians, W. G. (various soils).

Of such species as are unknown to Europe, I shall only mention here, Terpsinœ musica, one of the most striking of known forms, which I found in the first soil I examined, one from Brazil. It is accompanied by Nitzschia scalaris, a fine form, which occurs in Britain, but is far from frequent here.

I am satisfied that a close examination of such specimens of soil, which are often thrown away in putting up specimens in herbaria, will bring to light many new forms, and supply us at home with many exotic and rare species. It is very desirable that collectors of plants should preserve a little of the earth adhering to their roots, and in this way copious materials would be obtained.

I have not yet worked out the apparently new forms occurring in these soils, but there are a considerable number which require investigation.

The above observations entirely confirm Ehrenberg's statements as to the distribution of the Diatomaceæ. They furnish evidence of the fact that these organisms are far less affected by climate and temperature than larger plants or animals; since many of the very same species are found in every latitude and in every country. For example, such common forms as Achnanthidium lanceolatum, Achnanthes exilis, Gomphonema tenellum, G. constrictum, G. capitatum, Cocconeis Placentula, C. Pediculus, Cocconema lanceolatum, C. cymbiforme, Synedra radians, Navicula elliptica, N. rhomboides, Pinnularia viridis, P. major, P. oblonga P. borealis, Surirella biseriata, S. ovata, Meridion circulare; M. constrictum; Cymbella maculata; C. scotica; C. cuspidata; Epithemia turgida; Ep. Argus; Himantidium Arcus; H. gracile; H. majus; Odontidium mesodon; Diatoma tenue; D. vulgare; Nitzschia linearis; N. amphioxys; Melosira varians, and many others actually occur in every part of the world from whence these soils have come; and there is absolutely no difference between the exotic and the British forms.

Ehrenberg specifies two species, namely, Pinnularia borealis (P. latestriata W. G.), and Eunotia amphioxys (Nitzschia amphioxys, W. Sm.), as having been found by him in almost every instance. My results confirm this. In no one case have both of these been absent, and in at least nine-tenths of these soils both are present. They are often the predominant forms, and in a few cases almost the only forms present. As both of them occur very much scattered in ordinary gatherings from water, I suspect that moist earth is their usual habitat. I may add that Gomphonema tenellum and Achnanthidium lanceolatum are also found in a large majority of all these soils.

I am disposed to agree in opinion with Ehrenberg, that the microscopic organisms found in soils contribute materially to the increase of the soil. This is true both of the siliceous and calcareous forms. The Diatomaceæ, for example, live as we may see daily, in moist earth. They obtain silica from the water, and at their death their shells are added to the soil. Where many are present, this process of transference of silica from the rock out of which it is dissolved by the rain, to the soil where it remains in a solid but finely divided form, goes on very rapidly where many Diatoms are living. Now, we have so far evidence that they live (as we know they can do) in these soils, that we find them there very often in the state of self-division, which is not observed in old accumulations of the dead shells.

The peculiar capacity of the Diatomaceæ for resisting climatic changes, whereby the same species can live and thrive as well in the Arctic circle as under the line, corresponds well with the results of the study of the same organisms in the fossil state. In Ehrenberg's late great work, *Mikrogeologie*, will be found very fine figures of the Diatoms occurring in the different forms of Bergmehl, Tripoli or polishing slate, Kieselguhr, pumice, and other volcanic rocks, mountain limestone, Amber, &c., and it will be seen that by far the greater number of these species are quite identical with recent ones. Although microscopic organisms have been found so low down as the green sand of the Silurian system, I find that these do not appear to be Diatomaceous, but rather belong to the Polythalaria. But the earliest Diatoms, geologically speaking, yet found, as figured by Ehrenberg, agree in every point, as far as the great majority of the species is concerned, with those now living in our waters, and forming deposits which will become rock at some future time. It is evidently the same power of resisting change by climate, which, as we have seen, leads to the occurrence of many identical recent species in all parts of the earth, that has led to the permanent existence of so many of the same species, from the time of the Kieselguhrs and polishing slates to the present day.

Some years ago, it was supposed that most of the species in the much more recent Bergmehl, were no longer to be found living. But since then, most of them have been found recent. I myself have lately found two species of the Lapland Bergmehl to be still in existence, namely, Eunotia octodon, and

Synedra hemicyclus; and I may add that Eunotia incisa, which occurs both in the Lapland and the Mull earths, has been found recent by me in a dozen British gatherings. Yet all these forms were supposed, not long since, to be exclusively fossil. We cannot say that there are no species exclusively fossil, but so many that have been thought so are daily found living, that it is probable the rest may be so found too, and at all events, a very large proportion of the forms in the oldest fossil deposits are absolutely identical with the forms of the present day, as a glance at Ehrenberg's figures will prove.

I have only further to mention, that although so many species are universal in their habitat, some appear to be local. Thus Terpsinœ musica does not occur in Europe, nor has it yet been found except in America, and, I think, in Australia.

Some species are decidedly Alpine; for example, Orthosira spinosa, which Professor Smith found on the Mont d'Or in Auvergne, and Professor Balfour on the Grampians, occurs also in nearly every soil from the Andes.

3. *On the Effects of the Severe Frost of last winter on Plants in the neighbourhood of Sligo.* By the Right Hon. John Wynne, of Haslewood.

The following facts indicate the severity of the frost:—

First—The adjoining lake was frozen across, so as to bear skating for about one-third of its length for about a fortnight—a circumstance which never occurred in my recollection and I believe only once during the lifetime of my father, who lived to be 85, and spoke of his having once skated across the lake, which we did several times this last season. Secondly — The number of birds killed by it was very great, especially sea birds—curlews and seagulls. After the thaw the sea shore was covered with dead sea fowl. The thermometer at Markree Observatory, only six miles from this, and equally near the sea, on the 12th of February stood at 13.2 Fahrenheit, and on the 13th 17.6; on the 17th, 17.2; on the 18th, 15. There was no snow here during the continuance of the frost — only about two inches fell on the first day of the thaw, so that the plants were exposed to its full severity. Some days after its commencement I had the roots of the plants marked * covered with sawdust, but by no means soon enough.

Plants killed—Erica arborea, Erica ciliaris, growing in bog; same very slightly injured in garden; Phyllodoce cærulea, Rhododendron altaclarense, Adiantum Capillus Veneris, from Arran; *Davallia canariensis. This Fern has been for years in the rockery, covered during frost with a piece of calico.

Plants much injured—Edwardsia tetraptera, old plants on west wall; E. microphylla, old plants on north wall; Laurus nobilis, *Myrtus communis, on wall, both narrow and broad leaved; Ulex europæus in some places, not the least in others, Calluna vulgaris, in bog; *Abutilon striatum on east wall, out 4 or 5 years; Dabœcia polifolia, Verbena triphylla, *Aspidium longifolium, covered with calico.

Slightly injured as to the leaves—Arbutus Unedo, much injured a few miles off; Photinia serrulata, both on wall and standard very slightly; Viburnum Tinus, some plants close to others which were much injured received no injury; *Ceanothus azureus on south wall.

Uninjured—Fuchsia globosa major, on east wall; Magnolia grandiflora, on south wall; M. tripetala, standard; Rhododendron arboreum. Rhodothamnus Chamæcistus, Arbutus Andrachne, Olea excelsa, standard, sheltered; Daphne pontica, Pæonia Moutan, Pawlonia imperialis, Erica mediterranea, also Irish variety; Cedrus Deodara, Araucaria imbricata, Cupressus tomentosa, Taxodium sempervirens, Pinus canariensis, Abies Webbiana, A. cephalonica, Cryptomeria japonica, Quercus coccifera, Juniperus bermudiana, Buddlæa globosa. Cistus ladaniferus, Garrya elliptica, Woodwardia radicans covered with calico, as it has been for some years; Trichomanes brevisetum, Pinguicula grandiflora, Anemotheca cruenta, Mimulus moschatus.

4. *Notice of a Botanical Trip with Pupils to Falkland and the Lomond Hills, Fife.* By Professor BALFOUR.

On Saturday 30th June 1855, a party of upwards of 100 left Edinburgh by the train for Falkland Road Station. The party included Botanists, Geologists, and Artists. The two former employed themselves in the examination of the West Lomond Hill, the Bishop Hill, and Loch Leven, while the latter, under the direction of Mr Christie of the School of Design, took measurements of the old palace of Falkland, and casts of the more important sculptured figures.

Falkland was reached about 10 A.M.; and there, through the kind attention of Mr Barclay, Sheriff Clerk of Fife, a zealous promoter of science, breakfast was prepared on the green sward in front of the old palace. One hundred and fourteen sat down to a most abundant and sumptuous entertainment. The Rev. Mr Macduff, minister of the parish, officiated as chaplain; and there were present, besides the Edinburgh party, Mr Barclay, Mr Howden, factor for Mrs Tyndal Bruce of Falkland, who had kindly granted the use of the ground for the breakfast table; Mr Cruickshank, the schoolmaster of the parish; Mr Gulland, factor for Mr Johnston of Lathrisk; and others. After returning thanks to Mr Barclay for his liberal entertainment, and to Mrs Bruce and Mr Howden for their attention, the party proceeded to view the rooms in the old palace. Leaving the palace and town of Falkland, the party next walked to Falkland House. Passing through the interesting grounds around the house, they directed their course, under the guidance of the gardener, towards Maspie Den and the West Lomond Hill, which seemed to promise most in a botanical point of view. After skirting the hill on the northern side, they ascended to the summit, which is about 1720 feet above the level of the sea. From the top of the hill their course lay in a southern direction towards Glen Vale and the back of the Bishop Hill. Some of the party visited the latter, and particularly examined the Carline Knowe, while the greater part proceeded through the glen to Ballo and Purin—encountering on the road a very heavy thunder shower, which lasted during the remainder of their walk, and interfered with their intended examination of the East Lomond Hill, by the southern side of which they walked to the Falkland Road Station to meet the train at half-past seven in the evening.

The plants gathered were many of them of interest, and one or two of them very rare. The following may be recorded as some of those which deserve notice:—

Chelidonium majus, near Loch Leven.
Fumaria micrantha.
Viola lutea, abundant on Lomond hills.
Sagina subulata, West Lomond.
Geranium pusillum.
Oxytropus Halleri, Bishop Hill. The plant is abundant in this station; and now that the station at North Queensferry has been destroyed by the progress of agriculture, it is well to find that there is another in the neighbourhood of Edinburgh.
Epilobium alsinifolium. By the sides of rivulets on the northern side of the West Lomond, and in Glen Vale. These are interesting localities for a plant which is usually more alpine in its nature.
Epilobium angustifolium.
Hippuris vulgaris.
Sedum villosum.
Chrysosplenium alternifolium.
Saxifraga hypnoides, West Lomond.
Galium pusillum, Glen Vale.
Antennaria dioica.
Hieracium atratum, gathered and determined by Mr W. Nichol.
Leontodon Taraxacum, var. palustre.
Solidago Virgaurea.
Tanacetum vulgare

Vaccinium Vitis-Idæa.
Myosotis repens.
Solanum Dulcamara.
Veronica scutellata.
Trientalis europæa, in great profusion on West Lomond hill, as well as in the woods near Falkland House.
Littorella lacustris.
Polygonum viviparum, abundant in Glen Vale.
Gymnadenia conopsea.
Habenaria bifolia.
Listera cordata, very abundant on the west Lomond hill.
Orchis latifolia and var. incarnata.
Orchis maculata.
Orchis mascula,
Juncus supinus.
Potamogeton heterophyllus.
.. oblongus.
Carex ampullacea.
.. binervis.
... curta.
... dioica.
... flava.
... fulva.
... glauca.
... ovalis.
... panicea.
... pilulifera.
... præcox.
... pulicaris.
... stellulata.
Carex vulgaris.
Nardus stricta.
Poa nemoralis var. montana, on the West Lomond.
Equisetum arvense.
... limosum.
... palustre.
... sylvaticum.
... umbrosum, in large quantity on the northern side of the West Lomond hill.
Allosorus crispus. On south side of West Lomond hill.
Asplenium Adiantum-nigrum.
... Ruta-muraria.
... Trichomanes.
Athyrium Filix-femina.
Blechnum boreale.
Botrychium Lunaria.
Cystopteris fragilis (also forked).
Lastrea Filix-mas.
... Oreopteris.
... dilatata.
Polypodium Dryopteris.
... Phegopteris.
... vulgare.
Polystichum aculeatum.
Pteris aquilina.
Pilularia globulifera.
Lycopodium alpinum.
... clavatum.
... selaginoides.
... Selago.

The total number of Phanerogamous plants, collected during the trip amounted to about 250

Equisetaceæ	6
Filices	16
Marsileaceæ	1
Lycopodiaceæ	4
Musci	70
Desmideæ	30
Diatomaceæ	45
Total ...	422

Besides numerous Jungermanniæ, Lichens, Fungi, and Algæ.

5. *Report on the Diatomaceæ collected during the Excursion.* By Professor GREGORY.

The two wet gatherings from the West Lomond turned out to be almost exactly alike The dry one from the rock contained hardly any Diatoms, and was not worth examining further. In the two others I found the following species :—

1. Eunotia Arcus.
2. Cymbella cuspidata.
3. ... maculata.
4. Amphora ovalis
5. Cocconeis Pediculus.
6. Cocconeis Placentula.
7. Cyclotella operculata.
8. Surirella linearis.
9. ... ovata.
10. ... Crumena.

11. Surirella panduriformis.
12. Cymatopleura Solea.
13. Nitzchia linearis.
14. ... parvula.
15. ... amphioxys.
16. Navicula cuspidata.
17. ... varians, W. G., (several types.)
18. ... inflata.
19. ... rostrata.
20. ... lepida, W. G
21. Pinnularia acuta.
22. ... viridula.
23. Stauroneis Phœnicenteron.
24. Pleurosigma attenuatum.
25. Synedra radians.
26. ... pulchella.
27. Cocconema cymbiforme.
28. Cocconema Cistula.
29. Gomphonema geminatum.
30. ... constrictum.
31. ... coronatum.
32. ... tenellum.
33. ... Fusticulus.
34. ... olivaceum.
35. ... curvatum.
36. Meridion circulare.
37. Achnanthes exilis.
38. Achnanthidium lanceolatum.
39. Fragilaria capucina.
40. Odontidium mesodon.
41. Tabellaria flocculosa.
42. Diatoma vulgare.
43. ... elongatum.
44. Melosira varians.
45. Encyonema cœspitosum.

Many of the above are far from frequent in the gathering. The predominating forms are those I have given as Nitzchia parvula and Pinnularia viridula, and I do not feel sure that either of these is rightly named. The first may be Ntz. minutissima, or even Synedra minutissima or S. fasciculata; and the second may be possibly Nav. cryptocephala; but both are common forms. Next to these in frequency come P. acuta, Cymb. maculata, Gomph. tenellum, Synedra radians, Cocconema cymbiforme, and Nav. cuspidata, of which there are fine specimens. Most of the other forms are much scattered.

There is one small form which I cannot refer with certainty to any species known to me. I am not sure whether it be a Gomphonema or a Pinnularia, for want of the front view which I have not yet recognised. I daresay there are still several species which I have not noticed. Eunotia diodon also occurs.

6. *Report on the Musci and Desmideæ collected during the Trip to Wes Lomond Hill, Fife, 30th June* 1855. By George Lawson.

In the following List of Mosses, those species only are included which appear to deserve attention, either from their rarity or other points of interest; but in the case of the Desmideæ, whose distribution is so imperfectly known, all the species collected during the trip are enumerated. The nomenclature is that of our two standard British works (those of Mr Wilson and Mr Ralfs) in the respective departments of Musci and Desmideæ.

Andreæaceæ.

Andreœa rupestris, Hedwig.—Abundant on those parts of the hill where the bare rock (greenstone) is exposed, but not observed near its base.

Andreœa Rothii, Web. & Mohr.—With the preceding, (Mr Nichol.)

Sphagnaceæ.

Sphagnum cymbifolium, Dillenius, Ehrhart.—This was the most abundant species observed, varying much in size, according to the moisture of its locality (occasionally not more than half-an-inch high); but in every case readily distinguishable from all other species of the genus by its cauline sheath, the cells of which are furnished with spiral fibres, as in the analogous tissue which surrounds the aerial roots of epiphytal orchids.

Sphagnum molluscum, Bruch.—In marshes in very small quantity, intermixed with other semi-aquatic Mosses. This species not having been long known in Britain, its distribution is probably imperfectly ascertained. It is moreover liable to be overlooked, and, from its slender stunted appearance, to be discarded as an imperfect state of other species with which it generally grows intermixed, in a manner unusual in this genus. When once known however, it is readily distinguished by its weak habit, and when in fruit by the long pedicel. Under the microscope its best character is the remarkable form of the cells of the cauline sheath; these somewhat resemble in form the petiole of Pontederia crassipes, and their apex is so recurved as to project at a right angle with the body of the cell. The curved neck is slightly flattened anteriorly, and is marked on either side with a longitudinal line or ridge. A young branch with a few of the leaves carefully picked off shows these cells in profile under even a low power. In mounting preparations from dried specimens these cells often remain filled with air long after all the other tissues of the plant are completely saturated. This species I had seen only from Risley Moss (Mr Wilson, 1847) until Mr A. Oswald Brodie, Ceylon Civil Service, sent me specimens from Torc and Black Valley, Killarney (April 1855) both in fruit.

Sphagnum acutifolium, *Ehrhart*.—Abundant, and plentifully furnished with antheridia, which in the Sphagna differ remarkably from all other mosses in their minute size and globose form. Abundant, with ripe capsules, in the Glen Vale.

Sphagnum cuspidatum, *Dill.*, *Ehrhart*.—Our specimens of this are of a fine green colour, but otherwise appear to agree well with the typical form of the species.

Sphagnum contortum, *Schultz*.—Rare, on West Lomond.

Sphagnum contortum, *Schultz var. subsecundum*, *Nees & Hornsch.*, *Wilson.* On boggy ground in small quantity. This appears to agree with specimens sent to me by Mr W. M. Ogilvie, who has devoted much time to the study of Sphagna.

Sphagnum contortum, *Schultz*, *var. obesum*, *Wilson*.—In still water, with Littorella and Pilularia. The specimens to which I assigned the above name were sent to Mr Wilson, who reports them to be not essentially different from *obesum*, but scarcely so tumid as his Cheshire specimens, which have not the lurid hue of the Lomond hill plant. Specimens recently collected by Dr Greville at Demyat agree well with the Fife form, and partake, in some measure, of its hue, but are more robust, and have larger leaves.

Sphagnum squarrosum, *Persoon*.—Plentiful on various parts of the hill.

BRYACEÆ.

Rhabdoweissia denticulata, *Bruch & Schimp*.—(Weissia striata var. major, Hook. & Tayl.). (Mr Lowe, Mr Nichol). This rather uncommon and alpine species could scarcely have been expected to occur on so low a hill, and the spot where it was got was far from the summit.

Dicranum squarrosum, *Schrad*.—(Barren).

Ceratodon purpureus, *Brid*.—In immense profusion on bare earthy spots, inviting attention by the numerous forms assumed under different conditions of soil, moisture, and exposure.

Racomitrium heterostichum, *Bridel*.—(The male plant). On perpendicular greenstone rocks, with Andreæa rupestris.

Racomitrium lanuginosum, *Bridel*.—On rocky banks at 1400 feet and upwards.

Racomitrium canescens, *Bridel*.

Atrichum undulatum, *P. Beauv*.—(Polytrichum, Hook. & Tayl.). Woods at the base of the hill, near to House of Falkland, and traced a short way up the ravine, where Epilobium alsinifolium first appeared.

Pogonatum aloides, *Bridel*.—(Polytrichum, Hook. & Tayl). Near House of Falkland.

Polytrichum commune, *Linn*. (normal form).—Abundant with antheridian flowers and ripe fruit.

Polytrichum commune, *L. var. minus*, *Wilson*.—On heathy spots, at a low elevation. This form, which is the Polytrichum perigoniale of Funck (not of Michaux, whose species so called is Wilson's var. perigoniale), is very distinct in habit from the ordinary state of P. commune, and may prove a separate species. It is well distinguished by its short, sometimes branched stem, crowded appressed leaves, short seta and pale calyptra.

Aulacomnion palustre, Schwægr.—(Bryum palustre, Hook. & Tayl.). This, in a barren state, was gathered on various parts of the hill; and in one very moist spot I obtained a patch bearing the pedicellate masses of gemmæ, styled by Bridel "pseudopodia." Mr Wilson states (Bryologia Britannica, 217), that the pseudopodia are of much rarer occurrence in this species than in A. androgynum, apparently depending on the successive degrees of heat and moisture of the locality, and being formed at the expense of the fruit, which is then abortive.

Leptobryum pyriforme, Wilson.—Found only in small quantity, with pistillidia.

Bryum pallens, Swartz.—On wet clayey banks in Glen Vale, with Epilobium alsinifolium. Conspicuous from the deep vinous tinge of the leaves of many of the tufts.

Mnium rostratum, Schwægr.—Abundant in fruit in Maspie Den.

Mnium hornum, L.—On heathy places, an unusual habitat for this species.

Mnium undulatum, Hedwig.—Grounds around House of Falkland.

Mnium punctatum, Hedw.—Plentiful, with ripe capsules and antheridia, by the stream in Maspie Den.

Bartramia fontana, Bridel.—Abundant with antheridia and capsules nearly ripe. This plant and Polytrichum commune permit the antheridia to be dissected out with great facility, and are on this account very convenient to use in investigations relative to reproduction.

Splachnum ampullaceum, Linn.—In wet boggy ground, growing apparently upon cow dung. The fructification being in a green state, and imperfectly formed, this was at first overlooked as a state of S. sphæricum. The form of the turbinate apophysis, which is much widened at the upper part, and the narrower, toothed leaves, are unfailing characters whereby it may be distinguished from that species. (First found by Mr Alex. Davidson.)

Splachnum sphæricum, Hedw.—In wet boggy ground with the preceding, and apparently growing on cow dung; elevation about 1300 feet, and therefore much lower than usual for this species in a locality quite disconnected from alpine districts. (Gathered by Mr Lowe, Mr Nichol, and myself). All the tufts obtained were covered with an abundance of ripe capsules; and there were also plenty of antheridia, which were found to be in an excellent stage for examination, most of them being ready to discharge their contents. It was observed that in the same perichætium there were antheridia in various stages of development, those in the centre appearing to ripen first, even while some of those at the outer edge were of small size, and quite green. There is thus a constant succession of phytozoa produced—a provision which tends to ensure their application to the pistillidia at the proper time. In many of the antheridia examined, slight pressure of the thin-glass cover caused their granular contents to escape; this was beautifully seen under Nachet's lowest object-glass; the matter passes out in a continuous stream through a very small orifice in the apex of the antheridium, afterwards collecting in masses on the field of the microscope, as if of a gelatinous nature. The natural discharge of the contents of the antheridiumis probably a much slower process than what we observe under artificial treatment. This granular contents is by a higher power (say ¼ inch) resolved into a mass of living phytozoa, displaying the most active and lively movements, each whirling upon its own axis, and quickly moving about the field as if from an intense sense of animal enjoyment. Under Ross's one-eighth the form of the phytozoa was well seen; but the morning being cloudy, there was not sufficient light to show the cilia with which these bodies are furnished. The movements entirely ceased about two hours after their discharge from the antheridium, and on some occasions in a shorter period. In one preparation, however (mounted in water), Mr Forbes observed that the phytozoa still moved actively, two days after mounting. As in this case several antheridia were mounted together, it is possible that some of them, entire when put up, had discharged their contents in the interim, and that the movements were seen in phytozoa of these, and not in those originally discharged. The empty antheridium consists of a bag whose membrane is formed of somewhat oblong cells, most of which contain, in addition to granular matter, a bright red nuclear body, which appears in many cases to become divided into a number of smaller vesicular bodies of precisely the same character, thus presenting a striking *resemblance* to Protococcus nivalis, the curious development of which has excited so much attention.

Fissidens adiantoides, Hedwig.

Fissidens taxifolius, Hedwig.

Antitrichia curtipendula, Bridel.—(Anomodon curtipendulum, Hook. & Tayl.)—On dry rocky parts of the hill towards the summit.

Climacium dendroides, Web. & Mohr.—Boggy places, near the base of the hill.

Hypnum Schreberi, Dill., Willd.—This species approaches H. purum, but is well distinguished by the faintly two-nerved leaves, which, as in that species, have distinctly recurved points. In the field the deep red colour of the stem is a ready character, that of H. purum being quite pale.

Hypnum purum, Dill., Linn.—With the preceding.

Hypnum plumosum, Swartz, Schwægr.—A sub-alpine species.

Hypnum rivulare, Bruch.—This species was gathered near Manchester by Mr Wilson so long ago as 1828, but does not appear to have been known as a Scotch species until found on the Braemar mountains during our trip last autumn. It is probably not uncommon in alpine and sub-alpine districts.

Hypnum ruscifolium, Dill.—Glen Vale (ft.) (Leaves large, pale, capsule sub-erect.)

Hypnum stramineum, Dickson.—Fruiting freely in marshy places at the margin of a small muddy lake, at an elevation of about 1300 feet. This species is rare in fruit, and usually in small quantity when it does occur. (Gathered by Mr Lowe, Mr Nichol, and myself.)

Hypnum cuspidatum, Dill., Linn.—In marshy ground with the preceding.

Hypnum tamariscinum, Hedw.—Abundant on heathy ground at the foot of the hill.

Hypnum splendens, Dill.

Hypnum squarrosum, Dill.

Hypnum revolvens, Swartz.—Abundantly in fruit in marshy places, especially in Carex grounds.

Hypnum aduncum, Dillenius.—Plentiful in fruit in boggy ground, intermixed with other Hypna.

Hypnum filicinum, Dillenius.

Hypnum scorpioides, Dill.—(Mr Lowe.)

Hypnum pulchellum, Dickson.—Found in small quantity in fruit. Scarce in England and Ireland, but apparently not uncommon in Scotland.

Hypnum denticulatum, Dill.—Earthy banks by the stream where Equisetum umbrosum was got.

Neckera crispa, Dill.—Obtained in small quantity, (barren.)

Hookeria lucens, Dill.—(Mr Nichol.) Barren.

Hepaticæ.

Marchantia hemispherica, Linn.—Wet banks in the Glen Vale. (Mr H. Stewart.) Of the Liverworts collected, this is almost the only one requiring special notice. It was obtained with sporangia just ripening, and antheridia; the former are usually stated in books to be produced in March. The latter are rare, and furnished interesting materials for the microscope. In Marchantia polymorpha, which I have used much in examining antheridia, there is always a difficulty in dissecting out these organs uninjured from the receptacle in which they are imbedded; but in Fegatella hemispherica this can be done with great facility.

FUCACEÆ.

Phyllactidium pulchellum, Ralfs, Trans. Bot. Soc., Vol. II, plate XX. (Coleochæte, Kutz.)—West Lomond hill, on leaf of Potamogeton, only one specimen noticed. This beautiful and rare species has been obtained by Mr C. Jenner and myself in the neighbourhood of Edinburgh, and was found on a water-lily leaf sent by Mr Croall from Forfarshire.

Bulbochæte setigera, Agardh.—In still water upon leaves of Potamogeton. Plentiful, but much broken up and intermixed with Confervaceæ and Desmideæ. Remarkable from the long hair-like processes which project from the cells, and which are more distinctly seen than those of Phyllactidium pulchellum.

CONFERVACEÆ.

Nostoc sphæricum, Vaucher?—I have placed my specimens under this name as that of the only species in Hassall's book with which they appear to agree, but the determination is by no means satisfactory. The plant is very minute, the "jelly balls" being individually scarcely visible to the naked eye.

DESMIDEÆ.

Our party were ill prepared for collecting Desmideæ, having neither bottles nor spoons for that purpose; nor were we aware of the abundance of these interesting organisms which lay in our path until our return, when the decaying leaves of Potamogetons and other aquatic plants furnished an abundant supply of species. The whole of our Desmideæ were obtained at an elevation of about 1300 feet.

Those marked with an asterisk do not appear to have been hitherto observed in Scotland.

Hyalotheca dissiliens, Smith.—Scarce, and not observed until, by keeping in water, it had broken up into single cells.

Didymoprium Grevillii, Kutzing.—Abundant, and in a good state; a most elegant plant.

Didymoprium Borreri, Ralfs.—With the preceding, but less abundant.

Desmidium Swartzii, Agardh.

Micrasterias truncata, Corda.—Adhering to Hypnum aduncum in moist ground, not in water. (Desmideæ, Diatomaceæ, and other aquatic organisms, speedily vegetate in pools formed by rain on the public roads in Edinburgh.)

Euastrum ansatum, Ehrenberg.—Dr Dickie and Mr Grant have observed this species to rise so high as 3600 feet in Banffshire. On the Lomond Hill it was found at about 1300 feet.

Euastrum pectinatum, Brebisson.

Euastrum binale, Turpin.

Cosmarium pyramidatum, Brebisson.

Cosmarium bioculatum, Brebisson.

**Cosmarium Meneghinii, Brebisson.*—This species might be readily mistaken for an Euastrum; in fact it appears to connect Cosmarium with that genus.

* *Cosmarium undulatum, Corda.*—In this and the preceding species the remarkable molecular movements or "swarming of granules" described by Mr Ralfs were well seen. Mr Ralfs states than when these granules escape from the mature frond they appear to give rise to new plants. This mode of reproduction has been traced in many Algæ by Agardh, Berkeley, Borrer, Hassall, Itzigsohn, and others; and its occurrence in the Desmideæ appears to furnish a strong indication of their affinity. In the *Annals of Natural History* (July 1855), Dr Carter, H.E.I.C.S., gives a highly interesting account of observations on the development of "Gonidia?" from the cell-contents of Chara, which, it is to be hoped, will be carefully followed up. The above movements are not to be confounded with the "circulation" or rotation of the cell sap hereafter noticed.

Cosmarium tetraophthalmum, Kutzing.—This species was obtained with mature sporangia.

Cosmarium margaritiferum, Turpin. (Normal form.)

Cosmarium ornatum, Ralfs.
* *Cosmarium orbiculatum, Ralfs.*
Cosmarium Cucurbita, Brebisson.
* *Cosmarium Thwaitesii, Ralfs.*—Hitherto only observed at Bristol and Swansea.
Arthrodesmus convergens, Ehrenberg.—Only a few cells observed.
* *Staurastrum teliferum, Ralfs.*
Tetmemorus lævis, Kutzing. (Mr H. Stewart.)
Tetmemorus granulatus, Brebisson?—The specimens to which I have assigned this name appear to agree with Mr Ralfs' description, but may prove different from his plant: for, when the empty frond is examined, it shows on either side of the sinus two distinct rows of dots, much stronger than the markings on other parts of the frond; this is not indicated in Mr E. Jenner's drawing.
Penium Digitus, Ehrenberg.—In this species some interesting phenomena were observed.

I. *Locomotion.*

The power of locomotion possessed by the Desmideæ, in itself highly interesting, derives additional importance from the fact that it has been brought forward by Ehrenberg and his followers in support of the animal character of these organisms. "That the Desmideæ move," says Mr Ralfs (*Introduction, Brit. Desmid., pp.* 20-21), "must be admitted, for this fact has been noticed by too many accurate observers to permit any doubt of its truth; and although I have myself failed to perceive their actual movement, I have sufficient evidence of its occurrence;" but, again, "the movements of the Desmideæ must be very sluggish, or exercised only under very peculiar circumstances, since I have never witnessed it, notwithstanding I have almost daily living specimens under my inspection. Mr E. Jenner has been equally unsuccessful; and several friends, experienced in the use of the microscope, either have not seen it, or speak of it in uncertain terms." It is therefore useful to notice species in which the movements occur. The motion observed by me in this species was not a continuous one, such as appears to be described by the various writers on this subject, but strikingly similar to the jerking movements of Pleurosigma and other Diatoms. Movements precisely similar were observed in Cosmarium undulatum and other species.

II. *Circulation.*

In Penium Digitus I had likewise the opportunity of observing a phenomenon which appeared to me precisely identical in character with that termed the "rotation of the cell sap" in Chara and Vallisneria, and which I have described as occurring in Anacharis Alsinastrum, (*Microscopical Journal*, ii., 54). In Penium, as in these plants, large globular granules flow in uninterrupted currents on the inner surface of the utricle, and, as in Vallisneria and Anacharis, are best seen at the edge of the cell. The course of the currents is not very determinate, and they seem to pass each other in close proximity, continuing, however, for hours moving in the same manner. By using the fine adjustment, a single granule may often be followed in its course round the end of the cell, down the edge, and across the suture, thus affording a beautiful demonstration of the unicellular character of the plant. At the suture, however, the manner in which the granule passes seems to indicate a contraction there; its passage is not a slow steady movement, as in other parts of the cell; when it enters the clear space its progress is suddenly arrested, and then it quickly starts across into the part containing granules, as if suddenly released from compression; after which it resumes the even tenor of its way. The phenomenon is different from the usual appearance of the "circulation" of Closterium Lunula; but the granules probably owe their movements to the same cause.
Docidium Baculum, Brebisson.
Closterium Lunula, Muller.—In this organism I had the opportunity of

examining the "circulation" which has excited so much attention, and which has been observed by Dalrymple, Ralfs, E. Jenner, and others, and by Professor Goodsir so long ago as 1842. It is easily seen under Nachet's No. 3 objective with No. 2 eyepiece. The Hon. and Rev. S. G. Osborne, and Mr Hogg, have given full details of the circulation in this species, (*Microscopical Journal*, July and October, 1854). They believe that the currents are due to the action of cilia over the whole surface of the endochrome: these cilia I looked for with Ross's 1-8th inch, high eyepiece, and ½ inch as illuminator, but was unsuccessful, probably from want of convenient arrangement of light at the time. These gentlemen argue that the phenomenon is quite different from the rotation of the cell sap in Chara and Vallisneria. I do not think so Our knowledge of the true nature of the movements in these plants is, however, too meagre to enable us to understand the relations of the phenomena. Osborne's discovery of cilia in Desmideæ is an important step; in our utter ignorance of the *cause* of the movements in Hydrocharidaceæ, cilia ought to be looked for there also.

[Since the above remarks were read to the Botanical Society, the 12th No. of the *Quarterly Journal of Microscopical Science* has reached me, containing two valuable papers on this subject—one by Mr Wenham, in which he argues strongly in favour of the presence of cilia in Anacharis, and gives by far the best general account that has hitherto appeared of the circulation in that plant; the other by Dr Branson of Sheffield, in which he details the actual observation of the ciliary wave in Anacharis, by Powell & Lealand's 1-8th inch, aided by their improved achromatic condenser, and a No. 2 eyepiece. He describes the cilia as probably not much larger than the dots on some of the Naviculæ; but his belief in their existence appears to rest not upon his having seen them but entirely upon the observation of a "waving motion, such as would undoubtedly be attributed to ciliary action if seen in an animal structure."]

Closterium Dianæ, Ehrenberg. This was the most abundant species observed. Several specimens appeared to approach C. Leibleinii, Kutzing, from which it is perhaps not distinct.

Closterium didymotocum, Corda, var. (The normal form, which is rare, was not noticed.) Swarming of granules was observed in this species.

Closterium striolatum, Ehrenberg.

Closterium juncidum, Ralfs.

Pediastrum ellipticum, Ehrenberg. (Colonel Spottiswoode.) Only one specimen observed.

7. *Sketch of the Geology of the District Visited in the Course of Professor Balfour's Excursion.* By Mr James Hector.

Mr Hector stated that the West Lomond and Bishop Hills were closely related to one another in their structure. Taken together they present a ridge bent at right angles, the exterior faces of which are presented abruptly to the north and west respectively, while their interior faces slope gradually in an easterly direction until they meet, thus forming a large triangular table land, from the eastern corner of which the East Lomond Hill arises. The surface of the table-land is broken into subsidiary valleys by conical hills and ridges which are scattered throughout its whole extent. The greatest in magnitude, as well as the most elevated in the position of its base, of all these cones is that which forms the top of the West Lomond. This cone rises to the height of 340 feet above the table-land at its base, which is 1380 feet above the level of the sea, making in all an altitude of 1720 feet. In that side of the ridge which faces the west there is a deep notch which forms the valley of Glen Vale, and which separates the West Lomond from the Bishop Hill. These hills are separated on the NW. from the Ochils by the vale of Eden, and on the SW. from Benarty and Cleish hills by the hollow in which Loch Leven lies. Mr Hector then described this ridge as consisting of a great thickness of sedimentary rocks, all dipping to the SE. at an average of 25 degrees, thus presenting their cross section in an exposed manner on the abrupt sides of the ridge. Overlying and intruding among the upper of these beds, is the trap which forms the cones and secondary ridges before mentioned as existing upon the table-land. The succession of the sedimentary rocks is as follow:—1st, The great conglomerate of the Devonian System, which stretches across from the Ochils, being exposed for nearly half way across the Vale of Eden, at its upper part, and then dipping under the next series of rocks. It thus forms the floor upon which the hill is built. Next come a series of rocks, of which by far the greatest mass of the stratified part of the hill is composed, and which, although tolerably uniform in their mineral character, hold a doubtful position in Palæontological classification. The lower beds of the group afford Devonian fossils, while the upper abound in Sigillaria, Stigmaria and other coal plants. Mr M'Laren has called them Calciferous sandstones—a name which accurately expresses their lithological character—and considers them as a group intermediate between the Old Red and the Carboniferous epochs in Scotland, and parallel with the lowest beds of the carboniferous, and the highest of the Devonian of the English and Irish geologists. Mr Hector then stated that Falkland stood upon the lower beds of this series, at perhaps about the same horizon as that of the famous fish bed of Dura Den. At Nuthill, where there was an opportunity of examining them at a higher horizon, there were no traces of organic remains to be seen, but upon gaining the higher beds of the series, as for instance at the Pavillion, and again on the open hill it was found that they abounded in fossil plants. He then passed on to the next group of sedimentary rocks, viz., the northern limestone, and which he said was found to be separated from the last series by a trap floe of considerable thickness, what seemed to be the same floe being met with both on the northern and southern aspects of the hill. Only an obscure and small section of the limestone was seen, lying a little to the north of the base of the conical top. It had evidently been to some degree altered by the trap, but it abounded in ill-preserved specimens of the ordinary mountain limestone corals, and other fossils. The section also showed a few feet in thickness of the Culme shale, a white fissile rock, which in some places is quarried for the manufacture of slate pencil. Regarding the igneous rocks of the district, there are greenstones and basalts, which seem to pass into one another, probably according to the rate at which the rock had cooled. The basalt was found to occupy the summit of the hill, and one thin floe which was examined, while all the other portions were greenstone. In the section along the face of the Bishop Hill, the floe of greenstone, which was before mentioned as separating the sandstone from the limestone beds, presents a sub-columnar structure, and weathers into spheres.

Mr Hector next proceeded to consider the causes which have produced the present configuration of the district, stating that the gentle slope to the eastward was due to the dip of the beds, while the abrupt face to the westward must be the result of the denudation of those parts of the soft beds which had not been preserved by being overlaid by the more indestructible trap. In connection with this he stated that certain appearances at Glen Vale lead to the belief that there still exists at that place some remains of an ancient sea margin, at an altitude of 700 feet above the present sea level.

8. *Record of Localities for Rare Plants.* By PROFESSOR BALFOUR

Diatomella Balfouriana, Bracklin Bridge (Dr. Greville).
Scutellaria galericulata, near Lead-burn (T. G. Stewart).
Valeriana dioica, near West Linton (W. Nichol).
Littorella lacustris, near Lead-burn (W. Nichol).
Galium uliginosum, near Lead-burn (W. Nichol).
Jungermannia decipiens, Wilson, near Ardglass (A. C. Maingay).
Borrera flavicans, Ach., on Ardglass Downs (A. C. Maingay).
Rubus Chamæmorus, Hill South of Habbie's Howe (J. Lowe).
Rhinanthus major, Leven Links (J. Lowe).
Potamogeton prælongus, Kinghorn Loch (J. Lowe).

Eriophorum latifolium, near Crichton Castle (J. Lowe).
Saxifraga oppositifolia, Allermuir Burn, Pentlands (J. Lowe).
Lactuca muralis, near Musselburgh (J. Lowe).
Mentha sylvestris, Gogar Burn (J. Lowe).
Lythrum Salicaria, Lochgelly (J. Lowe).
Silene anglica, side of Peebles Railway (J. Lowe).
Helosciadium nodiflorum, Duddingston Loch.
Tulipa sylvestris, near Ravelrig J. Lowe); Donibristle, near Aberdour.
Viola canina, Fries and Bab. (V. pumila, Vill.), Dirleton and Gullane.
Lychnis Viscaria, Minto Crags (Mr Nichol).
Valeriana dioica, Marsh at foot of Middle Eildonhill, Melrose.
Crepis biennis, Field at Luffness.
Campanula Trachelium, Luffness (Mr Pow).
Lathræa squamaria, Woods near Melrose.
Neottia Nidus-avis, Woods near Melrose; near Ayton Castle.
Potamogeton gramineus, Pond in Dysart Garden (Mr Evans).
Typha latifolia, near Hassendean (W. Nichol).
Carex incurva, near Longniddry.
——— Œderi (true form) Gullane Links.
Alopecurus agrestis, North Berwick.
Asplenium germanicum, Minto Crags, near Hassendean (W. Nichol).
Lycopodium alpinum, near Tynehead.
Grimmia deusta, Eildon Hills.
Sticta scrobiculata, near Melrose.
Calicium furfuraceum, Ground in a Plantation at Bonaly (Messrs Maingay, Macmillan, and Nichol).
Gyrophora polyphylla, Arthur's Seat (Messrs Armstrong, Macmillan, Maingay, Nichol).
Gyrophora proboscidea, Stones on the top of Carnethie (Messrs Lowe, Maingay, Nichol).
Bryum atropurpureum, Experimental Garden (G. Lawson).
Closterium Lunula, Road behind Edinburgh Academy (G. Lawson).
Cuscuta Trifolii, Buckstone, Braid Hills (W. W. Evans).
Campanula latifolia, Eaglescairnie Woods (W. W. Evans), Craigcrook.
Cypripedium Calceolus, Arncliffe, Craven (Rev. J. L. Bigge).

Professor Balfour exhibited specimens of Conferva capillaris L. (Agahrd), sent by Mr Wilson from the farm of Rauburn, Craushaws, Berwickshire.

Dr. A. Douglas Maclagan, exhibited specimens of plants received by him from the Crimea, among which were the following:—

Convolvulus cantabrica.
Paronychia serpyllifolia.
Salvia Horminum.
Sideritis sp.
Onobrychis petræa.
Lathyrus tuberosus.
Helianthemum vulgare.
Linum hirsutum, L.
Adonis æstivalis, L.
Myosotis sp.

Professor Balfour exhibited from Sir W. C. Trevelyan, a small form of Leontodon, with deeply cut leaves, and short, upright, outer scales to the involucre, described by Dr Johnston in the Botany of the Eastern Borders.

Professor Balfour laid on the table the following list, prepared by Mr James Hardy, Penmanshiel, of *Vegetable Excrescences*, &c., (chiefly formed by Gall midges), that have not yet been discovered in Britain; but which may be expected to occur:—

Acer pseudoplatanus. The middle of the leaves crumpled together by *Cecidomyia irregularis*, Bremi.

Ægopodium Podagraria. A gall on the receptacle of the florets (C. Podagrariæ) Lœw.

Alisma Plantago. Galls on the leaves by Lasioptera auricincta of Winnertz.

Artemisia campestris. Round aggregated gall on the summit of the stalks C. Artemisiæ, Bouche.

Tube-shaped production of the receptacle. C. tubifex, Bouche.

Barbarea vulgaris. Pseudo gall of the flower. C. Sisynibrii, Schrank.

Berberis vulgaris. Bushy aggregations of leaves. Lasioptera berberina, Schrank.

Bryonia dioica. Gall on the stems. Trypeta sp.

Carpinus Betulus. Cylindrical galls with a lid, on the upper sides of the leaves. C. tornatella, *Bremi.*

Cratægus Oxyacantha. Leaves rolled up. C. Oxyacanthæ, Schrank.

Echium vulgare. Lateral buds deformed. C. Echii, *Lœw.*

Euphorbia cyparissias. Large tufts of curved leaves on the tops of the barren twigs. C. Euphorbiæ, Bouche.

Euphorbia cyparissias. Round buttons of leaves on the top of the barren twigs. C. capitigena, *Bremi.*

Galeobdolon luteum vel Lamium purpureum. Pouch-shaped swelling of the terminal leaves of the young twigs. C. strumora, *Bremi.*

Genista tinctoria. Bundles of altered leaves mentioned by Rennie.

Hieracium murorum. Blood red blisters on the radical leaves. C. sanguinea, Bremi.

Hieracium Pilosella. Gall on the midrib. C. gemini, Bremi.

Leontodon Taraxacum. Blister-shaped galls on the leaves. C. Leontodonta, Bremi.

Lithospermum officinale. Tufts of leaves inflated at the base, on the summits of twigs. C. Lithospermii, Lœw.

Lotus coniculatus. Pods excessively turgid; flowers rendered like bulbs. C. Loti, Degeer.

Lythrum Salicaria. Stalks in vicinity of the tops of twigs. C. Lythrii, Lœw.

Medicago falcata, and sativa. Buds and pod altered. C. Loti, Degeer.

Nasturtium sylvestre. Flowers form a pseudo gall. C. Sisymbrii, Schrank.

Onobrychis sativa. Leaves formed like a pod. C. onobrychidis, Bremi.

Papaver Rhæas. Under part of the receptacle much swollen. Unknown.

Peucedanum palustre. Seeds swollen. C. Tysselini, Lœw.

Pimpinella sp. var. Seeds swollen. C. Pimpinellæ, Lœw.

Pinus sylvestris. Leaves. C. Pini, Degeer.

... ... Sheaths of the leaves. C. brachycentra, Schwœg.

Pisum sativum. Pods. C. Pisi, Lœw.

Polygonum amphibium. Margins of the leaves rolled backwards. C. Persicariæ, L.

Populus tremula. Pea-shaped galls on the leaf and leaf stalk. C. populea, Schrank.

Prunus avium and Cerasus. Dried up spring tops. C. Cerasi. *Lœw.*

Ranunculus bulbosus. Edge of the leaves rolled together above. C. Ranunculi, *Bremi.*

Ribes rubrum. Margin of the leaves rolled upwards. C. Ribesii, Meig.

Rubus cæsius. Young leaves rolled together. C. plicatrix, Lœw.

Rubus. Woody galls on the branches. Lasioptera Rubi.

Salix. Numerous galls on various species, more especially S. alba, S. amygdalina, S. frigilis, S. purpurea, S riparia, S. rubra.

Sisymbrium Sophia. Flowers deformed. C. Sophiæ, Lœw.

Stachys sylvatica. Swollen pouches at the top of the lateral twigs. C. Stachydisi, Bremi.

Tilia europæa. Margin of leaves rolled upwards and thickened. C. Tiliæ, Schrank.

Do. Pea shaped, woody, deciduous leafy gall. C. tiliacea, Bremi.

Tormentilla erecta. Roundish gall on the stalk. C. Tormentillæ, Lœw.

Verbascum Thapsus. Flowers deformed. C. Verbasci, Vallot.

Veronica spicata. Large hairy gall under the receptacle.

Viburnum Lantana. Small flat blistered space on the leaves, mentioned by Reaumur.

9. *Notice of some of the Contents of the Museum at the Edinburgh Botanic Garden.* By Professor Balfour.

(*Continued from page* 60.)

Natural Order—Berberidaceæ.

Barberry Family.

The plants of this order usually supply an acid fruit, while the wood and bark possess bitter and astringent, as well as dyeing qualities.

Berberis vulgaris, L.—The common Barberry. Europe. Fruit, containing oxalic acid, used as a preserve: wood and bark, astringent, used in dyeing, yield a yellow, bitter, azotised matter called Berberine.

Berberis aristata, DC., *B. Lycium*, Royle, and *B. asiatica*, Roxb., are supposed to be the sources of the Lycium of Dioscorides. Specimens of Lycium, as sold in the bazaars in India under the name of Ruswut (Dr James Wise). This extract is used in diseases of the eye. Fruit of B. aristata is used like raisins in the Himalaya.

Caulophyllum thalictroides, Mich. North America. Seeds used as a substitute for coffee.

Natural Order—Nymphæaceæ.

Water-Lily Family.

Aquatic plants with large showy flowers, and cordate or peltate leaves arising from large rhizomes which are sunk in the mud. The order possesses bitter and astringent qualities, and the rhizomes and seeds contain much starch, which is used as food. The spiral fibres in the vessels of the leaf-stalks are occasionally used as wicks.

Nuphar luteum, Sm. Yellow Pond Lily. Europe. Rhizome dried; also preserved in diluted acetic acid (Mr Robert Hutchinson, Stranraer.) The markings left after the rootlets fall off resemble, in many respects, those of Stigmaria. The yellow flowers have a smell of brandy, and the fruit has a flask-like shape; hence it is sometimes called brandy-bottle. The rhizomes, steeped in water, yield a blue coloured powder, resembling indigo in appearance. The Turks prepare a cooling drink from the flowers.

Nymphæa alba, L. White Water Lily. Europe. Rhizome or underground stem. It is used for dyeing black or grey, as well as for tanning leather. It resembles also, in many respects, Stigmaria.

Victoria regia, Lindl. Still water in tropical America, east of the Andes. Fruit (Mr G. Lawson). The orbicular leaves of the plant are 6 to 6½ feet in diameter, leaf stalks 18 feet long, and flowers 14 to 16 inches in diameter. The seeds are called Water Maize in South America, and are eaten.

Natural Order—Nelumbiaceæ.

Water-Bean Family.

Aquatic plants having a remarkably large top-shaped receptacle, in the hollows of which the nuts or fruits are half-buried. The nuts are eatable. The receptacle resembles in appearance the rose of a watering-pan.

Nelumbium speciosum, Willd. Sacred Water-Bean of Egypt, or the Sacred Indian Lotus. Egypt and India. Receptacle with nuts immersed in it; also nuts separate (E. I. Company). A kind of Arrowroot prepared from the Rhizome in China (Mr Fortune). The flower is the Lotus represented on Egyptian and Indian monuments. The fruit is supposed to have constituted the Cyamus or Pythagorean bean. The edible nuts are said to be sown by being enveloped in clay and thrown into the river, so as to sink in the mud. Hence, it is said, the origin of the proverb, "Cast thy bread upon the waters, for thou shalt find it after many days."—Eccles. xi., 1. Sacred necklaces made from the nuts are sold at Benares. The rhizome is also used for food in China.

Natural Order—SARRACENIACEÆ.

Water-Pitcher or Side-Saddle Flower Family.

Plants growing in boggy ground in America and remarkable for their pitcher-like leaves, which contain a fluid secretion in which insects are usually found in large quantities. There are inverted hairs on the inner surface of the pitcher, which allow the entrance of the insects, but prevent their egress. At the top of the pitcher there is an elongated lid-like portion.

Darlingtonia californica Torrey. California, head-waters of the Sacramento. Portion of Pitcher laid open, showing peculiar transparent dots from thinning of the tissue (Mr Murray).

Sarracenia purpurea, Mich. Purple Side-saddle flower. North America. Pitcher or Ascidium.

Sarracenia flava, L. Yellow side-saddle flower. North America. Pitcher (Messrs Veitch).

Natural Order—CEPHALOTACEÆ.

Cephalotus Family.

Plants found in the marshes of King George's Sound, New Holland, remarkable for their hollow pitcher-like leaves.

Cephalotus follicularis, Labil. New Holland. Pitcher-like leaf (Messrs Veitch).

Natural Order—PAPAVERACEÆ.

Poppy Family.

The plants of this order possess narcotic qualities in a marked degree. Some of them have also acid properties. The juice is frequently white as in the Poppy, at other times it is coloured, being orange in the Celandine, and red in Blood-root or Puccoon of Canada. The seeds are oily, and usually have no narcotic qualities.

Papaver somniferum, L. White or Opium Poppy, supposed to be a native of Asia and Egypt, but cultivated in many warm and temperate climates. Capsules, commonly called Poppy heads. Opium prepared from the capsules. Morphine and narcotine prepared from opium. Seeds of the Opium Poppy, yielding a bland oil (T. C. Archer, Esq.) Poppy-oil cake is made from the seeds, and used for feeding cattle. In India the capsules are sliced by means of a little instrument like a saw, made of 3 iron plates, with ragged edges, tied together. Hooker states that 6,500,000 lbs. are annually bought up for manufacture, and as a source of revenue, by the East India Company. It has been calculated that 20,000,000 lbs. of opium are annually consumed by mankind, representing a value of £20,000,000.

Natural Order—CRUCIFERÆ OR BRASSICACEÆ.

Cruciferous or Cabbage Family.

The plants of this order have four petals arranged in the form of a cross and six stamens, four of which are long and two short. They are generally distributed, but abound in cold and temperate regions, especially in Europe. There are no poisonous plants in this order, which contains many esculent culinary vegetables and plants yielding oilcake. Antiscorbutic qualities occur. Some are pungent and a few are acrid. The plants contain much nitrogen and sulphur in their composition, and hence give out during decay very fetid gases.

Anastatica hierochuntina, L., Rose of Jericho. Deserts of Syria and Egypt.

Annual stem and branches rolled up like a ball in the dry state (Mr Keddie). When the dried ball is exposed to moisture it opens and spreads out the branches.

Brassica Rapa, L., Common Turnip. Egypt. Peculiar black Turnip cultivated near Edinburgh, and said to stand the winter well (Mr R. Girdwood).

Isatis indigotica.—Shanghae Indigo plant. China. Dye (R. Fortune, Esq.) It is the Tein-ching of the Chinese, and is extensively used in dyeing the cotton cloth produced in a district near Shanghae.

Isatis tinctoria, L., Woad. Europe. Seed vessels and seeds. Plant used for dyeing blue.

Megacarpæa polyandra, Benth. Roogee. East Indies. Winged seeds, from an elevation of 12,008 feet in Kumaon (Colonel Madden).

Sinapis alba. White or Essex Mustard. Europe. Seeds. The seeds contain a fixed oil, with a principle called sinapin, which gives rise to the formation of an acid substance when mixed with water.

Sinapis glauca, Roxb. East Indies. Seeds (E. I. Company). Used for yielding oil.

Sinapis nigra, L. Black Mustard or Cambridge Brown Mustard. Europe. The seeds are dark coloured and supply the best table Mustard. They contained a fixed oil, besides Myronic acid and Myrosine. The two latter on the addition of water combine and form a pungent oil, on which the physiological action of Mustard depends.

Sinapis rugosa, Roxb. East Indies. Seeds (E. I. Company).

Natural Order—Capparidaceæ.

Caper Family.

The plants of this order have pungent, stimulant, and antiscorbutic qualities.

Capparis spinosa, L. Caper-plant. Flower buds preserved in vinegar, constituting capers. Other species appear also to furnish capers: *C. rupestris*, Sib. in Greece, *C. Fontanesii*, DC. in Barbary, and *C. ægyptiaca* Sieb. in Egypt. The last named plant is supposed to be the Hyssop of Scripture.

Natural Order—Resedaceæ.

Mignonette Family.

This order possesses few properties of importance. The Mignonette, *Reseda odorata*, is prized for its fragrance.

Reseda Luteola, L. Yellow-weed or weld. Europe. Plant used to furnish a yellow dye.

Natural Order—Flacourtiaceæ or Bixaceæ.

Arnotto Family.

Some of the plants of this order are bitter and astringent; others yield dyes and edible fruits.

Bixa Orellana, L. Arnotto plant. South America. Fruit (Mrs Dr Smith). Seeds and cake made from the pulp around the seeds. The angular seeds are covered with an orange-red pulp, which constitutes Arnotto or Annotto, and is used for a red dye, and for staining cheese, as well as in the manufacture of chocolate. In 1853 upwards of 4590 cwt. of Arnotto were imported into Britain.

Kiggelaria africana, L Cape of Good Hope. Wood (Mr C. Watson).

Natural Order—Cistaceæ.

Cistus, or Rock-Rose Family.

The plants of this order are generally resinous and balsamic.

Cistus creticus, L. Crete and Syria. Ladanum or Labdanum, the stimulant resin procured from it. This resinous matter is also procured from Cistus ladaniferus, L., and Cistus Ledon, Lam. Some suppose that Ladanum is the Myrrh mentioned in Genesis under the Hebrew name of Lot.

Cochlospermum Gossypium, DC. East Indies. Seed vessel (Dr Christison.) The plant yields Gum Kuteera.

Natural Order—VIOLACEÆ.

The Violet Family.

The Violets and Pansies belong to this order. They have irregular flowers. Some tropical plants of the order have regular flowers. The roots of many of them are emetic, and contain a principle called Violin, similar to emetine.

Ionidium parviflorum, Vent. Cuchunchully. South America. Roots. Emetic and purgative. The roots of I. microphyllum, H. B., have similar qualities.

Viola odorata, L., Sweet Violet. Europe. Roots used as emetics and purgatives. Petals used to give a blue colour to syrup, and as a test for acids and alkalies.

Natural Order—POLYGALACEÆ.

Milk-wort Family.

The plants of this order are generally bitter and acid, and their roots yield a milky juice.

Polygala Senega, L., Seneka root, or Snake root. North America. Root used as an emetic, cathartic, and to promote the flow of saliva. It contains an acrid principle called Polygaline or Senegine.

Natural Order—KRAMERIACEÆ.

Rhatany Family.

The plants of this order have astringent qualities.

Krameria triandra, R. P. Rhatany plant. Peru. Rhatany root is an astringent. It yields a blood red infusion, which has been used to adulterate Port wine. It is mixed with charcoal in tooth powder.

Natural Order—TAMARICACEÆ.

Tamarisk Family.

The plants of this order have an astringent and slightly bitter and tonic bark. Those growing near the sea abound in the salts of soda.

Tamarix orientalis, Forsk. Persia. Wood and bark (James Cunningham, Esq).

Natural Order—CARYOPHYLLACEÆ.

Clovewort and hickweed Family.

The plants of this order have scarcely any marked properties. Some say that the principle called Saponine found in some of the plants is poisonous. Some of the plants have showy flowers.

Dianthus Caryophyllus, L. Clove Pink, Clove Gilly Flower, or July Flower. Europe. Flowers used as a syrup.

Saponaria officinalis, L , Soapwort. Europe. Root and herb. The plants form with water a lather like soap, and are used as a substitute for it.

Natural Order—MALVACEÆ.

The Mallow Family.

The plants of this order have mucilaginous and demulcent qualities. They supply various kinds of fibres.

Abelmoschus esculentus, Medic., or *Hibiscus esculentus*, L., Ochro plant. Tropical America and India. Fruit or pods (Dr M'Nab). The green pods or seed vessels, called ochro, okra, or gombo are mucilaginous and are used for thickening soups.

Althæa officinalis, L., Marsh Mallow. Europe. Dried flowers and leaves supply mucilage, and are used as a demulcent.

Althæa rosea, Cav., the Hollyhock. South of Europe. Spike of dried flowers and fruit, showing a peculiar fasciated stem (Mr D. P. Maclagan). Mucilaginous qualities. Leaves dye blue. Fibres from the stem, and paper made from them (Mr J. Niven, Keir).

Gossypium.—Various species of this genus supply the cotton of commerce, which consists of the hairs attached to the seeds. There are probably four distinct species of plants furnishing the cotton of commerce—1. *Gossypium herbaceum*, L., the common Cotton plant of India, a variety of which supplies the Chinese or Nankin cotton. 2. *G. arboreum*, L., the Tree Cotton of India, with red flowers, and a fine silky cotton. 3. *G. barbadense*, L., Barbadoes cotton, called in India Bourbon Cotton. This supplies the highly esteemed sea island cotton, also the Georgian and New Orleans cotton. 4. *G. peruvianum*, Cav., or *G. acuminatum*, Roxb., which supplies the Pernambuco or Brazil cotton; it has black seeds, which hang together in a kidney-shaped mass. There are nearly eight millions of hundred-weights of raw cotton consumed in the manufactories of this country.

Gossypium herbaceum, L. Pods containing seeds and cotton (Mr M'Nab and others).

Gossypium barbadense, L. Pods.

From Messrs Hussey, Graham, and others, Glasgow:—

1. Sea Island Cotton.
2. Stained Sea Island Cotton
3. Georgian Cotton
4. Mobile Cotton
5. New Orleans Cotton
6. Maranham Cotton
7. Madras Cotton
8. Peruvian Cotton
9. Pernambuco Cotton
10. Egyptian Cotton
11. Surat Cotton
12. Bowed Georgian Cotton
12. Georgian Cotton, cleaned with a circular saw

Also specimens of Cotton in various stages of manufacture:—

1. Raw Cotton
2. Machine Cotton
3. Cotton once carded
4. Cotton twice carded
5. Drawn Cotton
6. Stobb rove Cotton
7. Finished rove Cotton
8. Cotton Yarn

From the East India Company the following specimens have been received:—

1. Nankin Cotton (*Gossypium barbadense* var.)
2. Cotton Red, Palamcottah
3. Cotton called Cupas, Gwalior territory
4. Landum Cotton, Salem
5. Bourbon Cotton (*Gossypium barbadense*)
6. Hybrid var. of Sea Island Cotton, Shapoore
7. Sumatra Cotton
8. Opium Cotton
9. Burmese Cotton (*G. herbaceum*)

Australian Cotton (T. C. Archer, Esq.)

Zante Cotton (Miss White).

West India Cotton (Mrs Sawers).

Fine Cotton Yarn (Mr Hussey).

Mr Murray, of Manchester, states in Hooker's Kew Guide that the comparative fineness of the Yarn is estimated by the number of hanks in a pound avoirdupois, and that a hank is 840 yards in length.

A pound of No. 100 is 84,000 yards in length.
Do. No. 300 is 252,000 yards in length.
Do. No 600 is 504,000 yards in length=286 miles.

Cotton Seeds—used for supplying oil and oilcake.

Hibiscus cannabinus, L. East Indies. Fibres. A kind of Sun-Hemp.

Malva sylvestris, L. Common mallow. Plant used as a demulcent.

Thespesia populnea, Corr. E. and W. Indies. Seed kernels and seeds (E. I. Company.) The fibres of the plant are used as cordage,

Natural Order—STERCULIACEÆ.

Silk-Cotton-Tree Family.

This order includes tropical trees of the old and new world, having large handsome flowers, and possessing mucilaginous and demulcent properties.

Adansonia digitata, L., the Baobab-tree, Monkey-bread or Ethiopian Sour Gourd. Tropical Africa. Fruit (Dr. Greville, Mrs and Misses Yule, Dr. Dumbreck). This tree is one of the most remarkable known, some trunks being 30 feet in diameter, while the height rarely exceeds 80 feet. The fruit yields an acid pulp, which is mixed with water and used as a drink. The leaves, when dried, furnish the substance called Lalo, employed in Africa as an astringent.

Bombax Ceiba, L., Silk Cotton tree. British Guiana. Cotton in seed vessel surrounding seeds. The Silk Cotton is used for stuffing cushions, and in the manufacture of hats. Silk Cotton from Bolivia (Dr. Mathie Hamilton).

Bombax pentaphyllum, Cav. Simool or Semul. East Indies. Gum (E. I. Company).

Bombax pentandrum, L., Cotton tree of India. East Indies. Capsule and Cotton with seeds (Dr. Christison).

Durio zibethinus, L. Durion or Durian tree. Malay Islands. Fruit. This fruit is said to be delicious, although it has a civet-like odour. At first the perfume is very disagreeable, but by degrees the fruit is highly relished.

Helicteres Isora, L., Screw tree. East Indies. Fruit, which has a screw-like appearance in consequence of the twining of the follicles (E. I. Company).

Ochroma Lagopus, Sw. E. and W. Indies. Silk Cotton, and pods containing it (Dr. Cleghorn; Mr Crichton, Barbadoes). This cotton is used for making hats. Nest of one of the Humming birds formed by means of it.

Sterculia fœtida, L. East Indies. Fruit formed by 5 follicles (Dr. Cleghorn). Single follicle of Sterculia open.

Natural Order—BYTTNERIACEÆ.

Chocolate Family.

The plants of this order have mucilaginous properties in general.

Pterospermum glabrescens, W. & A. East Indies. Flowers and fruit (E. I. Company, and Dr. Greville).

Theobroma Cacao, L., the Cacao tree. South America. Fruits and seeds. The fruit is large, and contains several seeds immersed in pulp. From the seeds called Cacao beans, the substances denominated Cocoa and Chocolate are prepared. The former consists of the seeds with their outer crustaceous shell or husk reduced to powder; while the latter is prepared from the seed after the shell has been removed. Chocolate is made into a paste, and mixed with vanilla, sugar, cinnamon, and annotta.

Mr Law has sent the following preparations:—

1. Raw cacao or cacao from Trinidad
2. Roasted cacao
3. Cacao nibs, broken up shells of the seeds
4. Ground cacao
5. Soluble cocoa
6. Rock Trinidad or navy cocoa
7. Fry's chocolate
8. Chocolat de Santè in cake.

Natural Order—TILIACEÆ.

Lime or Linden Family.

The plants of this order possess mucilaginous qualities. Many of them yield timber, fibres, and edible fruits.

Corchorus capsularis, L. East Indies. Fibres (M. Connal, Esq.) These fibres constitute the Jute or Jute Hemp of India, used for manufacturing canvas or Guernsey cloth, of which Rice bags are made. The fibre is used in making paper.

Tilia europæa, L. Linden or Lime tree. Europe. Wood, bast, and matting. This is prepared from the endophlœum or inner bark of the tree, and is imported in large quantities from Russia. The wood is used for wainscoating and carving, and for the manufacture of gunpowder charcoal. The flowers are antispasmodic or sedative. Pulp of Tilia fibre for making paper (Chevalier Claussen).

Natural Order—DIPTEROCARPACEÆ OR DIPTERACEÆ.

Malay Camphor Family.

The plants of this order are trees found in the Indian Islands, yielding a resinous balsamic juice, which assumes various forms.

Dryobalanops Camphora or aromatica, Gærtn. Borneo or Sumatra Camphor tree. Camphor oil of Borneo. This tree is 100 to 130 feet in height, and 7 to 10 feet in diameter at its base. In the interior of its trunk there are large cavities containing, it may be, five gallons of liquid or more. Camphor is deposited in crystals on the walls. This is the hard camphor of Sumatra, which is sometimes found in the trunk in pieces weighing 10 to 12 lbs.

Shorea robusta, Gært. East Indies. Resin called Dhoona or Dammar pitch (E. I. Company). It is used for incense. Wood known under the name of Sâl.

Vateria indica, L. Malabar or Ceylon. Resin called Piney resin or Piney-Dammar (E. I. Company). It is used as varnish, and for making candles. The resin is sometimes made into beads resembling amber. When rubbed it is electric.

Natural Order—TERNSTRŒMIACÆ.

Tea Family.

The plants of this order have stimulating and slightly narcotic qualities. It is an order of great importance as furnishing a beverage to millions of mankind.

Camellia japonica, L. Common Camellia. Fruit.

Thea is the genus which includes the species and varieties of tea. There are three species in extensive cultivation. *Thea viridis*, L.; *Thea Bohea*, L., and *Thea assamica*, respectively called green, black, and assam Tea plants. Fortune states that green and black tea are prepared from the same plant, and that from each of the species both these kinds of tea may be prepared. *Thea viridis* is the species which supplies the tea sent from China to Britain. The difference in the appearance and quality of teas depends partly on the climate and species, but chiefly on the time of gathering, and on the mode of manufacture. The young leaves quickly dried and subjected to a particular kind of manipulation supply the green tea, while the older leaves dried more slowly, and after undergoing a process of fermentation, constitute the black tea. The importation of tea into Great Britain amounts to 70 millions of lbs. Tea is scented by means of various plants.

The following are some of the plants indicated by Fortune:—

1. Rose scented (Tsing moi-qui-hwa)
2. Plum, double (Moi-hwa)
3. Jasminum Sambac (Mo-le-hwa)
4. Jasminum paniculatum (Sieu-hing-hwa)
5. Aglaia odorata (Lan-hwa, or Yu-chu-lan)
6. Olea fragrans (Kwei-hwa)
7. Orange (Chang-hwa)
8. Gardenia florida (Pak-sema-hwa)
9. Chloranthus inconspicuus (Chu-lan) is also said by some to be used.

Samples of various kinds of Teas, presented by Michael Connal, Esq., Glasgow:—

Black Teas—Woping, alone and mixed with low Congou; Chincha, a coarse tea, consisting of a mixture of leaves, seed vessels, &c.; Spurious Souchong, formerly imported from Singapore; Canton Bohea, East India Company's import of Bohea; Congou; Congou from Java; Fine blackish leaf Congou with Pekoe flavour; Souchong; Pouchong (Sincapore); Sonchi Tetsing (Ankoi district); Flowery Tetsing (do.); Ning-yong (Ankoi); Imperial Caper; Ankoi Tea; Ankoi Caper; Ankoi from Siam; Campoi tea; Fine Oolong, when grown by the Priests called Oolong Padre; Flowery Pekoe; Java Pekoe; Orange Pekoe.

Green Teas—Twankay; Hyson; Young Hyson or Pontazan, two kinds, one having a silvery aspect; Hyson skin or bloom; Imperial Gunpowder; Java Gunpowder.

Souchong Tea, in small balls, wrapped in Bamboo paper, and called Lung-twan (Mr Fortune, Mr Connal).

Tea in large balls, enclosed in the flowering sheaths of Indian corn, to preserve the aroma (Mr Fortune).

Tea in the form of short twisted sticks, called Lung-seu and Old Man's Eyebrows (Mr Fortune and Mr Connal).

Brick Tea, made from old damaged leaves and stalks pressed into moulds, used in Tibet (Mr Fortune).

Tea leaves and stalks arranged in flat circular masses, 7½ inches in diameter and an inch in depth, with a depression in the centre about three inches in diameter (Mr Fortune).

Extract of tea in large cakes (Mr Fortune).

Extract, in the form of lozenges of various shapes, marked with Chinese characters, and used to dissolve in the mouth during long journeys (Dr. Murchison).

Java Jungle Tea (Mr Connal).

Burmese Tea made into balls the size of an orange (Mr Connal).

Tartar Tea, highly glazed (Mr Connal).

Brazil Tea (Rio Doce); a Sao Paulo Tea or Perola, from Brazil (Mr O. Adamson.

Wild Green Tea from Sincapore (Mr Connal).

Hyson Tea made close to Deyrah Dhoon on Himalaya (Mrs J. Drummond).

Assam Bohea, and Assam Souchong (Mr Connal).

Pouchong from Kemaon (Mrs J. Drummond).

Himalayan Black Tea (Dr Thos. Thomson).

Assam Tea Dust (Mr G. Law).

Pekoe of the Hyson, for the Emperor's use only (Mr Connal).

Lung Ching, Gems of spring tea.

Tea made from the plants of Thea viridis, in the Edinburgh Botanic Garden, by Mr Thomas M'Nab.

Fruit and seeds of the Tea plant from China (Sir John Robison, W. Taylor Esq., T. C. Archer, Esq.)

Materials used in China for dyeing Tea—Prussian blue, Turmeric, and Gypsum, received by Mr Fortune at a Tea manufactory in China.

Theine, bitter principle found in Tea, as well as Coffee, and other plants (Dr. Stenhouse).

Ash of Java Gunpowder Tea, and of Assam Bohea Tea, analysed by Mr Jones:

Java Gunpowder.

Water,	8.86
Organic matter,	84.68
Ash,	6.46
	100.00

Assam Bohea.

Water,	8.70
Organic matter,	86.89
Ash,	4.41
	100.00

Natural Order—Aurantiaceæ.

Orange Family.

The plants of this order are familiar to all, as supplying Oranges, Lemons, &c. The leaves and the rind of the fruit contain a volatile oil, and the pulp of the fruit is more or less acid. They are handsome trees of India, having fragrant flowers, and the blade of the leaf articulated to the petiole.

Ægle Marmelos, Corr. East Indies. Fruit, entire and sliced. The ripe fruit is excellent, but is laxative. The unripe fruit, called Bael, Bela, or Bengal Quince, sliced (Mrs Col. Spottiswoode); used as a remedy for diarrhœa and dysentery.

Citrus Aurantium, L. Sweet Orange. West Indies. Fruit, wood, and seeds. The chief varieties of the Orange are—St Michael's, Maltese, Blood-red, Tangerine, and Chinese or Mandarin. Majorca, or Seedless Oranges, are also known in commerce. The Navel Orange of Pernambuco exhibits at one end an abortive condition of part of the ovary, and has been named from its aspect in this particular. The wood in sections (Colonel Yule): walking sticks made from it.

Citrus Decumana, L. Shaddock. Fruit. The largest of the Orange tribe.

Citrus Limetta, Risso. Lime. Fruit (Mr Hinshaw). Wood (Colonel Yule). Pulp acid.

Citrus Limonium, Risso. Lemon fruit. Yields an acid antiscorbutic juice, and an oil.

Citrus medica, L. Citron fruit. Rind used as preserves. Citron from China, in which the fruit is divided into numerous separate portions (R. Fortune, Esq.) called Fingered Citron.

Citrus Paradisi, Macf. Forbidden fruit, and wood. Jamaica.

Citrus vulgaris, Risso. Bitter or Seville Orange; perhaps a variety of Citrus Aurantium. Fruit. The young fruit called Orangettes or Curaçoa Oranges. Neroli oil procured from the flowers. Rind used for marmalade.

Some Indian botanists are disposed to think that the Citron, Orange, Lemon, Lime, and their numerous varieties are all derived from one botanical species, *Citrus medica*, indigenous, and still found wild on the mountains of the East Indies. A singular variety, called Bizzaria, has been raised by hybridizing or cross grafting, in which the same tree produces Oranges, Lemons, and Citrons, on the same branch, and sometimes combined into one fruit.

Feronia elephantum, Corr. Wood Apple. East Indies. Fruit. A kind of gum resembling gum Arabic is produced by the plant.

Natural Order—Guttiferæ or Clusiaceæ.

Gamboge Family.

The plants of this order yield a yellow gum resin which is acid and purgative. Some bear edible fruits.

Cambogia Gutta, L. *Hebradendron cambogioides* of Graham. Gamboge plant of Ceylon. Gum resin in lump.

Garcinia cochinchinensis. Chois. Siam Gamboge plant. Gum resin in pipe.

Garcinia Mangostana, L. Mangosteen. Molucaas. Fruit dry and in fluid. It is one of the finest known fruits. The plant was flowered at Syon House in 1855.

Garcinia pictoria, Roxb. India. Gamboge prepared for it (Dr Hugh Cleghorn). Fruit. This Gamboge is procured in the Wynaad.

Garcinia purpurea, Roxb. East Indies. Solid oily matter called Kokum butter produced in Scinde (D. C. Bell, Esq.).

Other specimens of fruits of *Garcinia*, the species unknown.

Mammea americana, L. Mammee Apple. West Indies. Fruit in liquid.

Seeds (Dr G. M'Nab). Wood and bark. The fruit is esculent, and in America is called wild Apricot. The plant yields a kind of gum.

Moronobea coccinea, Aubl. West Indies. Gum procured from it called Hog gum, according to M'Fadyen (Dr M'Nab); some say this gum is the produce of *Clusia flava* belonging to the same order.

Natural Order—MALPHIGIACEÆ.

Malphigia or Barbadoes Cherry Family.

The plants of this order are handsome trees or climbers with showy flowers, and often remarkable stems, as regards the arrangement of the wood. Their properties are astringent.

Banisteria Clausseniana, Juss. South America. Section of stem showing fasciculated wood (Dr Gardner). See p. 186 in *Balfour's Class Book of Botany.*

Banisteria nigrescens, Juss. South America. Section of fasciculated stem (W. Rashleigh, Esq.)

Banisteria scandens, Juss. South America. Twining stem peculiarly flattened (W. Rashleigh, Esq.).

Natural Order—ERYTHROXYLACEÆ.

Coca Family.

The plants of this order have stimulating qualities. The bark is tonic· The wood has a red colour, hence the name of the order.

Erythroxylon Coca, Lam. Coca plant. Peru and Columbia. Leaves called coca; also, alkaline cakes used along with them (Dr Mathie Hamilton). The Coca is used as a masticatory. It stimulates the nervous system, and when taken in large quantities acts like opium. Dr Hamilton in sending the specimen writes:—

"These leaves are much used by the Indians of Peru; they are chewed together with a small portion of an alkaline substance called by them 'Llucta,' which is made by mixing the ashes of the Cactus and stalks of Maize, or Indian Corn, with a little boiled potato, so as to form a mass, which is then formed into cakes such as the one herewith sent.

"The Coqueras, *i.e.* the people who prepare the Llucta and sell the Coca, are usually Indians, and give the necessary quantity of Llucta gratuitously along with the Coca which is not of much use when taken singly. The aid which an Indian derives from the use of Coca, is according to his belief, very great; so much does he count upon it, that he cannot, or will not labour well, nor undertake any fatiguing work, nor attempt to go on a long journey, without this fascinating and strengthening substance.

"It is prepared for immediate use in the following manner:—A portion of the leaves and a small bit of the 'Llucta' are slightly masticated so as to form a mass somewhat like a quid of Tobacco, which is deposited in a bag carried by the Indians, suspended in front, and which contains the Coca in its natural state, as well as in the above-mentioned state of preparation. When a few portions have undergone this process and been stored in the bag or purse, the Indian begins his journey or labour of any sort; putting a quid of Coca in his mouth; he retains it so long as the taste of the Coca, or a roughness in the mouth is felt, which roughness is caused by the leaves, and is much relished by the native Peruvian."

This plant is called Ipadu by the Indians of the Rio negro. The leaf replaces Tea in Peru. In the province of Yungas the annual consumption amounts to 9,600,000 Spanish pounds. *(See Weddell's Journey into the north of Bolivia and the adjoining parts of Peru.)*

Natural Order—ACERACEÆ.

Maple Family.

The plants of this order are trees with light and useful timber, and having saccharine qualities.

Acer platanoides, L. Winged fruit or Samara.

Acer campestre, L., Common Maple. Europe. Wood.

Acer Pseudo-platanus, L., Common Sycamore or Great Maple. Europe. Wood, and sections showing the silver grain caused by the medullary rays. Sycamore Wood from the garden of the Archbishop of York (Mr Baines). Sycamore stem, with a horse shoe imbedded in its substance. The shoe had been hung over a branch where it joined the stem, 11 or 12 years before, and had gradually been covered by the woody layers (Dr John Smith.)

Acer saccharinum, L., Sugar Maple. United States and Canada. Wood and sugar. Sugar Maple stems from the Alleghany Mountains (Mr M'Nab). Sugar prepared from it by tapping the tree in spring. Specimens of the sugar in a small basket made of American Birch bark.

Natural Order—Sapindaceæ.

Soap-berry Family.

The plants of this order are usually trees or shrubs, some of which yield edible fruit and seeds. Some are astringent, others poisonous. Many have saponaceous qualities—hence the name of the order.

Æsculus Hippocastanum, L., Horse Chestnut. Europe and Persia. Wood and seeds. Bark is febrifugal. Seeds contain starch and are saponaceous.

Cupania or *Blighia sapida*, Roem. Akee-plant. Tropical Africa. Fruit. The Akee plant is esculent, and has a remarkable succulent aril. Model of the fruit in wax (Dr G. M'Nab).

Nephelium (Euphoria) Litchi, G. Don. The Li-chi plant. China. Fruit (Miss Neill, T. C. Archer, Esq.). The pulp is edible, and the fruit is used in China and India. It is also imported into Britain.

Ophiocaryon paradoxum, Schomb. Snake nut tree. British Guiana. Fruit sent from Demerara (W. H. Campbell, Esq., Charles Murray, Esq.). The embryo is twisted, and has a marked resemblance to a coiled snake.

Paullinia pinnata, L. South America. Section of stem showing a peculiar arrangement of the wood (Dr Gardner.) The stem is called fasciculated. The seeds of another species of this genus, *P. sorbilis*, yield the Guarana, which is used as a beverage in the Amazon district.

A kind of wood called *Bastard Mammee* has been sent to the museum by Mr T. Hay.

Sapindus saponaria, L., Soap-berry plant. India. Branch with leaves and fruit; specimen of fruit separately (Mrs Sawers, Col. Madden); also seeds. The acrid fruit of this and other species forms a lather with water, and is used as soap; hence its name. The pounded fruit is said to poison fish.

Natural Order—Rhizobolaceæ.

Suwarrow or Souari-nut Family.

The plants of this order are large timber trees, some of which yield edible fruit.

Caryocar butyrosum, Willd. Souari-nut tree, South America, fruit and seeds (T. C. Archer, Esq.). The seeds are sometimes called Butter-nuts. They yield a bland oil, and are esteemed the most agreeable of all the nut kind.

Natural Order—Meliaceæ.

Melia Family.

The plants of this order have bitter, astringent, and tonic properties. Some of them are emetic and purgative.

Canella alba, Mur. Canella bark tree. South America. Bark and seeds (Dr. G. M'Nab). Bark used as an aromatic tonic. Some put the plant in a separate order denominated Canellaceæ.

Ekebergia capensis, Spaum-Essenhout. Cape of Good Hope. Wood (Mr Charles Watson).

Melia Azedarach, L., Neem-tree, or Pride of India. East Indies. Wood. Seeds made into a necklace.

Natural Order—Cedrelaceæ.

Mahogany Family.

The plants of this order are trees found in Tropical India and America. Their bark is tonic and febrifugal, and they yield valuable timber.

Cedrela odorata, L., Cuba Cedar. West Indies. Wood. This tree yields excellent timber.

Cedrela Toona, Roxb., Cedar wood of New South Wales. This plant is found also in India. Wood. This tree is the Simal-Kun of the Lepchas.

Chloroxylon Swietenia, Dec. Satin-Wood tree. East Indies. Wood (Dr Cleghorn). The wood is remarkable for its satiny aspect. This plant yields an oil.

Flindersia australis, R. Br. Australia. Seed vessels (Dr Greville).

Oxleya xanthoxyla, Cumming. Yellow wood. Australia. Seed vessels.

Soymida febrifuga, Juss. Red Wood tree. India. Wood and bark (T. Hay, Esq.). The bark is febrifugal and astringent.

Swietenia Mahagoni, L., Mahogany tree. America. Wood (Col. Yule and Mr Brown). Seed vessels in various states, and winged seeds. This tree grows in dense forests, and forms one of the most lofty and gigantic tropical trees. This valuable wood is imported chiefly from Honduras, St Domingo, and Cuba. In 1853, 27,495 tons were imported into Britain. Single trunks or logs in the Liverpool and London markets often bring from £300 to £800.

Natural Order—Vitaceæ or Ampelidaceæ.

Vine Family.

The Vine is the characteristic plant of this family. The plants of this order have acid leaves, and a pulpy fruit, more or less acid at first, but producing grape-sugar as it ripens.

Vitis vinifera, L., Vine. Europe and India. Fruit of various kinds. Currants of Zante or Levant Currants in fluid (Miss M'Nab.) These small stoneless Grapes, originally from Corinth, constitute the common dried Currants of the shops. In 1853, 267,265 cwts. were imported,

The Grape-Vine has followed the footsteps of man. Its fruit has been used for making wine for more than 4000 years. It is said that 300 tons of Grapes are imported annually into Britain from Sicily, Lisbon, and Hamburgh. Of Raisins the annual import is 12,000 tons. The Muscatel Raisins are the best.

In the Journal of the Horticultural Society of London the following remarks are made regarding the ancient Grapes:—The Vine is indigenous in Southern Europe, and has extended over the greater part of South-Central Asia—*Vitis indica* not being specifically distant. Noah planted the Vine after the flood. Pliny records sixty kinds of Vines; others are enumerated by Virgil, Columella, Varro, Macrobius, and others. In some collections of the present day there are above 300.

The Apiana of Pliny, or Apicea of Cato, is supposed to be a Muscat imported from Greece. The Ambrosiaca is supposed to be a Muscat. The Græcula is the Corinth stoneless or Currant Grape. The Spæliaca, the uva passa of Spoleto, another stoneless or Currant Grape. The Vincula, Sircula or Stacula, is the Marzemina of the Venetians. The Dactylites is perhaps the uva galetta of Modern Italy. The Trifera, the uva di tre volte from Chio. The Picina, perhaps the uva colore. The Trebalana, the Trebbiano, yielded a wine celebrated for its excellence by Tasso. Other Roman names of Grapes are derived from countries,—Biturgica from Bourdeaux, Pharia from Illyria, Prusina from Broussa in Anatolia, Ægios from Ægia near Corinth, Alexandrina from Alexandria in the Fivas, Aminea (highly prized) from Aminei near Falerno.

Vitis vulpina, L., called Wild Vine in Rhode Island. North America. Wood. Its fruit is known as Fox Grapes.

Natural Order—Geraniaceæ.

Cranesbill Family.

This order embraces the Geraniums and Pelargoniums which are so well-known to every one; the latter abound in South Africa. The plants of the order have astringent and aromatic qualities. Some are very resinous. Many are fragrant, and some have a musky odour.

Erodium gruinum, Willd. Spain and Africa. Seed-vessels with long beaks.

Geranium maculatum, L., North America. Root called Alum root, used as a powerful astringent.

Natural Order—Linaceæ.

Flax Family.

The plants of this order have mucilaginous qualities, and yield valuable fibres. Some of the plants are purgative and diuretic.

Linum usitatissimum, L., Common Flax. Europe. Flax prepared from it in various states (Redford Flax factory, Kirkcaldy). Linseed (E. I. Company). Flax cotton (Mr Hodges, Belfast).

Specimens sent from the Redford Flax Factory:—

1. Specimen of the Flax plant straw as received from the farmers with the seed vessels attached.
2. Specimen of the green straw with the seed vessels removed, ready for steeping.
3. Specimen of the straw after being steeped.
4. Specimen of the green straw partially scutched to show the fibres.
5. Specimens of steeped straw partially scutched to show the fibres.
6. Specimen of finished Flax.
7. Specimen of the Flax chaff used for feeding cattle.
8. Linseed.

Paper made from Flax grown on the farm of Braidwood (Mr Maclean). Linseed oil, Linseed meal, and Linseed cake or oil cake, as prepared from the seeds. Tow used by surgeons, being the broken Flax fibres detached during the process of heckling. Flax cotton is prepared by steeping the fibres in carbonate of soda, and afterwards dipping them in a weak solution of acid.

Natural Order—Oxalidaceæ.

Wood-Sorrel Family.

The plants of this order have generally acid properties, from the presence of oxalic acid, in the form of binoxalate of Potass, which is called Salt of Sorrel. The roots of some, as Oxalis crenata are used as food.

Hugonia Mystax, L. East Indies. Circinate thorns of the plant (Dr H. Cleghorn).

Natural Order—Tropæolaceæ.

Indian Cress Family.

The plants of this order have acid and pungent qualities.

Tropæolum majus, L. Common Indian Cress or garden Nasturtium. South America. Unripe fruit, used as a substitute for capers.

Natural Order—ZYGOPHYLLACEÆ.

Bean-Caper and Guaiac Family.

The plants of this order have diaphoretic and anthelmintic qualities. They yield a stimulant resin. The wood is hard and durable.

Guaiacum officinale, L. Guaiac plant. West Indies. Wood and Resin (Dr G. M'Nab). Resin (Messrs Duncan and Flockhart). The wood receives the name of Lignum Vitæ. It is hard and has a greenish-black colour.

Natural Order—RUTACEÆ.

Rue Family,

The plants of this order have a peculiar penetrating odour. They have antispasmodic, tonic, and febrifugal qualities.

Barosma crenata, Eck. and Zeyh. *B. serratifolia*, Willd., and other species. Buchu or Bucku plants. Cape of Good Hope. Leaves (Messrs Duncan and Flockhart). They are antispasmodic and diuretic, and have an overpowering odour.

Correa alba, Andr. Australia. Leaves; used as a substitute for tea.

Galipea officinalis, Hanc. and *G. Casparia* St. Hil. South America. Bark called Angostura. Melambo Bark; supposed to be furnished by another species.

Ruta graveolens, L. Rue plant. South of Europe. Herb and unripe fruits; used as antispasmodics.

Natural Order—XANTHOXYLACEÆ.

Xanthoxylon Family.

The plants of this order have pungent and aromatic qualities. They yield a volatile oil, and a bitter principle called xanthopicrine. They are used as stimulants and tonics.

Xanthoxylon Budrunga, D. C. A kind of prickly ash. East Indies. Bark (E. I. Company). The seeds have an odour of Lemons.

Natural Order—CORIARIACEÆ.

Coriaria Family.

The plants of this order have astringent and narcotic qualities.

Coriaria myrtifolia, L., South of Europe. Leaves used to adulterate Senna. They have been employed to stain black.

Natural Order—SIMARUBACEÆ.

Quassia Family.

The plants of this order have bitter properties, and they are used as tonics.

Nima (Picrasma) quassoides. East India. Wood (Colonel Madden): used as a tonic.

Picræna excelsa, or *Simaruba excelsa*, DC. Bitter wood or Bitter Ash. West Indies. Wood. This constitutes the Quassia wood and chips of the shops. It is used as a tonic and occasionally as a substitute for hops. An infusion of it poisons flies.

Quassia amara, L., The true Quassia plant. Surinam. Wood and Bark (Dr G. M'Nab), Fruit. The plant is called Guavito Amargo in Panama. Its wood is now rarely exported. It is bitter and tonic.

Simaruba Cedron. Cedron plant. New Grenada. Large cotyledons. They are used as a tonic, and contain a bitter principle called Cedrine.

Simaruba amara, Aubl., *S. officinalis*, DC., Simaruba bark plant. British Guiana. Stem and bark. Tonic and astringent. Timber resembles that of the white pine.

SUB-CLASS II. CALYCIFLORÆ.

1. Polypetalæ or Dialypetalæ.

Natural Order—Celastraceæ.

Spindle Tree Family.

The plants of the order are more or less acrid, some yielding oil.

Celastrus scandens, L., Virginian wax work. N. America. Wood and bark. Emetic and purgative bark.

Wood of a species of Celastrus from the Cape of Good Hope (Mr Watson).

Euonymus atropurpureus, Jacq. North America. Wood.

Euonymus europæus, L., Common Spindle tree. Europe. Wood used for spindles. Charred wood employed in France for making common gunpowder; young shoots charred, used in drawing. Fruit, showing scarlet arillode.

Natural Order—Staphyleaceæ.

Bladder-Nut Family.

The bark of the plants is often bitter, and their seeds oily and acrid.

Staphylea pinnata, L., Bladder-nut tree. Europe. Branch showing the inflated fruit.

Natural Order—Rhamnaceæ.

Buckthorn Family.

The properties of this order are generally acrid and purgative. Some of the plants are bitter and tonic, others yield edible fruits.

Rhamnus catharticus, L., Buckthorn. Europe. Wood.

Rhamnus glandulosus, Ait. Madeira. Wood called Sanguinho (Mr J. M'Laren).

Rhamnus infectorius, L., South of Europe. Fruit called Persian or yellow berries, used in calico printing. *R. saxatilis* and *R. amygdalinus* are said also to yield these berries.

Natural Order—Anacardiaceæ.

Cashew Nut Family.

The plants of this order abound in a resinous or milky, acrid and poisonous juice, which often becomes black in drying. In some cases, however, the fruit is edible.

Anacardium occidentale, L. Cashew Nut. East and West Indies. Fruit or Nuts separate and attached to the Pear-shaped peduncle called Cashew Apple (Dr Gilbert M'Nab). Preserve made from Cashew Apple (Dr M'Nab). Gum from the Cashew called Cadjii gum.

Mangifera indica, L., Mango tree. East and West Indies. Fruit (Dr Christison, John Shaw, Esq., &c.) This is one of the best tropical fruits. Fruit grown at Leigh Park, (Mr Scott). Seeds of Mango, East Indies. (Colonel Mackinnon). Wood.

Pistachia Lentiscus, L., Mastich tree. Mediterranean. Gum Mastich procured from it. P. atlantica also yields Mastich.

Pistachia vera, L., Pistachio tree. South of Europe. Nuts procured from it called Pistacia or Pistachio Nuts.

Rhus Cotinus, L., Venetian Sumach, Wig tree. South of Europe. Dried branches, with hairy flower stalks (Mrs Willoughby); used for dyeing black.

Rhus glabra, L. North America. Wood and bark. Used for tanning.

Semecarpus Anacardium, L. Marking Nut tree. East Indies. Nuts (E. I. Company, and Mr W. Macfarlane); used for marking linen.

Spondias lutea, L. West Indies. Wood.

Natural Order—AMYRIDACEÆ.

Myrrh Family.

The plants of this order abound in balsamic resin.

Balsamodendron Myrrha, L., Myrrh tree. Arabia. Gum-resin called Myrrh.

Natural Order—LEGUMINOSÆ, OR FABACEÆ.

Leguminous Family.

Properties of the order various. Some of the plants are nutritious, others tonic and astringent, others purgative, and some poisonous.

Sub-Order 1.—PAPILIONACEÆ.

Pulse Section.

Abrus precatorius, L., Crab's eyes. India. Legumes and seeds. Necklace formed of the latter.

Æschynomene aspera, L. East Indies. Soft pithy stem called Shola; supplies a kind of Rice paper. Hat made from the stems (Dr Hutchinson).

Apios tuberosa, Moench. North America. Tubers used as a substitute for Potatoes.

Arachis hypogæa, L. Ground Nut. Africa. Pods and seeds (Dr Christison). The fruit is buried under ground. The seeds yield food and oil.

Astragalus glycyphyllus, L. Europe. Pods showing the septum formed by the dorsal suture.

Astragalus verus, Oliv. Smyrna. Tragacanth procured from it.

Butea frondosa, Roxb. Dhak tree, or Pulas. East Indies. Flowers used for dyeing (E.I. Company). Kino procured from the plant (E.I. Company.)

Cajanus indicus, Spr. Pigeon or Cajan Pea. East and West Indies. Seeds used as food (T. C. Archer)

Calabar Ordeal Beans, the produce of a leguminous plant (Mr Waddell, Dr Christison).

Cicer arietinum, L. Chick Pea or Gram. India. Seeds (Dr Christison, E.I. Company, and T. C. Archer). Gram oil containing oxalic acid (Dr Owen).

Colutea arborescens, L. Bladder senna. Europe. Pods showing the inflated pericarp. Leaves used to adulterate Senna. Wood.

Crotalaria juncea, L. East Indies. Fibres procured from it, forming Sunn or Bengal Hemp. Legumes of species of Crotalaria (Dr M'Nab.)

Cytisus Laburnum. L. Common Laburnum. S. Europe. Wood; pods and seeds. Seeds poisonous.

Dalbergia arborea, Heyn. East Indies. Pods and seeds from Calcutta (Dr Christison).

Dipterix odorata, Willd. Tonka Bean. Guiana. Beans having a fragrant odour (T. C. Archer).

Dolichos Catjang, L. East Indies. Pod (Dr Christison). Seeds from Palamcottah (E.I. Company).

Dolichos uniflorus, Lam. East Indies. Seeds, from Bellary (E. I. Company).

Various other pods of species of Dolichos (Miss Yule, &c.)

Ervum Lens, L. Lentils. Europe. Seeds used for food. Egyptian Lentils (T. C. Archer).

Erythrina latifolia, Schum. Africa. Pods and seeds from Algoa Bay (Dr Fraser.

Faba vulgaris, L. Common bean. Legume and seeds.

Genista virgata, D.C. Madeira. Wood called Piorno.

Geoffroya, sp.? Wood.

Glycyrrhiza glabra, L. Liquorice plant. S. Europe. Root and Extract.

Indigofera tinctoria, L. Indigo plant. East and West Indies. Indigo, various samples (M. Connal).

Medicago ciliaris, Willd.; *M. intertexta*, Willd.; *M. muricata*, Ait.; and *M. orbicularis*, Willd. European species of Medick. Curved Legumes.

Mucuna atropurpurea, DC., *M. gigantea*, DC., *M. pruriens*, DC.; species of Cowitch. East Indies. Pods with irritant hairs (Drs Greville and Christison); another species of *Mucuna*, allied to *monosperna*, DC., from Sierra Leone.

Phaseolus multiflorus, Lam. Scarlet Runner. America. Seeds.

Phaseolus vulgaris, L. Kidney beans or Haricots. Pods and seeds. Seeds and pods of several species of Phaseolus (E. I. Company, &c.).

Pisum sativum, L. Common pea. Pods and seeds.

Pterocarpus Marsupium, Rox. Malabar. Wood and bark (Dr Cleghorn). Supplies Malabar kino. Solid tincture of kino (Dr J. B. Balfour).

Pterocarpus Santalinus, L. fil. East Indies. Wood, called red Sanders wood, or Sandal wood, from Madras (Dr Cleghorn).

Robinia Pseudacacia, L. Locust tree. North America. Pods and wood (Mr Fairly).

Soja hispida, Moench. Bengal. Seeds (E. I. Company). Used in the sauce called Soy.

Trigonella Fœnum-græcum, L. Fenugreek. South of Europe. Seeds.

Triptolemœa, sp.? S. America. Rose-wood of commerce.

Ulex europœus, L. Common whin or furze. Europe. Wood.

Vicia sativa, L. Tares. Seeds.

Virgilia capensis, Lam. Keurhout. Cape of Good Hope. Wood (Mr C. Watson).

Sub-Order—Cæsalpinieæ.

Senna Section.

Baphia nitida, Lodd. Sierra Leone. Wood called Cam-wood, or Bar-wood (Mr Connal). Yields a red dye for the Bandana handkerchiefs.

Bauhinia candida, Ait. India. Pods from Calcutta (Dr Christison).

Cœsalpina braziliensis, L. South America. Wood called Brazil wood, or Braziletto, used as a dye (Mr Connal, Mr T. Hay).

Cœsalpinia coriaria, Willd. South America. Twisted legumes called Libi-dibi or Divi-Divi; used for tanning (T. C. Archer, Dr Stenhouse).

Cœsalpinia echinata, Lam. South America. Wood, called Solid Nicaragua wood, or Rio de la Hache wood, used as a dye (Mr Connal).

Cœsalpinia Sappan, L. India. Wood called Sappan, Wukkum or Bukkum wood; used as a dye (Dr Christison, Mr Connal).

Cassia—various species, yielding Senna.

C. obovata, Collad. Leaves and pods; Port Royal, Jamaica (Dr G. M'Nab).

Cassia Fistula, L. (Cathartocarpus Fistula). India. Legumes and seeds and wood. (Dr Christison, Miss Yule, Mr Connal). Pulp is laxative.

Cassia grandis, L. fil. Brazil. Large legume (Dr Gardner).

Castanospermum australe, Cunn. Australian Chestnut. Legumes and seeds. One of the few esculent seeds of Australia.

Ceratonia Siliqua, L., Algaroba Bean or Carob tree. S. Europe. Pods used as food for horses, &c (Dr Cornwall). The tree is also called Locust tree, St. John's Bread, and Husk tree.

Cercis canadensis, L. N. America. Wood.

Copaifera multijuga, Mart. Brazil. Balsam of Copaiva; used in inflammation of mucous membranes.

Copaifera pubiflora. Guiana. Wood called Purple Heart or Zapatero, or Mariwayana.

Gleditschia Triacanthos, L. N. America. Wood. (Mr Henderson).

Guilandina Bonduc, L. Nicker-tree. East Indies. Pods and seeds (E. I. Company, Dr Duff, Professor Anderson).

Gymnocladus canadensis, Lam. N. America. Legumes.

Hæmatoxylon campechianum, L. Logwood tree. S. America. Wood and extract (Mr Connal, Dr M'Nab). Used as a dye and astringent.

Hymenæa Courbaril, L. South America. Brazilian Copal. Pods called Locust pods, and resin called anime (Dr Seller, T. C. Archer, Dr G. M'Nab, and Miss Yule). Wood is called Locust wood, and is used in ship carpentry; the bark, called Simiri bark, is employed as a vermifuge.

Mora excelsa, Benth. British Guiana Wood used in naval architecture (Mr Campbell, Mr John Gray, Dr Christison).

Poinciana pulcherrima, L. East Indies. Pods, seeds, and wood.

Tamarindus indica, L., Tamarind tree. India. Pods and wood (Dr Christison, Mr T. Hay). Pulp used as a laxative.

Sub-Order 3—Mimoseæ.

Gum Arabic Section.

Acacia arabica, L., and other species. Arabia, India, and Africa. Gum Arabic, and Gum Senegal. Bark under the name of Babul bark used for tanning (Mr Connal); pods (Dr Christison); wood (Mr Cunningham).

Acacia Catechu, Willd. East Indies. Extract call East Indian cutch (Mr Connal); used as an astringent, and in tanning.

Acacia eburnea, Willd. Branch, with long, ivory-like spines.

Acacia horrida, Willd. Doornboom. Cape of Good Hope. Wood (Mr C. Watson).

Acacia Lebbeck, Willd. Egypt. Wood.

Acacia lophantha, Willd. Australia. Pods.

Acacia melanoxylon, R. Br., and *Acacia mollissima*, Willd. Australia. Bark imported under the name of Mimosa bark. Astringent.

Adenanthera pavonina, L. India. Pods and seeds; the latter in the form of necklaces.

Entada gigalobium, DC. West Indies. Large pods and seeds (Miss Yule, Mr Blackie).

Entada Pursætha, DC. India. Large pods and seeds (Dr Cleghorn).

Mimosa abstergens, Roxb. East Indies. Pods. Fibrous bark imported from Manilla under the name of Gogo or Gogoo (T. C. Archer). Hairy pods of a species of *Mimosa* from South America (Mrs Dr Smith).

Vachellia Farnesiana, W. and A. East and West Indies. Legumes (T. C. Archer).

Natural Order—Moringaceæ.

Moringa Family.

The plants of this order have usually stimulant and pungent qualities.

Moringa pterygosperma, Gært., Horse Radish Tree. India and South America. Seed vessels and winged seeds called Ben-nuts. The root is used as Horse radish, and the seeds yield Ben-oil. Fruit of a species of Moringa from the East Indies (E. I. Company).

Natural Order—Rosaceæ.

Rose Family.

The Bark and Root of many of the plants are astringent. Some yield prussic acid. Many supply edible fruit.

Sub-order Amygdaleæ or Drupiferæ.

Stone-Fruit Rosaceæ.

Amygdalus communis, L. var., *dulcis*, sweet Almond; var *amara*, bitter Almond. S. Europe. Fruit and seeds or kernels. Amygdaline, a nitrogenous product of the bitter Almond. Almond oil.

Cerasus Avium, Moen. var., common Cherry. Europe. Fruit. Cerasine, a kind of gum procured from the tree. Wood.

Cerasus Laurocerasus, Bosc. Cherry Laurel, Levant. Wood.
Cerasus serotina, Loesl. Black Cherry. Bark used as a bitter astringent.
Prunus Armeniaca, L., Apricot. Wood.
Prunus communis, Huds, var. *domestica*. Common Plum. Europe. Fruit. Double plum. Wood (Miss Jackson, Kingston).
Prunus lusitanica, L. S. Europe. Portugal Laurel. Wood.
Prunus Padus, L., Bird Cherry. Europe. Wood. Peculiar pod-like fruit, produced in place of Drupes (Dr Wyville Thomson).
Prunus spinosa, L., Sloe. Europe. Wood (Messrs Lawson).

Sub-order Roseæ.

Brayera anthelmintica, Kunth. Kousso. Abyssinia. Plant used as a vermifuge (Dr Douglas Maclagan).
Geum. Specimen of the fruit showing geniculate styles.
Quillaia saponaria, Poir. South America. Bark used as soap, and called Quillai or Calliguaja bark.
Rosa. Fruit of various species of Rosa. *R. moschata*, Ait. India. Genuine attar of Roses, prepared from it in northern India (Dr J. B. Fleming).
Rubus idæus, L., Raspberry. Black Fruited Raspberry from America (Mr W. T. Thomson).

Sub-order.—POMEÆ.

Apple and Pear Section.

Cotoneaster affinis, Lindl. India. Fruit.
Cratægus coccinea, L. N. America. Fruit.
Cratægus Oxyacantha, L., Common Hawthorn. Europe. Wood. Section of Graft, showing union between *C. tanacetifolia* and *C. Oxyacantha* as the stock. Section of a large thorn called Queen Mary's thorn, which grew at Loch Leven Castle (Sir Graham Montgomery, Bart.) Section of a similar thorn from the neighbourhood of Duddingston, and from Jardine Hall (Sir W. Jardine, Bart.)
Eriobotrya japonica, Lindl. China. Loquat. Fruit.
Mespilus germanica, L. Medlar. Europe. Fruit.
Pyrus Aucuparia, Gaertn. Mountain Ash. Europe. Wood.
Pyrus communis, L. Common Pear. Europe. Several varieties of Fruit. Wood. A variety showing the production of leaves from the upper part of the fruit.
Pyrus domestica, Sm. Service tree. Europe. Wood.
Pyrus Malus, L. Common Apple. Europe. Common Crab fruit, Siberian Crab, &c. Wood.
Pyrus pinnatifida, Ehr. Europe. Wood.
Pyrus prunifolia, Willd. Siberia. Wood.

Natural Order—LYTHRACEÆ.

Loosestrife Family.

Astringency is met with in many plants of the order. Some of them furnish dyes.
Lawsonia inermis, L. Henna plant. Egypt. Wood and bark. Plant used in the East for dyeing the finger nails.

Natural Order.—RHIZOPHORACEÆ.

Mangrove Family.

Plants are usually astringent, and are used for tanning and dyeing black.
Rhizophora Mangle, L., Mangrove tree. W. Indies. Wood and Bark.

Natural Order—Combretaceæ.

Myrobalan Family.

Astringency prevails in the order. Some yield timber.

Terminalia angustifolia, Jacq., a kind of Myrobalans. E. Indies. Fruit. (East India Co.)

Terminalia belerica, Rox. Myrobalans. East Indies. Fruit. Seeds eaten.

Terminalia Chebula, Roxb. Myrobalans. India. Fruit in a ripe and an an unripe state (Dr Christison, Mr T. C. Archer), used for dyeing.

Terminalia tomentosa, W. & A. East Indies. Gum (East India Co.).

Natural Order—Myrtaceæ.

Myrtle Family.

The plants of this order are generally aromatic, and yield a pungent volatile oil. Some supply edible fruits, others yield spices.

Caryophyllus aromaticus, L. Clove plant. Malay Islands, but cultivated in Tropics generally. Flower buds dry and in fluid, constituting cloves (East India Company, J. Rose, Esq., Penang).

Eucalyptus dumosa. Australia. Lurp, a saccharine matter formed on it by a Coccus.

Eucalyptus pulverulenta, Sims. Australia. Wood (Wentworth).

Eucalyptus robusta, Sm. Australia. Red gum procured from it in Western Australia (Dr Bower).

Other species of Eucalyptus exhibiting leaves and flowers.

Eugenia Pimenta, DC. Allspice. West Indies. Fruit, as well as branch and leaves (Mr Daw, Mr W. Macfarlane). The fruit has the flavour of cloves, cinnamon, and nutmeg. It is also called Pimento and Jamaica pepper.

Stem of a Pimento tree from the West Indies, having the interior filled with the hive of a bee (Sir W. Jardine).

Melaleuca minor, Sm. Cajeput oil plant. Malacca. Stem with foliated bark; oil used as an antispasmodic. Fruit of various species of Melaleuca.

Metrosideros sp.? Australia. Fruit attached to branch.

Psidium pomiferum, L. Apple-shaped Guava. East Indies. Fruit.

Psidium Cattleyanum, Sabine. A kind of Guava. South America. Fruit.

Punica Granatum, L. Pomegranate. South of Europe. Fruit

Natural Order—Lecythidaceæ.

Monkey-pot Family.

Many of the plants yield edible seeds. The seed vessels resemble pots with lids, and hence their name. The seed-vessels are also used to entrap monkeys.

Bertholletia excelsa, H. B. South America. Seed vessels and seeds called Brazil, Castanha or Para nuts. Oil used in the Amazon district.

Couratari legalis, Mart. South America. Seed vessel in the form of a small narrow pot (Dr G. Gardner).

Lecythis grandiflora, Aubl. South America. Large capsules with seeds (Dr Traill, Dr Gardner).

Lecythis minor? Jacq. South America. Capsule imported for tanning. (T. C. Archer).

Lecythis Zabucajo, Aubl. South America. Capsule and seed, which are called Zabucaio or Sapucaia nuts.

The seed vessels of several other unknown species of Lecythis.

Natural Order—Barringtoniaceæ.

Barringtonia Family.

Some of the plants have a bitter and tonic bark.

Barringtonia acutangula, Gært. India. Seeds (East India Company).

Barringtonia speciosa, L. India. Flowers and fruit.

Natural Order—HALORAGEACEÆ.

Water-Chestnut Family.

Some of the plants yield edible seeds.

Trapa bicornis, L. India. Fruit having the shape of a bull's head. It is used as food.

Trapa bispinosa, Roxb. India. Fruit eaten in India.

Trapa natans, L. Water Chestnut, Marron d' Eau. South Europe. Fruit used as food (Mr Greliche).

Natural Order—CUCURBITACEÆ.

Gourd Family.

The plants of this order in general possess acridity. The fruit of many is edible when cultivated. The seeds are usually harmless, and yield an oil.

Citrullus Colocynthis, Schrad. Coloquintida or Bitter Apple. Turkey and Mogadore. Fruit and seeds. Pulp of fruit constitutes Colocynth of the shops.

Cucumis Melo, L. Melon. Asia. Fruit from Crimean seeds (Dr White). Seeds (East India Company).

Cucumis sativus, L. Cucumber. South America. Fruit.

Cucurbita ovifera, L. Vegetable marrow. Fruit.

Cucurbita Pepo, L. Gourd. India. Fruit. Club Gourds of various forms used as water-vessels (Miss M'Nab, Dr M'Nab, Mrs Mackay. These are often called Calabashes.

Ecbalium purgans or *agreste*, Rich. South of Europe. Squirting Cucumber, so called from discharging its seeds and juice with force through an opening formed by the separation of the fruit from the stalk. Fruit and feculence called Elaterium.

Feuillœa cordifolia, L. Cacoon antidote seeds. West Indies. Seeds (Dr Bowerbank).

Lagenaria vulgaris, Ser. Bottle Gourd. Tropics. Fruit (Mr Gourlie, Dr Douglas Maclagan). Various kinds of vessels made of the Bottle Gourd. Carib baskets (Mrs Miller). Mate cup made from a small Gourd (Dr Gardner).

Luffa œgyptiaca, DC. Towel Gourd. Africa and West Indies. Fruit entire, and with the outer skin removed, showing internal network (Dr Douglas Maclagan). A sort of sponge or flesh brush made from the Gourd (Mr T. Hay). Other species of Luffa are also in the collection.

Momordica muricata, Willd. East Indies. Stalks (East India Company).

Natural Order—PAPAYACEÆ.

Papaw Family.

The plants have an acrid milky juice, while the fruit is eatable.

Carica Papaya, L. Papaw. South America. Fruit (Dr Christison, Mr Connal). The juice of the unripe fruit is used to render meat tender.

Natural Order—PANGIACEÆ.

Pangium Family.

The plants of this order are poisonous.

Gynocardia odorata, Roxb. East Indies. Chaulmougra Seeds and Fruit (Dr Murchison), used for Leprosy.

Natural Order—PASSIFLORACEÆ.

Passion-Flower Family.

Astringent and narcotic qualities occur in the order. Many yield edible fruits.

Passiflora cœrulea, L. Blue Passion Flower. South America. Flowering branch in fluid. Fruit (Capt. Boyle).

Passiflora quadrangularis, L. Granadilla. West Indies. Fruit (Dr J. T. Mackay).

Tacsonia mollissima, H. B. South America. Fruit (Professor Syme).

Natural Order—MESEMBRYANTHEMACEÆ or FICOIDEÆ.

Fig Marygold Family.

Some of the plants are esculent, others yield soda. Some have edible fruit.

Lewisia redivira, Pursh. N. America. Dried roots called Spætlum used as food by the Indians of North-west America.

Mesembryanthemum Tripolium, L. Africa. Seed-vessel expands in a radiating manner when moisture is applied. The esculent fruits of some Mesembryanthemums are called Hottentot figs.

Natural Order—CACTACEÆ.

Cactus Family.

Succulent plants with a sub-acid, esculent fruit.

Cereus grandiflorus, Mill. Night flowering Cereus. West Indies. Flowers preserved in diluted acetic acid.

Cereus speciosissimus, DC. Mexico. Flowers preserved in liquid.

Opuntia cochenillifera, Mill. Cochineal Cactus. S. America. Stem dried with the Cochineal female insects having their cottony covering surrounding them.

Natural Order—GROSSULARIACEÆ.

Gooseberry and Currant Family.

Wholesome plants often yielding edible fruits.

Ribes Grossularia, L. Gooseberry. Europe. Fruit preserved.

Natural Order—CUNONIACEÆ.

Cunonia Family.

Some of the plants have astringent properties

Cunonia capensis, L. Cape of Good Hope. Wood (Mr C. Watson).

Natural Order—HAMAMELIDACEÆ.

Witch Hazel Family

Hamamelis virginica, L. N. America. Wood.

Natural Order—UMBELLIFERÆ or APIACEÆ.

Umbelliferous Family,

Various properties exist in this order. Some of the plants are esculent, others poisonous, some yield oils, others fetid gum resins.

Anethum graveolens, L. Dill. India. Fruit called Dill seed.

Apium involucratum, Roxb. India. Fruit (Dr Christison).

Apium maculatum, Loftus. Persia. Beelahar Gum resin (Mr Mather).

Carum Carui, L. Carraway. Europe. Fruit called Carraway seeds.

Conium maculatum, L. Hemlock. Europe. Leaves.

Coriandrum sativum, L. Coriander. Europe and India. Fruit called Coriander seeds (E. I. Company).

Cuminum Cyminum, L. Cumin. Levant. Fruit called Cumin seeds (E. I. Company.)

Dorema Ammoniacum, Don. Persia. Gum resin, called Ammoniac (Mr Mather).

Dorema robustum, Loftus. Persia. Gum resin (Mr Mather).

Ferula sp. ? yielding Sagapenum.

Fœniculum dulce, D.C. Sweet Fennel. Europe. Fruit (Dr Christison) called Fennel seeds.

Fœniculum Panmorium, D.C. India. Fruit (Dr Christison).

Galbanum officinale, Don. Levant. Gum resin.

Narthex Assafœtida, Falc. Assafœtida. Persia. Gum resin.

Œnanthe crocata, L. Hemlock Dropwort. Europe. Root like parsnip, said to be poisonous in some situations.

Opoponax chironum, Roth. South of Europe. Gum resin, called Opoponax.

Pimpinella Anisum, L. Anise. S. Europe, &c. Fruit.

There are also numerous umbelliferous Gum resins from Persia, presented by Mr Mather, the sources of which are unknown.

Natural Order—ARALIACEÆ, OR HEDERACEÆ.

Ivy Family.

The plants have stimulant and tonic qualities.

Aralia papyrifera, Hook. Chinese Rice paper plant. Formosa. Paper with various drawings on it; the paper is the pith of the plant cut into small sheets.

Hedera Helix, L. Common Ivy. Section of large stem. Also large stem encircling a tree by union of its branches (Mr Scott); the Ivy stem is two feet in circumference at the base.

Natural Order—CORNACEÆ.

Cornel Family.

The plants have tonic and febrifugal qualities.

Cornus florida, L, N. America. Wood.

Cornus mascula, L. Europe. White and red Cornel berries (Mr Jackson).

Cornus sunguinea, L. Europe. Wood.

Specimens of wood of Cornus, called Dogwood.

Curtisia faginea, Thunb. Cape of Good Hope. Wood.

CALYCIFLORÆ.

2 GAMOPETALÆ OR MONOPETALÆ.

Natural Order—LORANTHACEÆ.

Mistleto Family.

Parasitic plants having generally astringent qualities.

Viscum album, L. Mistleto. Europe. Section to show the mode in which the Mistleto is attached to the tree on which it grows.

Natural Order—CAPRIFOLIACEÆ.

Honeysuckle Family.

Some of the plants are astringent, others emetic and purgative.

Sambucus nigra, L. Common Elder. Europe. Pith manufactured into a cross in Ireland (Miss Rutherfurd).

Natural Order—CINCHONACEÆ.

Peruvian Bark Family.

The plants of the order have tonic, stimulant, febrifugal, emetic, and purgative qualities.

Cephäelis Ipecacuanha, Rich. Brazil. Root used as an emetic and diaphoretic.

Cinchona Calisaya, Wad., and other species. South America. Yield various kinds of Peruvian bark. Sulphate of Quinine as prepared from Cinchona bark.

Coffea arabica, L. Coffee plant. Arabia. Berries, seeds in the husk, and freed from the husk. Specimen of coffee seeds presented by Mr Connal from Jamaica, Manilla, Sincapore, Porto Rico, La Guayra, Demerara, St Domingo, Ceylon, Cuba, Maracaiba. Coffee from Aden (E. I. Company). Wood of Coffee tree. A fine specimen of Caffeine under glass cover (Messrs T. and H. Smith).

Gardenia armata, Sw. India. Fruit (E. I. Company).

Gardenia radicans, Thunb. China. Fruit (Fortune). The fruit yields a yellow dye, used in colouring wood. It is boiled with a small quantity of glue, and rubbed over the wood, and then oiled over.

Morinda citrifolia. Sooranjee. E. Indies. Roots used as a dye (Mr W. Graham).

Portlandia grandiflora, L. W. Indies. Seed vessels.

Uncaria Gambir, Roxb. East Indies. Astringent extract called Gambeer in the form of square and oblong pieces, also in large and small round cakes. Stem and flowers of plant preserved in liquid.

Natural Order—GALIACEÆ or STELLATÆ.

Madder Family.

The plants yield valuable dyes.

Rubia cordifolia, L. Munjeet. India. Root used as a dye (East India Company, Mr W. Graham, Mr Connal).

Rubia tinctorum, L. Madder. South of Europe. Root used as a dye.

Natural Order—VALERIANACEÆ.

Valerian Family.

Nardostachys Jatamansi, Dec. India. Root supposed to be the spikenard of the ancients (East India Company, and Colonel Madden).

Valeriana officinalis, L. Europe. Root used as an antispasmodic.

Natural Order—DIPSACACEÆ.

Fuller's Teasel Family.

Dipsacus Fullonum, Mill. Europe. Flower heads used for fulling cloth.

At the close of the meeting, the President stated that he had been requested to convey to Mr Barclay the thanks of the party who enjoyed his generous hospitality and attention during the trip to Falkland and the Lomond Hills; and, in their name, he presented to Mr Barclay a handsomely bound copy of *Harvey's Phycologia Britannica*, accompanied by an address contained in a Silver Botanical Box, and signed by Professor Balfour and seventy botanical pupils and friends, in acknowledgment of the kind attention they received.

Mr Barclay expressed his acknowledgments to Professor Balfour and his students for this unexpected mark of their regard, and stated that it afforded him great pleasure at all times to do anything in his power to facilitate their investigations, either in the county with which he was connected, or elsewhere.

PROCEEDINGS OF THE BOTANICAL SOCIETY FOR NOVEMBER 1855.

The Society met on Thursday, 8th November, 1855, Professor Balfour, President, in the chair.

Donations were announced to the Society's Herbarium and Library, as follows:—

From Mr John Lowe, rare English plants.

From Mr Hector, fine specimens of Eriocaulon septangulare, and other Scotch plants.

From Professor Balfour, a parcel of Scotch Alpine plants, including upwards of 30 specimens of Cystopteris montana, Saxifraga cernua, Draba rupestris, Gentiana nivalis, &c.

From the Academy of Science of New Orleans, their Proceedings.

From the Smithsonian institution, their 8th and 9th Annual Reports, and other publications.

From the Boston Natural History Club, their Transactions.

From the Liverpool Literary and Philosophical Society, their Proceedings.

Mr Sansom's Paper on Illumination of Diatomaceæ, from the Author.

M. Alphonse De Candolle's Geographie Botanique, from the Author.

Mr Dana's Isothermal Oceanic Chart, illustrating the geographical distribution of marine animals, from the Author.

Professor Balfour stated that the following donations had been made to the Museum of Economic Botany at the Royal Botanic Garden, since last meeting of the Society:—

From Dr M'Vitie, Dress worn by the Natives of the South Sea Islands.

From H. Graham, Esq., specimen of Abies excelsa, showing the leading shoot of the tree terminated by a peculiar cone supported on an elongated stalk.

From Messrs. P. Lawson & Son, cones of Picea Pinsapo; specimens of Californian Wheats; Tussack grass seeds, ripened in the Lewis.

From Mr John Sadler, specimens of Lichens, from Lochwood Wood Dumfriesshire, arranged on stones:—Scyphophorus pyxidatus; Ramalina fraxinea; Sticta pulmonaria and Lecidea geographica.

From Mr M'Nab, cones taken from the Old Larch at Monzie.

From Dr Cornwall, Pods of Ceratonia Siliqua.

From Mrs Mackay, 3, Toll Cross, Edinburgh, a group of Wax Flowers.

From Dr Cleghorn, Madras, Seeds of Aleurites triloba; Plamunjel, a fungus found growing on the Jack tree, considered an efficacious Cattle medicine; Moonshee reed pens (Saccharum fuscum); Senna seed, native of Tinnivelly.

From Mr Thomas C. Archer, Cheshire, Chinese mat made of a rush, used extensively to cover Tea chests; Fibre called Pine apple fibre, and the leaves from which it is made (Manilla), probably a Bromelia or Billbergia; Palmetto plaiting, from E. Indies; Myrobalans, Terminalia chebula, supposed to have been gathered ripe; the same, supposed to have been gathered unripe; Hickory nuts; Safflower; Go go or Go Goo, probably the bark of Mimosa abstergens; Niger seeds, Guizotia oleifera; Capsule of Lecythis minor, imported for tanning; Kessuree flowers used for dyeing blue (Butea frondosa); Divi divi, Savanilla (Cæsalpinia coriaria); Mandioca Sorarmha; Tea seed yielding oil; Pigeon pea (Cajanus); Juglans cinerea; Australian cotton; Poppy seeds (oil seeds); Exidia aur. Judæ from Manilla said to be used both as food and medicine; Pecan nut; Litchi; Agar carang (Plocaria candida); Vegetable wax (Corypha cerifera); legumes of Vachelia Farnesiana; a fibre from Para called Tecum supposed to be the produce of some Palm leaf; Myrtle Wax (Myrica cerifera); Sokaria or Demerara nut; Cici or chick pea (Cicer arietinum); Fruit of Hymenæa Courbaril; Dipteryx odorata; Egyptian Lentil; Lecythis ollaria; Gingelly or Sesamum seed (Sesamum orientale); Sassafras nuts; Cotyledons of Nectandra Puchury;

Ceara Piassava probably from Leopoldina sp.; Para Piassaok, from Attalea funifera.

From Dr Cleghorn, Madras, Cloth made from Aloe fibre and Tassah silk mixed; Cloth made of Aloe and silk of two twists; Cloth made from Aloe (Agave Cantula); Cloth made of Aloe and silk of 4 twists, the latter made at Aurungabad; Slippers made by a Mochee in the Bazaar from the cloth of Aloe and silk mixed; sections of Diospyros Ebenaster (Ebony wood), and Chloroxylon Swietenia (Satin wood).

From Robert Paterson, Esq., portion of a large fossil coniferous tree found in a sandstone quarry.

From William Thomson Esq., Trinity Grove, Fruit of the black Raspberry, from N. America; also sections longitudinal and transverse of Cedrus Deodara and Pinus excelsa.

From Mr Scott, Leigh Park, fruit of the Mango (Mangifera indica); a cluster of fruits of the Caryota urens; branches of Cupressus funebris, Cryptomeria japonica, and Taxodium sempervirens, each covered with cones; also heads of Nelumbium luteum and speciosum, all ripened at Leigh Park.

From Robert Nasmyth Esq., peculiar twisted root of an Ash tree from Greyfriars Churchyard.

From Mrs Baillie, specimens of Cotton.

From Mr Loney, Fingask Castle, Large Branching Fungus, found growing at Camperdown in the hollow of an Ash tree (probably a form of Polyporus squamosus).

From the Royal Botanic Gardens, Kew, Cone and male flowers of Araucaria columnaris (Hook) collected on the Isle of Pines, by Mr Wm. Milne, H. M. Ship Herald.

From Michael Connal Esq., Cohoon nuts as imported for the preparation of Oil (Attalea sp.).

From Mr Moore, Botanic Garden, Chelsea, two cones of Zamia furfuracea.

From Misses Jackson, Kingston, Surrey, white and red berries of Cornus mascula, produced at Claremont; large fruit of the Black Mulberry, from an old tree in Hampton Court Gardens; also, a twin Plum from the same Gardens.

From Sir W. C. Trevelyan, a collection of seeds, consisting of 500 kinds, arranged in cases.

From Mrs W. Thomson, Trinity Grove, a collection of well executed wax models of the following fruits, &c: Achras Sapota (naseberry, sappodilla), Chrysophyllum cainito (Star Apple), Persea gratissima (Avocado Pear), Artocarpus incisa (bread fruit), Anona squamosa (sweetsop), Anona muricata (soursop), Solanum melongena (a kind of egg plant), Citrus paradisi (Forbidden fruit), Tamarindus indica (Tamarind), Eugenia Jambos, or Jambosa vulgaris (Rose Apple), Musa sapientum (Banana), Capsicum annum (Cayenne Pepper), Ficus Carica (Fig), Eugenia fruit, Psidium Cattleyanum (a kind of Guava), Psidium pomiferum (Guava), Opuntia vulgaris (common prickly Pear), Lycopersicum esculentum (var. Tomato), Spondias mombin Hog Plum), Punica granatum (Pomegranate), Mangifera indica (Mango), Saccharum officinarum (Sugar Cane), Zea Mais (Indian Corn), Abelmoschus esculentus (Ochro or Okra fruit).

From Dr Hooker, Kew, cone of Altingia Cunninghami.

From Alexander Beattie, Esq., cluster of Hops from Kent.

From Dr Thomas Anderson, H.E.I.C.S., stem of Gnetum from Penang.

From Misses Walker, Drumseugh, two fruits of the Passion Flower, ripened at Drumpellier.

From Mrs Fortune, Portobello, section of Spartium junceum.

From the Gutta Percha Company, City Road, London, specimens of Gutta Percha, and a series of articles manufactured from it, including cups, flasks, tubes, funnels, stethoscopes, ear trumpets, salvers, vases, mouldings, inkstand, coverings for telegraph wires, &c.

From Thomas Patton, Esq., Glenalmond, cluster of Cones of the Abies Picea (Silver Fir).

From Dr Douglas Maclagan, two specimens of Jack fruit—one measuring 1 foot 4 inches long, and 2 feet 5 inches in circumference; Bananas, large heads of Celosia cristata, flowering Spadix and Spathe of Coco Nut, warted stick—all from West Indies.

From Mr V. E. L. Walker, Arno's Grove, Southgate, fruit of Berberis vulgaris red and white, Cones and male spikes of Cedrus Lebani, a kind of Hickory Nut, Corylus with laciniate calyx round the fruit, Cratægus pyrifolia (fruit), Cratægus tanacetifolia (fruit), Pyrus syriaca (fruit), fruit of Platanus occidentalis and fruit of Ligusticum lucidum.

From Mr Ziervogel, fruit of Podophyllum peltatum, from a garden at Leyden.

From James Hector, Esq., 57, Inverleith Row, four specimens of Fucoides from Balruddery Den; six specimens of Parkia decipiens, Flem. same locality; large branched plant, with carbonized stem of doubtful nature, same locality; Sphenopteris affinis Hib., Burdie House; curious vegetable structure (Core of Stigmaria?) Gilmerton ironstone shale.

Mr M'Nab read the following list of plants presented to the Royal Botanic Garden during the last three months, amounting in all to 314 species and varieties

From G. L. Hay, Esq., Campie, Musselburgh, three Nutmeg plants, produced from seeds brought home in soil.

From John Duncan, Esq., Burnhead, plant of Phytolacca Icosandra.

From Mr Henderson, Wentworth House, several recently introduced species of Lycopods and Ferns, also a plant of Theobroma bicolor (White Chocolate.)

From James Blyth, Esq., Isle of Wight, a strong plant of Mangifera indica (Mango Tree, &c.)

From Robert Marnock, Esq., Regents Park, Chamærops excelsa, &c.

From Messrs Low and Son of the Clapton Nurseries, London, a collection of rare and interesting plants, including Garcinia Mangostana (Mangosteen). Cephalotus follicularis, Artocarpus rigida (a species of bread fruit), Sarracenia rubra, &c.

From Messrs Lee, Nurserymen, Hammersmith, several interesting plants, including Cereus senilis, Dammara obtusa, &c.

From Professor Balfour, several luxuriant tufts of Cistopteris montana, Ben Lawers.

From the Horticultural Society's Garden Chiswick, some recently introduced and useful plants, as Centradenia Skinneri, Bambusa glomerata, Asagrea officinalis, Poterium spinosum, &c.

From Mr Moore, Botanic Garden, Chelsea, a collection of interesting Ferns and Lycopods.

From the Royal Gardens, Kew, some rare and valuable plants, including Palms, Theobroma Cacao (Chocolate), Antiaris saccidora (sack tree), Eugenia dysenterica (Pitanga fruit), Argania Sideroxylon (Argan). also the plant which yields the Cuba Bast of Commerce, &c.

From James Backhouse and Son, York, several British plants, including Pseudathyrium flexile, Lastrea abbreviata, &c.

From Charles James Hope, Esq., plants of Woodsia hyperborea from Crieff.

From Mr Thomson, Dalkeith Park, strong bulbs of Amaryllis Aulica.

From Messrs Veitch and Son of the Exeter and Chelsea Nurseries, some remarkably interesting and rare plants, including Nepenthes ampullacea, N. lævis, Wellingtonia gigantea, Desfontania spinosa, Sonerilla margaritacea, &c.

From Mr Lonie, Fingask Castle, Perthshire, bulb of Sisyrinchium grandiflorum album.

From Messrs Dickson and Turnbull of the Perth Nurseries, several useful plants, including the cut leaved Mulberry (Morus alba laciniata), &c.

From Messrs Glendinning of the Chiswick Nurseries, London, some very useful stove, greenhouse, and hardy plants, including Gesnera Donkelairii, Curcuma Roscoeana, Campanula primuloides, Conifers, &c.

From Mr Scott, Leigh Park, several useful plants, including a grafted plant of the Alphanzo Mango, also the Sycamore of the Ancients (Sycomorus antiquorum), and the Arrowroot (Maranta arundinacea) &c.

From Miss Clarkson, Avenue Road, Regents Park, several interesting British Ferns, including branching forms of Lastrea dilatata and Blechnum boreale, also some singular forms of Asplenium lanceolatum.

From N. B. Ward, Esq., Clapham Rise, a luxuriant tuft of Lycopodium dendroideum.

From Messrs Jackson and Son of the Kingston Nurseries, a rich collection of interesting and useful plants, including a beautiful branching silver Fern (Gymnogramma pulchella), Lychnis Sieboldtii, also the recently introduced Geraniums, Verbenas, Fuchsias, &c.

From Miss Beever, Coniston, some peculiar forms of Athyrium Filix femina.

From Dr Knapp, Inverleith Row, a strong plant of Bouvardia longiflora.

From Messrs Weeks and Co., Nurserymen, King's Road, Chelsea, two fine plants of Chamædorea concolor, Rhapis, &c.

From Messrs P. Lawson and Son, of the Golden Acres Nursery, a growing plant of the Doom Palm of Egypt (Hyphæne thebaica.)

From the Cambridge Botanic Garden a collection of interesting plants, including several species of the genera, Pothos, and Caladium, also some beautiful Ferns and useful succulents.

From Francis Brent, Esq., Sandgate, Kent, some plants of Polypodium vulgare, showing a remarkably forked state of the pinnæ, also plants of Scolopendrium vulgare showing fructification both on the upper and under side of the frond.

Mr M'Nab stated that the following collection of seeds had been presented to the Royal Botanic Garden during the last three months:—

From C. Garstin, Esq., Darjeeling, a collection of Indian seeds.

From Mr Jeffrey, Botanic Garden, Madras, a collection of Indian seeds, also cuttings of Euphorbia Cattimundoo.

From Miss Hamilton, Ranelagh, Dublin, a collection of Australian seeds.

From Dr James M. Maclagan, a collection of Indian seeds.

From E. Ravenscroft, Esq., a collection of Indian seeds.

From the Cambridge Botanic Garden, seeds of Hardy Herbaceous plants.

From — Brande, Esq., Chiswick, seeds of Gynerium argenteum (Pampas grass.)

From Messrs P. Lawson and Son, seeds of Dactylis cæspitosa (Tussack grass.)

From J. H. Archer, Esq., Indian seeds.

From Dr Ferdinand Muller, Melbourne, a collection of Australian seeds.

Mr Murray exhibited a specimen of Phyllium Scythæ, which had lived for many months in the Edinburgh Botanic Garden on a Myrtle. The eggs of the insect had been sent from Assam to Mrs Major Blackwood, who had sent some to the Garden. The insect was a male, which underwent several metamorphoses before acquiring wings, after which it died.

Professor Balfour exhibited the following specimens:—

Carex irrigua, near Symington Railway Station (Mr Alex. Dickson.)

From Mr Maingay, specimens of *Cladophora Brownii* (Dillw.), from the only recorded locality, in a cave about 150 or 200 yards beyond the Black Castle, Wicklow, exposed to the drip of fresh water and the occasional overflow of the tide, as well as from another station nearer the Castle; *Parmelia Borreri*, Turn. (in fructification), on a fallen tree in Rossava Demesne, Co Wicklow; *Ceramium acanthonotum*, near Ardglass; *Lyngbya majuscula*, Wicklow; *Cladophora falcata*, Wicklow.

From Mr Hope, forked form of *Asplenium viride;* varieties of *Cystopteris fragilis*, *Woodsia hyperborea*, &c., from the neighbourhood of Crieff.

From Mr Blackhouse, *Athyrium Filix femina var. marina*, and *Cystopteris montana* from Canlochan.

From Mr G. Mann, *Lastrea rigida*, Ingleborough; *Lastrea collina*, Newm., Little Langdale, Westmoreland.

From Mr Nichol, Calicium furfuraceum, near Bonaly, Pentland Hills.

From Mr Eyton, a variety of *Polystichum lobatum*, Lochindaal, Isle of Skye.

From Mr Hardy, Penmanshiel, a specimen of *Dianthus barbatus*, with the upper leaves united in the form of a tubular involucre, also several plants, respecting which, he writes as follows :—

"*Ranunculus hirsutus* occurred in some abundance in a grass field at Dulow, and in a few instances here—most likely introduced with Clover seeds. *Thymus Acinos* is from a field near this place. As I have seen it abundantly elsewhere in the parish, I take it to be a native species. *Thlaspi arvense* has occurred abundantly near St Helen's Church. I have lately discovered too localities for the *Cranberry* within reasonable distance."

From Mr Laing, Saponaria officinalis, near Newburgh.

Mr M'Nab exhibited specimens of Indian Hemp grown in the Botanic Garden, from seeds communicated by Mrs Colonel Spottiswoode. The seeds were smaller than those which had previously been sent to the Garden as those of Indian Hemp. The plants had a strong resinous odour, and appeared to be hardier than those of the common Hemp grown in the same circumstances. The latter were also much less odoriferous. Sir W. Gibson Craig had also raised similar plants at Riccarton from Indian seeds.

Mr Lowe exhibited specimens of Anagallis arvensis, showing the conversion of the petals into green leaves, the other parts of the flower being apparently perfect.

Mr M'Nab read a notice from Mr Gorrie of Rosemains, Ford, announcing that an Ash tree, with a stem four feet in circumference, growing on the Farm of Turniedykes, Parish of Crichton, had been shivered with lightning during a thunderstorm which passed over that district in July last.

During the month of October, an Ash tree growing at Balgonie, in Fifeshire, had also been struck with lightning.

The following papers were read :—

1. *On the Batrachian Ranunculi of Britain.* By C. C. Babington, M.A., F.R.S.

The author opposes the view of those botanists who conceive that there is only one species of Batrachian Ranunculus, and adopts the opinion of Fries, Koch, Godron, Cosson, and other continental botanists who divide Ranunculus aquatilis into several species. After stating the characters upon which the species ought to be founded, he proceeds to arrange the species in the section Batrachium into three subsections.

I. Submersed leaves twice or thrice trifurcate with filiform segments spreading in the form of a section of a sphere, rarely wanting. Receptacle hispid. This includes R. trichophyllus, Chois., R. Drouetii, Schultz, R. heterophyllus, Fries, R. confusus, Godron, R. Baudotii, Godr., R. floribundus. Bab., R. peltatus, Fries, R. tripartitus DC.

II. Submersed leaves not like those of the 1st subsection. Receptacle hispid. This includes : R. circinatus, Sibth., R. fluitans, Lam.

III. No Submersed leaves. Receptacle not hispid. This includes : R. cœnosus, Gun., and R. hederaceus, Linn.

The paper will appear in the Annals of Natural History, and in the Society's Transactions.

2. *Note on Linaria sepium, Allman.* By C. C. Babington, M.A., F.R.S. In this paper the author stated that seeds of L. sepium, sent from Bandon, produced.—1. The proper L. sepium. 2. Plants closely resembling L. repens. 3. Plants slightly differing between L. repens and L. vulgaris.

Professor Allman remarked that he found some difficulty in allowing the plant to be a hybrid as represented by Mr Babington, but that from a recent examination of specimens at Bandon he believed it to be only a variety of L. repens.

3. *On the Influence of Last Winter on Trees and Shrubs at Aberdeen.* By G. Dickie, M.D., Professor of Natural History, Queen's College, Belfast.

I am indebted to Professor Gray of Marischal College for the accompany ing table of temperatures during the month of February last (1855). The absolute lowest temperature occurred on the 15th, viz., one degree below zero; the absolute highest was on the 24th, viz., 41 degrees F. The thermometer had been compared by Mr Glaisher at Greenwich. Temperatures of 4° and upwards were however observed in districts more inland.

Extract from Meteorological Observations at Aberdeen. February, 1855.

1855. Feb.	Max.	Min.	At 8.45 A.M.	1855. Feb.	Max.	Min.	At 8.45 A.M.
1	36	18	29	15	33	20	28
2	34	9	14	16	39	-1	9
3	36	25	35	17	23	4	10
4	39	35	37	18	31	11	30
5	39	35	37	19	34	21	26
6	37	31	35	20	39	22	24
7	40	31	34	21	34	22	28
8	38	30	32	22	35	14	17
9	33	31	30	23	34	15	26
10	33	18	27	24	37	20	28
11	33	23	31	25	41	25	27
12	37	23	27	26	35	19	21
13	34	22	28	27	37	14	24
14	33	17	22	28	40	23	35

Mean temperature of February, 26° 8.

The readings (which were taken daily at 8.45 A.M.) refer to the preceding 24 hours.

D. GRAY.

Most of the facts respecting the damage occasioned were communicated to me by Mr Roy, Ferryhill, by Mr Benjamin Reid, of Alford Place Nursery, and by Mr Cardno; I am also indebted to Mr Aitchison for a general statement of the effects produced at Huntly Lodge, 40 miles N. W. from Aberdeen; both at Aberdeen and Huntly Lodge I had opportunities personally of testing the accuracy of the statements. The following records were made during the last week of July:—

At Ferryhill every grafted Rhododendron was killed, the stock generally safe; the same sorts not grafted but dependant on their own roots were not lost, but, although generally killed to the ground, or within a few inches of it, they are now pushing out afresh.

Hybrids between Rhododendron arboreum, and Rhododendron catawbiense, twelve years old, and 4 feet in height, are generally all killed to the ground. A few branches are now pushing buds (July 24, 1855); a cross section shows their bark and outer layers of wood to be completely dead and disorganized.

At Ferryhill, Rhododendron cinnamomeum seven years old, very fine, grafted upon Rhododendron ponticum, were all killed; one of the same on its own roots was safe; the Rhododendron ponticum on which they were grafted is now pushing shoots.

Rh. robustum and Rh. campanulatum, not grafted, were safe; the same was generally the case with Rh. caucassicum, Rh. lepidotum and Rh. dauricum.

Plants of a hybrid of Rh. arboreum, with another species not stated, grafted on Rh. ponticum, were all killed, the stock was uninjured; one low graft protected by the snow was safe.

Rh. robustum and Rh. campanulatum in sheltered places were only slightly injured; but more generally untouched.

Mr Cardno reports that scarlet hybrid Rhododendrons were killed to the very ground, but are now pushing buds from below. Old plants of Rhododendron ponticum were all killed to the ground; young plants covered by the snow were safe.

At Huntly Lodge early Scarlet Rhododendrons were almost all killed to the ground. The influence of last season has proved that Rh. ponticum is less hardy than Rh. catawbiense and that hybrids of the former with Rh. catawbiense, or Rh. maximum, are hardier than the pure Rh. ponticum. The only two of the Sikkim Rhododendrons kept in the open air at Ferryhill, viz., Rh. glaucum and Rh. ciliatum, were killed down to the point where the snow covered them. With respect to the almost total destruction of grafted species, it may be observed that this had no reference to the fact that they were grafts, but was owing to this, that the stock being of considerable height (a foot or more) they were thus deprived of shelter from the accumulated snow, for wherever a stock was short the supported graft was generally safe.

Roses. At Ferryhill, all budded cloth of gold roses were killed—all on their own roots were killed to the ground, but are now pushing shoots—that called Souvenir de Malmaison when budded, was completely destroyed, but not injured when on its own root. Every one was killed belonging to the kinds called *Tea*, *Noisette*, *China*, and *Bourbon*. Both at Huntly Lodge and at Aberdeen, all the Ayrshire roses were killed to the ground; common Moss and Cabbage Roses were not hurt.

Coniferæ.

Pinus Cembra of all ages quite untouched.

P. sylvestris in exposed places lost young shoots.

P. macrophylla—all the young ones killed—one of seven years old also appears to be killed.

P. Russelliana, killed.

P. insignis. Plants 21 years old killed—young plants in another part of the nursery not killed.

P. Teocote, killed to the ground.

P. longifolia, killed to the ground, but sending up shoots from below.

P. Sabiniana, not injured.

P. Hartwegii, not injured.

P. austriaca, safe everywhere.

P. Pumilio. At Huntly Lodge—lost the leading shoot.

Abies Douglasii. Of all ages, uninjured.

A. Morinda, 20 years old, all but killed—a few green shoots only (July 23, 1855).

Picea Nordmanniana. Quite safe.

P. nobilis. Of all sizes, uninjured.

P. Pindrow. Five or six years old; safe in a sheltered part of Ferryhill nursery.

Cedrus Deodara. Slighly injured at Ferryhill. In other places in the vicinity of Aberdeen, plants 18 to 20 inches in height were safe on high ground, but almost all destroyed on low ground. At Huntly Lodge, Deodars 8–9 feet high were uninjured.

Cedrus Libani (var. argentea) was untouched.

Aracuaria imbricata. At Ferryhill, plants of seven years old were killed to the ground. Young plants were safe, excepting any branches protruding above the snow. One tree of this species, 12 or 13 years old, had always stood unprotected, but was last winter killed to the ground, and is now pushing buds below. Generally speaking, all of this species not protected by snow were destroyed. At Huntly Lodge the same remark generally applies, especially in low spots; some of those on high ground were injured but not killed.

Taxodium sempervirens. At Ferryhill plants seven years old were killed to the ground, but are pushing below.

Thuja japonica. Slightly injured.

Cupressus macrocarpa. Six to seven years old, killed. In one case the lower shoots safe.

C. Goveniana. Killed.

C. funebris. Almost entirely destroyed.*

Fitzroya patagonica. Killed down to part protected by snow, all below uninjured.

Saxegothea conspicua. Same as the preceding.

Cephalotaxus Fortuni. Nearly three feet high, killed to the ground.

Species of Juniper from E. Indies, Mexico, and N. America, have all escaped uninjured.

Irish Yew. At Ferryhill, all above the snow were damaged. Mr Cardno reported that Irish Yews four to five feet in height were killed to six inches from the ground, the part covered by snow.

Portugal Laurels, at Aberdeen, were all killed down to the part covered by snow.

Common Laurel. A good deal injured, but not so much as the Portugal.†

Variegated Holly. Six to eight feet high. Were killed to within a few inches of the ground.

Ornus europæa. At Ferryhill, flowered twice in 1854; the second time abundantly, up to the middle of November. Plants 30 years old, lost one year's wood; had never, so far as known, suffered during any preceding winter.

Garrya elliptica. At Ferryhill, plants 12 years old had all the main branches killed to near a foot above the ground. No injury observed during any previous winter.

Syringa Emodi. Suffered no injury.

The following were also reported at Ferryhill, by Mr Kay:—

Mitraria coccinea. Killed to the ground, 1 year old.

Calycanthus macrophylla. 1 year old, safe, covered by snow.

Magnolia Thomsoniana, 4 years old, safe, 10 feet high.

Weigelia rosea, 1 year, 18 inches; and 1 year old, 48 inches: not injured.

Arbutus Andrachne. Killed to the ground, but pushing from below.

Arbutus procera, 10 years old, 8 feet high, quite hardy.

Veronica Lindleyana, 2 years old, 18 inches high, safe.

Mahonia nepalensis, 1 year, 8 inches, safe, protected by snow.

Neillia myricifolia, 1 year, 16 inches, safe, quite hardy.

Veronica decussata, killed to the ground.

Viburnum magniflorum, safe, protected by the snow.

At Ferryhill, a tree of Acer obtusatum had a large branch ringed five years ago near its junction with the stem, in order to promote the development of seed; the desired result was obtained. This ringed branch has ever since expanded its leaves a month earlier than the rest of the tree. The low temperature of last winter occasioned the death of a considerable number of shoots, particularly on the ringed branch. Last spring (1855) the leaves of the ringed branch were two months later than usual in expanding. The exposed wood at the ringed part is dead to a depth of at least an eighth of an inch; the two lips of the wound are widely separated; the process of healing has made little progress.

With respect to the influence of last winter on wild plants, the most conspicuous effect is upon Whin and Broom. Of these, it may generally be stated, that in all exposed places they were killed nearly to the ground.

Small bushy plants of Whin browsed by cattle were uninjured, because protected by snow. The effects of the low temperature of last winter on Whin and Broom, were most conspicuous near the coast line, for two reasons. The plants there attain large size, and the shelter afforded by snow is less. In the more inland districts, the accumulations of snow are greater and more permanent, and the plants never attaining very great height, are consequently less likely to suffer from the inclemency of the season. In every instance examined, where the species in question had been injured above,

* Every Cypress not covered by snow, was killed, as reported by Mr Cardno.

† At Banchory House, old Laurels were almost entirely destroyed. At Huntly Lodge, the common Laurel was killed to the part covered by the snow; the Portugal Laurel did not suffer so much.

they were this season pushing vigorous shoots from below. It was remarkable to observe the contrast between them and species of Rosa, and Rubus, and Salix growing along with them, the latter being uninjured. Sections of stems of Whin and Broom killed by the frost were very carefully examined under the microscope, for the purpose of ascertaining whether any physical change in their tissues had occurred; no such could be detected; the only apparent difference between such stems and sections of healthy living ones, by way of comparison, was this,—viz., brown stains in the vicinity of the ducts; such, however, were not always present. We can only account for the death of certain plants from exposure to low temperatures, by the supposition that constitutionally they are less fitted to resist cold than others.

Respecting the exotic trees and shrubs reported as either materially injured or totally destroyed, it would be rash to say that this indicates their inability to resist low temperatures under any circumstances. In every instance it was observed that the destruction was greater in low than in high localities, and this even in the same garden. Thus, at Ferryhill, Rhododendron cinnamomeum was more injured in shady, sheltered spots than in high and open situations. At Huntly Lodge, Pinus excelsa was scarcely injured on high situations, but in places not distant more than a hundred yards, but 20 feet lower, all the plants were killed; the same remark applied generally to Araucaria imbricata. The great destruction occasioned at Ferryhill was attributed by Mr Roy to the fact that there was continued growth till January, and the sudden transition to a lower temperature, occasioned the destruction of parts not properly matured. It is probable that the same explanation will account, in some degree, for the greater loss sustained in high than in low localities; in the latter, especially if shaded, maturation of tissues will be less perfect, and therefore greater risk of injury from cold. There seems, however, some reason for the belief held by not a few, that the gravitation of very cold air into low lying spots may be at least one cause of the difference to which we have alluded.

A report already published respecting the loss sustained in the Belfast Botanic Garden, may be worthy of notice here, as contrasted with the results of inquiry at Aberdeen. The comparatively small amount of loss at Belfast is worthy of notice, but easily accounted for when it is considered that the site of the garden is high and well drained, and the lowest temperature recorded was only 13° F., and therefore 14° F. above that recorded at Aberdeen on the same day. Still it is worthy of record that in such a favourable locality as that of the Belfast Garden the temperature just mentioned occasioned the death of the following plants, viz.:—Pinus apulcensis, P. Russelliana, P. palustris; Abies Brunoniana, A. jezoensis; Cupressus elegans, C. mexicana, C. torulosa, C. lusitanica; Fitzroya patagonica; Saxegothea conspicua; and Erica arborea. It is worthy of notice, however, that at Beneden, three miles N.E. from the Belfast Botanic Garden, one mile from the shore, and 450 feet above the level of the sea, the above named trees have stood uninjured.

The experience of past winters has demonstrated that lower temperatures than that observed at Belfast occasion almost irreparable damage, even to such plants as the common and Portugal Laurels, the Holly, Irish Yew, Rhododendrons, certain Roses, such as the Ayrshire, &c.; and even some indigenous species, such as Whin and Broom, are liable to periodical destruction of all the part above the soil. Such facts also enable us better to appreciate that admirable arrangement by which most of our native perennial species are able to resist the inclemency of the severest season. The subterranean stock is protected by the snow which accumulates in severe winters, and the soil in which it is imbedded; the reviving influence of spring stimulating to the upward development of the subterranean buds, and the formation of leaves, flowers, and seed.

It appears unnecessary to urge at any length the importance of recording the influence of different seasons upon exotics as well as on our native species. Much has been done of late years to increase the number of foreign plants likely to bear free exposure in our climate, and no inconsiderable amount of capital has been expended with this view. Past experience has shown that not a few highly ornamental as well as useful trees and shrubs may continue to thrive for some years in different parts of the United Kingdom, thus giving promise that they might ultimately prove valuable acquisitions to our arboretums or our forests. But the experience of last winter has demonstrated that too sanguine expectations have been formed regarding some, and that our collections are liable to periodical thinning, occasioned by the influence of low temperatures on species which are more delicate than had been supposed. The loss of time, and of capital occasioned by such occurrences, render these inquries more than mere subjects of interest to the physiologist.

Every garden in the kingdom, whether public or private, ought to be considered as an experimental establishment; the subjects of experiments are already provided, viz , the trees and shrubs which have been introduced, and the varying seasons are the agents whose influence on such we ought to observe and record. A continued series of such observations would ultimately lead to valuable results, and we should cease to hear of money vainly expended, and of valuable soil encumbered by vegetable productions which must ultimately in most instances succumb under the influence of unusually severe winters It would not be necessary to keep a continued register of temperature throughout the whole year. Records kept for a few weeks at the coldest season, and especially attended to during very cold winters would be amply sufficient, and doubtless in course of time we should arrive at very important results. A dealer in exotics ought to be able to recommend in general such ornamental or useful trees or shrubs as might be expected to withstand the severest winter in any part of the United Kingdom, instead of indiscriminately sending out to every locality species reported by the trade as hardy, to the ultimate disappointment of both seller and buyer, but especially the latter. Such intimate acquaintance with the constitution of exotics, is not in every instance at present possessed by cultivators, and we cannot therefore blame them for disappointments experienced by purchasers It is the interest, therefore, of all parties to aid in collecting the kind of information to which we have been referring, and in our forests, and our gardens, we cannot fail ultimately to reap important results from the accumulation of such practical knowledge.

4. *Notice of the Flowering of the Victoria regia in the Royal Botanic Gaden, Glasgow.* By Mr Peter Clarke, Curator of the Garden.

A Victoria House has been erected in the Royal Botanic Garden at Glasgow. It measures 40 feet in length by 34 feet in breadth; and is constructed on the ridge and furrow principle. A tank is formed in the centre, measuring 22 by 20 feet, which is thus amply sufficient for the full development of the plant. It is so constructed as to give a depth of 3 feet of water, gradually becoming more shallow towards the margin, where it is only 18 inches. Heat is applied by means of four rows of hot water pipes. A pit is formed in the centre of the tank for the reception of the compost of charred loam and leaf mould, which is raised up in the form of a conical mound—about three cart loads were required. The young Victoria was planted on the summit of this mound on the 12th of May last, having then no leaves larger than 12 inches across. The temperature of the tank was maintained at from 83° to 85°, and the plant soon increased in the size of all its parts. By the end of May the leaves reached a foot-and-a half in diameter; by the middle of June two feet—after which, in consequence of dull weather, no progress was made during a whole month. By the end of July the return of clear weather exercised a marked effect on the health of the plant, and in a week afterwards it had 14 good fresh leaves, some of which were 3 feet-and-a-half across. By the middle of August the plant was in great vigour, and some of the leaves increased in diameter at the rate of 12 or 14 inches in 24 hours. On the 22d August the first flower bud appeared, the largest leaf being then 4 feet 10 inches across, but some of the leaves subsequently produced have measured more than 5 feet across.

On 31st August, 9 days after the bud's first appearance, it began to expand, filling the house with a perfume resembling that of a well-ripened pine-apple. During the afternoon and night it continued to open, and at ten o'clock on the following morning began to close again, being quite shut up an hour afterwards. At 3 o'clock in the afternoon, however, it opened again, and reached its full expansion about half-past-six, when the rosy central petals became elevated, and the flower thus assumed its most beautiful form —its diameter was 13 inches. During that evening alone it was inspected by 2000 visitors. After this period the plant continued to produce flowers abundantly, but gradually decreased in vegetative vigour. Notwithstanding its continued health, however, and a constant succession of fine flowers, no seeds have been produced, probably owing to the pollen being imperfect; in the specimens examined by Mr Lawson, there were no perfect pollen grains.

5. *On the Structure of Victoria regia, Lindl.* By Mr George Lawson.

While attending the recent meeting of the British Association at Glasgow, I was very kindly allowed facilities for examining the Victoria regia, then flowering in the Glasgow Garden. This plant presents many points of interest to the vegetable anatomist, which have long been before the public; and although my observations were necessarily little more than a repetition of some of the researches of Lindley, Hooker, Planchon, Loescher, Henfrey, and Trecul, still there are one or two points which appear to have been hitherto imperfectly explained, and to these I shall limit my remarks.

The accordance of the Victoria in all its important botanical characters with other Nymphæaceæ has been well shown, so much so indeed, that its place is not now doubted by any one. This similarity also exhibits itself in the anomalous structure of the stem, which has been shown by Henfrey to bear a striking resemblance to that of Nuphar, partaking of the same so-called "monocotyledonous" character. In my examinations I have been much struck with the remarkable manner in which many details of minute structure exhibited in the tissues of our common Water Lillies are repeated in the Victoria. We have in all the same paucity of vascular, as compared with the vast abundance of cellular tissues, and throughout the latter there are numerous lacunæ, many of which are remarkably large, larger than in any other family of plants with which I am acquainted; and some of these lacunæ are furnished with internal stellate hairs so peculiar as to form a characteristic mark of the family.

It is a well-known fact, that although the stomata (or breathing pores) of most plants chiefly occur on the *under* surface of the leaf, it is different with those leaves whose under surface is closely applied to the soil, or to the surface of water. In Water Lilies accordingly, the stomata occur on the *upper* surface of the leaf only. In the Victoria the massive ribs appear to act as floats, and prevent the actual contact of a large portion of the under surface of the leaf with the water, notwithstanding which, however, the plant agrees with other Nymphæaceæ in having no stomata on the under surface. We have in this plant an upturned margin, and both surfaces of this portion of the leaf are equally exposed to the action of the atmosphere, notwithstanding which, however, the lower or outer surface of the rim partakes of the same purple hue as other parts of the lower surface of the leaf, and has no stomata, these being present only on the green inner surface of the rim.

The stomata are nearly circular, formed of two crescentic cells. They are minute, measuring only the 1-960th of an inch in diameter, and so closely placed that one square inch of epidermis will contain 139,843. An ordinary sized leaf, 4 feet in diameter, with a surface of 1850.08 square inches, will thus contain upwards of twenty-five millions of stomata (25,720,937.)

The lower surface of the Victoria leaf is somewhat peculiar. It exhibts no stomata, but is thickly clothed with flexuous hairs, consisting of cylindrical cells, and arising each from a small round basal cell very distinct both from the other cells of the hair and those of the epidermis, which latter are filled with diffused colouring matter, mostly red, but some blue, and a few without colour. These hairs average about the 1-55th part of an inch in length, by the 1-490th of an inch in breadth. There are seen scattered over the surface, in addition to the hairs, numerous round cells, precisely similar to those which form the bases of the hairs; these apparently indicate non-developed hairs. The arrangement of these cells (taking together those which from the bases of hairs and those whose hairs are abortive), is so strikingly similar to the arrangement of the stomata on the opposite surface of the leaf as to suggest the question whether these cells are not homologous with the stomata; are in fact the cells from which stomata would be evolved if they were produced. This idea is strengthed by the fact that a trace of chlorophyll is seen in these cells, while it is entirely absent in the ordinary epidermal cells, but present in well-defined globules in the cells of the true stomata. Whatever be the homological relationship between the hairs and the stomata, there can be no doubt that the cells to which I have alluded represent undeveloped hairs; and, indeed, Dr Lankester has long ago shown the tendency to non-development of hairs on aquatic plants, such, for example, as in the case of Callitriche, where peculiar rosette-shaped cells in the epidermis, represent non-developed hairs.*

The under surface of the leaf of Victoria, and especially its large ribs, as well as the petioles and peduncles, are abundantly provided with strong prickles; these vary much in size. They are more or less of a conical form, and consist of cellular tissue; the central part being formed by large elongated cells, which gradually decrease in breadth towards the outside, where numerous compressed cells of much smaller size give strength to the prickle, which is soft in the interior; those I examined did not contain spiral vessels.

It will be observed that there is an appearance of a canal at the termination of the prickle; attention has been drawn to this structure as probably an important one in the economy of the plant, serving for gaseous absorption, or some other function; but it appears to me to be a simple depression in the apex of the prickle of no physiological importanee.

If a portion of the leaf of the plant be held between the eye and the light, it will be seen that the thinner parts are perforated with numerous minute holes; indeed these are distributed more or less over the whole leaf, excepting those parts occupied by the ribs. The nature of these openings, as well as their purpose in the economy of the plant, have given rise to some speculation. Hooker describes them thus†:—"Conspicuously may be seen the numerous pores or *stomata*; these are circular, generally margined with red, and apparently formed of a thin membrane, surrounded by a circle of red cells;" and Fitch's drawing shows a membrane stretched across the pore. This is only the case, however, in the early condition of the leaf; at maturity, the thin pellicle disappears, leaving an actual perforation, measuring in the specimens I examined the 1·84th part of an inch across. The development of these pores has been carefully described by Planchon,‡ who has given them the name of Stomatodes, and subsequently by Trecul.‖ Planchon believes that they are designed to permit the escape of gases which are disengaged from the water, and would otherwise collect in the spaces formed between the ribs and the under-surface of the leaf. It appears to me, however, that they might with equal propriety be regarded as intended to drain off the superflous water which, from rain or other sources, might collect upon the surface of the leaf, whose edges being turned up as a bulwark against the surface ripple of the water, would prevent its speedy escape otherwise; and we well know that such a huge mass of cellular tissue shut out from the air by a covering of water soon dies. But, I believe, neither hypothesis explains the real nature of the so-called stomatodes. It is desirable to understand their homology before we speculate on their functions. They have none other than a fanciful relationship with stomata. In their own structure, they

* English Clyclopædia, Nat. Hist., I., 722.

† Fitch's Illustrations, (1851).

‡ Flore des Serres et des Jardins de l'Europe, vi., 249 &c.

‖ Annales des Sciences Naturelles. Botanique, 4 ser., I., 145-172.

present no characters in common with stomata, nor are they even connected with true stomata; on the contrary, there is an absence of stomata around their margin on the upper surface, the thinning of the tissue at that part rendering such organs unnecessary.

While the perforations may serve both the purposes indicated above, and thus afford an example of the modification of a structure to suit the requirements of a plant, such as we see every day in the organs of animals and plants. I believe that they are merely the simplest form of a reduction of tissues more fully brought out in other plants. We well know the tendency of phanerogamous plants growing in water to lose the soft tissues of their leaves; Ranunculus aquatilis is a familiar example wherein the submersed, as well as some of the floating leaves exhibit only a very partial development of parenchyma; we also know that this reduction of parenchyma is not confined to leaves actually submersed, but is participated in by those which float upon the surface. Ouvirandra fenestralis is a striking example, the parenchyma being so much reduced as to give the leaf the appearance of a skeleton leaf. In the Victoria it appears to me that the perforations indicate the beginning, as it were, of a reduction of this kind, which if it proceeded far enough would result in a lattice-work leaf like the Ouvirandra, represented only by the strong ribbed venation with which the Victoria is furnished. In fact the thinness of the intercostal parts of the leaf as compared with the ribs, is an equally striking indication of such a reduction. Viewed from this point of view, these pores resolve themselves into a form of development with which we are familiar in other plants, and lose their supposed singularity as a feature of structure peculiar to the Victoria.

Mr Lawson exhibited specimens illustrating his remarks; also microscopical drawings, showing the various epidermal structures of both surfaces of the leaf, as well as the stomatodes, lacunæ, and stellate cells, prickles, and the tissues of the petals containing colouring matter, &c.

6. *Notice of some of the Contents of the Museum of Economic Botany in the Edinburgh Botanic Garden.* By Professor Balfour. *(Continued from page 108.)*

Natural Order—Compositæ.
Composite Family.

This is a most extensive family, embracing about 10,000 species. The plants are found in all parts of the world. Their properties are various; some are inert, others bitter and tonic, others stimulant and aromatic, and others narcotic.

Sub-order I.—Cichoraceæ.
Chicory or Lettuce Section.

Cichorium Intybus, L. Chicory. Europe. Root in various states, raw and prepared, sliced and roasted, in chips and ground (Mr James Fulton). Used as a substitute for Coffee.

Lactuca virosa, L Wild Lettuce. Europe. Inspissated milky juice, called Lactucarium, or Lettuce Opium. Of this plant the garden Lettuce is probably a cultivated variety.

Leontodon Taraxacum, L. Dandelion. Europe. Inspissated milky juice, which is used as a diuretic and alterative. Roots sliced, roasted, and ground, and used as a substitute for Coffee.

Sub-Order II.—Cynarocephalæ.
Artichoke Section.

Aucklandia Costus. Koosht or Puchak. Cashmere. Root constituting the Costus of the ancients, used as incense (Dr Christison).

Carthamus tinctorius, L. Safflower. India. Dried flowers, which yield a pink dye (E.I. Company and Mr Archer).

Cynara Scolymus, L. Artichoke. Europe. Head of flowers; the bottoms or prepared receptacles being used as food.

Tripteris sp.? from Algoa Bay. Fruit (Dr Fraser).

Sub-Order III.—CORYMBIFERÆ.

Chamomile Section.

Anacyclus Pyrethrum, Cass. Pellitory of Spain. S. Europe, N. Africa. Root—used as a masticatory.

Anthemis nobilis, L. Chamomile. Europe. Flowers, used as emetic, diaphoretic, and for fomentation. Extract bitter and tonic.

Baccharis halimifolia, L. N. America. Wood.

Ceradia furcata, Lindl. West Africa. Stem having a coral-like appearance; yields a resinous matter.

Gnaphalium eximium, L., and other species of Everlasting from the Cape of Good Hope (Prof. Piazzi Smyth and Mrs Elliotson).

Guizotia oleifera, D.C. Ramtil. Madras. Seeds, yielding oil (Mr Archer.)

Lychnophora Pinaster, Mart. Brazil. Part of stem, covered with a thick coating of hairs (Dr G. Gardner).

Madia sativa, Molin. Chili. Oil from the plant (Cal. Hort. Soc.).

Mikania Guaco, H.B. Guaco. S America. Portion of stem (John Maclean, Esq.). Plant used for cure of snake bites

Spilanthes oleracea, L. India Plant used as a potherb (E.I Company).

Natural Order—LOBELIACEÆ.

Lobelia Family.

The plants of this order have usually an acro-narcotic milky juice.

Lobelia inflata, L. Indian Tobacco. United States. Herb used in asthma.

Natural Order—STYRACACEÆ.

Storax Family.

Some of the plants are bitter and aromatic, others yield a fragrant resin.

Styrax Benzoin, Dryand. Benzoin tree, Malay Archipelago. Concrete balsamic exudation called Benzoin.

Natural Order—VACCINIACEÆ.

Cranberry Family.

Plants have astringent properties. The berried fruit is sub-acid and eatable

Vaccinium Oxycoccus, L. Cranberry. N. Europe. Fruit.

Vaccinium Myrtillus, L. Bilberry, or Blaeberry. Europe. Pulp prepared from it for making paper (Chevalier Claussen). Tannate of soda prepared from the plants (C. Claussen).

SUB-CLASS COROLLIFLORÆ.

I. HYPOSTAMINEÆ.

Natural Order—ERICACEÆ.

Heath Family.

Some of the plants are astringent, others yield edible fruits; a few are poisonous.

Arbutus Andrachne, L. S. Europe. Section of stem.

Arbutus serratifolia. Section of stem.

Arbutus Unedo, L. Strawberry tree. Europe. Fruit and wood.

Arctostaphylos Uva Ursi, Spr. Bearberry. Europe. Leaves—astringent.

Calluna vulgaris, L. Common Heather or Ling. Europe. Pulp prepared from it for paper (C. Claussen).

Clethra arborea, Ait. Madeira. Wood.

Erica arborea, L. Tree Heath. Madeira. Wood.

Kalmia latifolia, L. N. America. Wood.

Rhododendron arboreum, Sm. Tree Rhododendron. Stem.

Rhododendron catawbiense, Mich. N. America. Section of stem.

Rhododendron Dalhousiæ, Hook. fil. Sikkim. Flowers preserved in fluid (Mr Laing).

Rhododendron maximum, L., N. America. Wood.

2. Epicorollæ or Epipetalæ.
Natural Order—Ebenaceæ.
Ebony Family.

The trees of the family yield hard and durable timber. Fruit is often eatable.

Diospyros Ebenaster, Retz. Bastard Ebony of Ceylon. Wood (Dr Cleghorn).

Diospyros Ebenus, Retz., Ebony. Africa. Wood (Mr Connal).

Diospyros Melanoxylon, Rox. East Indies. Fruit (Dr Christison).

Diospyros hirsuta, L. fil., Ceylon. Calamander wood (Messrs Kinnear & Watson).

Diospyros, sp. Iron wood. West Indies (T. Hay, Esq).

Royena villosa, L., Zwartbost. Cape of Good Hope. Wood (Mr C. Watson).

Natural Order—Aquifoliaceæ.
Holly Family.

Bitter tonic, astringent and emetic properties exist in the order.

Ilex Aquifolium, L., Common Holly. Europe. Wood, Fruit. Fasciated branch with flowers. Bark tonic, and yields birdlime. Berries cause vomiting.

Ilex opaca, Ait., North America. Wood.

Ilex paraguayensis, St. Hil. Mate or Paraguay Tea plant. S. America. Tea prepared from it (Dr Gardner, Mr Macfarlane, Dr Maclagan). It contains theine. Mate cup and tube used in drinking the infusion.

Ilex Perado, Ait., and varieties. Madeira. Wood.

Prinos glaber, L , N. America. Wood and Bark.

Natural Order—Sapotaceæ.
Sappodilla Family.

The fruit of many of the plants is eatable. The bark is bitter. Some furnish caoutchouc, others fatty matters.

Achras sapota, L., Sappodilla Plum or Naseberry. W. Indies. Model of fruit in wax (Mrs W. T. Thomson) Seeds. Section of stem.

Bassia butyracea, Rox. Madhuca tree. Yel Pote of the Lepchas. India. Butter prepared from it (Colonel Madden).

Bassia Parkii, G. Don. Butter tree of Mungo Park. Africa. Shea or Galam butter prepared from it; and section of stem (Dr Stanger).

Bumelia nigra, Sw. Bully tree. Jamaica. Wood (Mr T. Hay).

Chrysophyllum cainito, L. Star Apple. W. Indies. Fruit modelled in wax (Mrs W. T. Thomson). Section of wood.

Imbricaria obovata. Wit Peer. Cape of Good Hope. Wood (Mr C. Watson.

Isonandra Gutta, Hook. Taban tree. Singapore and Malay Islands. Gutta Percha procured from it in the raw state, and in the form of various manufactured articles, such as tubes, coating of telegraphic wires, inkstands, salvers, mouldings, mugs, shoes, surgical instruments, &c., (Gutta Percha Co., City Road, London).

Mimusops, sp. White Bullet tree. W. Indies. Wood.

Sideroxylon inerm, L. Milkwood. Cape of Good Hope. Wood.

Stderoxylon mastichodendron, Jacq. West Indies. Section of wood.

Sideroxylon meermulana, Low. Madeira. Wood.

Natural Order—Myrsinaceæ.
Myrsine Family.

Many of the plants are handsome Evergreen Shrubs. Some yield food.

Heberdenia excelsa, Banks. Madeira. Wood.

Embelia robusta, Rox. East Indies. Fruit (E. I. Company).

Myrsine melanophleos, R. Br. Beukenhout. Cape of Good Hope (Mr Watson).

Natural Order—Oleaceæ.
Olive Family.

Some of the plants have laxative properties, others are bitter and tonic. Some supply oil.

Fraxinus excelsior, L. The Ash. Europe. Wood and bark; the latter tonic. Section of Ash stem, 5 feet 2 inches in diameter (Sir Wm. Keith Murray).

Olea capensis, L. Cape of Good Hope. Section of stem.

Olea europæa, L. Olive tree. S. Europe and Palestine. Wood from the mount of Olives (Dr Keith and Dr Bryce).

Olea excelsa, Ait. Pao Branco. Madeira. Wood.

Olea laurifolia, Lam. Gezerhout. Cape of Good Hope. Wood (Mr C. Watson).

Ornus rotundifolia, Pers., and *O. europæa*, Pers. Manna trees. Europe. Manna procured from them.

Natural Order—Asclepiadaceæ.

Milkweed Family.

The plants have acrid, diaphoretic, and emetic properties. Most of them yield a milky juice.

Asclepias, sp ? India. Fibres made in Madras from it (Dr A. Hunter).

Calotropis procera, R., Br. Kind of Mudar plant. E. Indies. Stem and bark (Captain Maclagan).

Hemidesmus indicus, R. Br. India. Roots used as a substitute for sarsaparilla (Prof. T. Anderson). Sold in London as root of Smilax aspera.

Stephanotis floribunda, A. Brongn. Fruit ripened at Millbank (Professor Syme).

Tylophora asthmatica, W. and A. India. Seeds with hairs attached.

Follicles with comose seeds of several other species of *Asclepiadaceæ*.

Natural Order—Apocynaceæ.

Dogbane Family.

Many of the plants of this order are poisonous. Bark is often tonic.

Aspidosperma excelsum, Schomb. Paddle wood or Yarroura wood. South America. Large specimen of the trunk of the tree from Demerara (Dr W. H. Campbell).

Echites splendens ? Seed vessels (Mrs Henderson).

Gonioma Kamassi, E. Mey. Gomassichout. Cape of Good Hope. Wood (Mr C. Watson).

Nerium antidysentericum, L. E. Indies. Seeds and hairs from Calcutta (Dr Christison).

Nerium odorum, Soland. India. Section of stem.

Plumieria rubra, L. Red Jasmine tree. S. America. Section of stem.

Tabernæmontana utilis, Arn. Cow-tree. Demerara. Milky juice, used as a nutritious fluid.

Natural Order—Loganiaceæ.

Strychnia Family.

Poisonous plants causing tetanic spasms.

Ignatia amara, L., St Ignatius' Bean. India-Seeds (Dr Christison).

Strychnos Nux vomica, L. Nux Vomica plant. E. Indies. Fruit and seeds (Dr Christison, Dr Fraser, E. I. Company). Bark called false Angostura bark. Strychnia prepared from the seeds (Messrs Duncan & Flockhart).

Strychnos potatorum, L. Clearing nut. India. Seeds (Dr Christison).

Natural Order—Gentianaceæ.

Gentian Family

Bitterness prevails in this order.

Ophelia chirata, Griseb. Chirita or Chirayetta. India. Plant used as a tonic.

Gentiana lutea, L. Yellow Gentian. Europe. Root used as a tonic.