provide for systematic photography of native types, occupations and ceremonies.

Mr. R. A. S. Macalister gave an account of the customs, ceremonies and beliefs of the Fellahin of Western Palestine.

Mr. D. MacRitchie, under the title "Hints of Evolution in Tradition," discussed the value of the widespread stories of giants, dwarfs, fairies and hairy folk as evidence of the survival of primitive types of mankind in remote localities until comparatively recent times.

Mr. J. S. Stuart Glennie criticised Dr. Frazer's views of the relations between magic, religion and science, as expressed in the second edition of the "Golden Bough." The new stage which Dr. Frazer named "science" would give a higher and more verifiable form to the common ideal and social observances which constituted religion.

Archaeology.

Dr. W. Allen Sturge opened a discussion on the chronology of the Stone Age of man, with especial reference to his coexistence with an Ice Age, laying stress on the evidence of patination as a test of relative age, and exhibiting a series of implements which appeared to show traces of reworking after a prolonged interval, and also scratches on a patinated surface, which he claimed to be due to ice-movement. In discussion, Sir John Evans pointed out that patination is not always a safe guide as to relative age; and Prof. Kendal and others held that scratches similar to those exhibited are produced by small local movements in the mass of a gravel-bed.

Mr. Coffey attacked the same question from another side by an exhibit of naturally chipped flints from the Larne gravels and North Irish beaches, which so closely resembled the chipping of the alleged "Eolithic" implements as to prevent any certain conclusion being reached as to what really is artificial chipping.

Miss Layard exhibited a flint palæolith with alleged "thong-marks," which seemed, however, to be patches of the rough skin of the nodule; and also a series of implements of stone and horn from the neighbourhood of Ipswich.

Mr. F. D. Longe exhibited a piece of yew from the forest bed near Kessingland, showing cuts made by a straight-edged instrument. Doubts were, however, expressed as to the antiquity of the cuts.

The Report on the age of stone circles gave full particulars of excavations conducted by the committee at Arbor Low. The occurrence of a Bronze Age interment-barrow *on* the rampart of the circle gave a downward limit of date for the latter, and the discovery of flint flakes and other objects *in situ* went far to determine an upward limit. Further investigation, however, is required, and the committee was reappointed with a grant of 30*l*.

An important paper on excavations on Neolithic sites in the Isle of Arran was contributed by Drs. Duncan and Bryce. The results show that the mere presence of stone implements affords no test of the archæological horizon, but that the pottery found in the "Megalithic cists serially arranged" distinguishes these as earlier than the short cists in cairns or circles, and as truly Neolithic. No traces of cremation were found; but only a few of the human remains were in a condition for examination. The cephalic indices of four individuals were 66·6, 70, 75, 75·5, and the anatomical characters were identical with those of the English "long-barrow" folk. The paper will be published in full in *Proc.* Soc. Antiq. Scot., and the anthropographic material in *Journ.* Anthr. Inst.

Dr. Munro gave an account of a "kitchen midden" excavated near Elie, in Fife, which was proved to occupy the site of a wooden house belonging to pastoral or hunting people, and to belong to the eighth century, A.D. (cf. *Proc.* Soc. Antiq. Scot. xxxiv.)

Mr. J. H. Cunningham described the excavation by the Scottish Society of Antiquaries of the Roman station at Ardoch in Perthshire; the results are published fully in *Proc.* Soc. Antiq. Scot., xxxii. Mr. Thomas Ross described the recent excavation of the Roman camp at Inchtuthill.

The Report of the Silchester Excavation Committee recorded the clearance of four fresh *insulae* (xxiii–xxvi) and the discovery of some interesting pavements, and of a large hoard of smith's tools. The Committee was reappointed with a grant of 5*l*. and a similar committee was granted to cooperate with the Cardiff Naturalists' Club in excavation at Gelligaer.

Mr. R. A. S. Macalister discussed the external evidence bearing on the age of Ogham writing in Ireland, pointing out that certain Ogham inscriptions occur in association with tumuli, circles, and alignments, on stones with non-Christian symbolism, or in other circumstances which suggest a pre-Christian origin for the Ogham script.

Mr. James Paton gave a demonstration of Scottish antiquities in the Art Gallery of the Glasgow Exhibition; an innovation which was fully justified by the result, and might be repeated elsewhere with advantage.

Mr. C. S. Myers described the bones of Hen Nekht, an Egyptian king of the third dynasty, who was of giant stature (1870 mm.), and identified him with the gigantic king recorded diversely by Manetho as penultimate king of the second dynasty, and by Eratosthenes as first king of the third.

The Report of the Cretan Exploration Committee summarised the results of excavation on Mycenæan sites at Knossos, Zakro and Præsos in the seasons 1900 and 1901. At Knossos the remains of a splendid palace have yielded a large number of fragmentary fresco paintings, many works of art in bronze, stone and pottery, and a great wealth of clay tablets inscribed in Ægean hieroglyphic and linear characters. The excavations at Knossos demand another season's work, and the Committee was reappointed, with a further grant of 100*l*.

Mr. A. J. Evans, F.R.S., supplemented the Report with a description of the Neolithic settlement which underlies the Mycenæan palace at Knossos, drawing particular attention to the stone mace heads and small human figures in clay and marble, which seemed to him to present Anatolian analogies, and to indicate intercommunication between the Ægean and Babylonia. The Neolithic culture of the Ægean presents points of strong contrast with that of the Bronze Age; and the absence as yet of spiraliform ornament confirms the opinion that this motive was introduced into the Ægean at a later date, and probably from Egypt.

Mr. Bosanquet gave a detailed account of the excavations on the site of Præsos, the ancient capital of eastern Crete. Two large sanctuaries were discovered, together with an "andreion" or public dining-hall, of Hellenistic date, and a remarkable inscription written in Greek characters of the fifth century, but composed in the Eteocretan language.

Mr. Hogarth contributed a description of a Mycenæan site excavated by him at Zakro on the east coast of Crete, with houses, tombs, much pottery of new types, and a deposit of clay impressions from Mycenæan seal-stones.

Mr. R. A. S. Macalister described the result of several seasons' excavation on small sites in western Palestine, which throw important light on the civilisation of the early Israelites and of Philistia.

Interim reports were received from the committees on anthropological photographs and on the present state of anthropological teaching. A new committee was appointed, with Prof. Macalister, F.R.S., as chairman, Mr. C. S. Myers as secretary, and a grant of 15*l*. to conduct anthropometric observations among the native troops of the Egyptian army.

BOTANY AT THE BRITISH ASSOCIATION.

AFTER the delivery of the presidential address by Prof. Bayley Balfour, F.R.S., Dr. Lotsy (Hilbersum, near Arnhem, Holland) explained to the Section the aims and proposals of the International Association of Botanists, which was founded at Geneva in August. The Association has purchased the *Botanisches Centralblatt*, which it proposes to conduct as a first-class review of current botanical literature. Dr. Lotsy pointed out that an increased number of subscribers and shareholders is desired in order to ensure success. On Saturday the members of the Section were invited by the President to the Edinburgh Royal Botanic Garden, where they inspected the museum and garden and were afterwards entertained at lunch by Prof. and Mrs. Bayley Balfour. The excellence of the museum preparations was a striking feature, particularly the specimens and dissections preserved in spirit and labelled for teaching purposes. A very useful paper was read before the Section by Mr. Tagg, in which he gave an account of the methods employed by him with conspicuous success in the Edinburgh Museum in preserving and preparing plants for museum purposes.

On Friday afternoon Prof. Reynolds Green, F.R.S., delivered a lecture on flesh-eating plants. Monday morning was devoted to a joint discussion (Botanical and Educational

Sections) on the teaching of botany, an account of which has appeared in the report of the work of the latter Section. Mr. A. G. Tansley described the vegetation of Mount Ophir and gave a lantern exhibition of several photographs which he had taken during a recent expedition to the Malay Peninsula. The views of dense masses of *Matonia pectinata*, *Dipteris conjugata* and *D. Lobbiana* growing in the Mount Ophir region were particularly striking as illustrating the present home of these isolated fern genera which played a prominent part in European vegetation during the Mesozoic epoch. Some excellent botanical photographs from the Malay Peninsula were also exhibited by Mr. Yapp, who acted for some months as botanist to the Skeat Expedition.

Thallophyta.—Cytology of the Cyanophyceæ, by Harold Wager. The researches of Scott, Zacharias, and others have definitely revealed the fact that the contents of the cells of the Cyanophyceæ are differentiated into two distinct portions, an outer peripheral layer in which the colouring matters are placed, and a central colourless portion which is usually spoken of as the "central body." The central body is regarded by many observers, and notably by Bütschli, as a true nucleus. According to the author's observations, it appears to resemble the nuclei of higher organisms, in that it is composed of a chromatic network, but it differs from them in the absence of a nuclear membrane and nucleolus. Staining and other reactions show that chromatin is present, but in most cases only in small quantities. The presence of phosphorus in the central body can also be demonstrated, as Macallum has shown, by means of the molybdate phenylhydrazine reaction. In the process of division the cell begins to divide and new cell-walls are formed independently of the division of the nucleus. In the process of nuclear division the chromatin threads become drawn out longitudinally and parallel to one another, and are then divided transversely. Some of the division stages, especially in elongate cells, resemble stages in true karyokinetic division.

The Bromes and their brown rust, by Prof. Marshall Ward, F.R.S. The author has been for some time occupied with the grasses of the genus *Bromus* and the behaviour of the *Uredo* of the brown rust (*Puccinia dispersa*) upon them. The plan of the investigation includes the nature of infection and conditions of attack, and all discoverable relations between host and parasite. The germination of the grass seeds has led to interesting points. They can be treated antiseptically in various ways and grown as pure cultures in nutritive solutions in glass tubes of various shapes, designed either to allow of the continuous aëration of the plantlet by a current of filtered air drawn through by aspirators, or not.

Such pure cultures of the grass were then infected with uredo-spores, and in ten to twelve days gave rise to *pure cultures of the Uredo*, which germinated and infected other similarly pure cultures of the grass inoculated with them.

Long series of sowings were made to test the conditions of germination of the uredo-spores. The minima and maxima temperatures of germination were found to be about 10° C. and 27°·5 C. respectively, the optimum being about 18° C. The effects of light, of other organisms (*e.g.* Algæ), of various extracts, and of the age of spores, &c., were also examined. Infection experiments on pot plants were made—several hundreds in all—on twenty-one species or varieties of *Bromus*.

The general results are, put very shortly, as follows:—Although the *Uredo* examined is in all morphological respects absolutely identical on all the species of *Bromus* on which it occurs, nevertheless if spores gathered from *B. sterilis* are sown on *B. mollis* the infection fails, whereas spores of the same batch sown on *B. sterilis* infect normally and rapidly. And similarly in other cases. Spores from *B. mollis* readily infect *B. mollis*, and (less certainly) its allies *B. secalinus* and *B. velutinus*, *B. arvensis* and others of the *Serrafalcus* group; but they fail on *B. maximus*, *B. tectorum*, *B. sterilis*, *B. madritensis*, &c.—the *Stenobromus* group—and so with other cases.

These observations lend no support to either the mycoplasm theory of Eriksson, or to any theory which attempts to explain outbreaks of rust to intra-seminal infection handed down from parent to offspring, and the author believes that the difficulties hitherto met with in understanding the sudden epidemics of these rust-diseases will disappear as we gain exact information of the conditions of germination, infection, and incubation of the disease-producing parasite; as also of its habits of lurking in the older leaves of the grass in spots where the production of a very few spores—quite invisible on a casual overhauling of the grass—prepares the way for more extensive infection as the weather changes.

Prof. Marshall Ward, F.R.S., communicated a paper by Mr. T. Barker on spore-formation in yeasts, also an account, by Mr. Howard, of a *Diplodia* parasitic on cacao and on the sugar-cane.

Pteridophyta.—Contributions to our knowledge of the gametophyte in the Ophioglossales and Lycopodiales, by William H. Lang. (1) The prothalli of *Ophioglossum pendulum* and *Helminthostachys zeylanica*. The wholly saprophytic prothallus of *O. pendulum* is at first button-shaped, but by branching the older prothalli come to consist of a number of short cylindrical branches radiating into the humus. The young prothallus and the branches are radially symmetrical. In the older parts all the cells except the superficial layers contain an endophytic fungus. The prothallus is monœcious. The antheridia are sunken, with a slightly convex outer wall one layer of cells thick; in surface view this shows a triangular opercular cell. The neck of the archegonium, which projects very slightly, consists of about sixteen cells in four rows. The central series in all archegonia yet observed consists of an ovum and a single canal cell. A basal cell is present. The prothalli of *Helminthostachys* were found a few inches below the surface of the soil in a frequently flooded jungle in Ceylon. The prothalli are radially symmetrical. The smallest were stout cylindrical structures the lower part of which was darker in tint and bore rhizoids; the upper bore the sexual organs, which arise acropetally behind the conical apical region. In prothalli which bear archegonia the vegetative region is relatively more developed, and in both these and the male prothalli it becomes more or less lobed. The antheridia are large and sunken; the slightly convex outer wall is two-layered except at the places where dehiscence may occur, which consist of single large cells. The archegonia have a neck, consisting of four rows of cells, which projects considerably.

(2) On the mode of occurrence of the prothallus of *Lycopodium selago* at Clova. The sporophyte of this plant is very common on moors, screes and crags in the Clova valley, and in these situations it seems to be reproduced almost entirely by means of bulbils. On the sometimes submerged margin of Loch Brandy, however, numerous sexually produced plants and prothalli may be found growing in the soil between the stones. The difference in the conditions under which the sporophyte can exist and those necessary for the successful germination of the spores is analogous to what has been found to be the case for *Helminthostachys*.

(3) On some large prothalli of *Lycopodium cernuum*. The prothalli of this plant, described by Treub, were of small size, one of the largest measuring 2 mm. in height by 1 mm. across. On the banks of roads close to Kuala Lumpur much larger prothalli were found. They were cake-like structures, of a deep velvety green colour, about 2 mm. in vertical thickness, but measuring sometimes 6 mm. across: they were attached to the soil by numerous rhizoids springing from the flat base.

(4) On the prothallus of *Psilotum*. The prothallus of this plant was searched for without success in Ceylon. The sporophyte occurred on tree-fern trunks on Maxwell's Hill in Perak, and a single prothallus was found there embedded among the roots of a tree-fern close to a *Psilotum* plant. No other plants grew on this tree-fern, and, although a few species of *Lycopodium* occur sparingly in the locality, there seems a strong probability in favour of this specimen being the prothallus of *Psilotum*. The specimen measured one quarter of an inch in height by $\frac{3}{16}$ inch across at the widest part. It consists of a cylindrical lower region covered with rhizoids; near the lower end of this is a well-marked conical projection (primary tubercle). The upper part widens out suddenly, and its thick overhanging margin bears numerous antheridia. In general form the prothallus resembles some small specimens of *Lycopodium cernuum*, but the upper region, from which assimilating lobes are absent, finds its closest analogue in prothalli of *L. clavatum*.

Some observations upon the vascular anatomy of the Cyatheaceæ, by D. T. Gwynne-Vaughan. In a number of Dicksonias with creeping or prostrate stems the vascular system is solenostelic, the leaf-traces departing as a single strand curved into the form of a horse-shoe, with its concavity facing towards the median line of the rhizome—*Dicksonia adiantoides*, *cicutaria*, *davallioides*, *apiifolia*, and *punctiloba*. In *Dicksonia rubiginosa* the vascular ring is interrupted by gaps other than those due to the leaf-traces, and it may therefore be termed polystelic. In

addition, there are two or three small accessory steles lying within the vascular ring. Throughout the internode the course of these internal steles is quite free from the vascular ring, but at each node one of them approaches the free margin of the leaf-gap, and completely fuses with it, separating off again after the leaf-gap has become filled up. *Pteris elata* var. *Karsteniana* has a typically solenostelic vascular ring, and also possesses internal accessory steles, which behave like those of *Dicksonia rubiginosa*, but they are relatively larger, and frequently they all fuse up together so as to form a second, inner, completely closed vascular ring. It is suggested that the several internal steles and vascular rings that occur in the Saccolomas and in *Matonia pectinata* are also of the same origin and nature as those described by the author.

Prof. Bower, F.R.S., exhibited a specimen of *Ophioglossum simplex*, n. sp., collected by Mr. Ridley in Sumatra. It appears to be entirely without the sterile leaf-lobe, though the fertile spike is characteristically that of an *Ophioglossum*. If it be actually demonstrated that the sterile lobe is really absent, this peculiar plant may give rise to considerable morphological discussion.

The anatomy of *Ceratopteris thalictroides*, by Sibille O. Ford. *Ceratopteris thalictroides* is the single member of the Parkeriaceæ. It is an annual aquatic fern which occurs in the tropics, either rooted in the mud or floating freely. The stem is much reduced; sterile as well as fertile leaves are found, both kinds bearing numerous vegetative buds. The sporangia are scattered on the under side of the fertile leaves, and have no true indusium. The roots in the mature plant arise from the bases of the petioles. An account was given of the anatomy of the leaves, roots and polystelic stem. The apex of the stem was described as having the form of a cone terminating in a three-sided cell. Miss Ford spoke of *Ceratopteris* as possessing more strongly marked affinities with the Polypodiaceæ than with any other of the leptosporangiate ferns, and as possibly intermediate in position between the Marsiliaceæ and Polypodiaceæ.

On two Malayan "myrmecophilous" ferns, by R. H. Yapp. *Polypodium* (*Lecanopteris*) *carnosum* and *Polypodium sinuosum* are two epiphytic ferns, which occur almost exclusively in the Malay Peninsula and Archipelago. Their creeping rhizomes are thick and fleshy, the ventral surface closely adhering to the substratum, the dorsal bearing the leaves, which are articulated upon large conical leaf-cushions. Branching is lateral, and is so frequent in the case of *Polypodium carnosum* that thick compact masses of interlacing stems are formed, which completely encircle the branches of the trees on which the fern grows. The fleshy stems of both ferns are traversed by an extensive system of hollow spaces, which are invariably inhabited by colonies of ants. These "ant-galleries" are arranged on a perfectly definite plan, the details of which differs to some extent in the two ferns. In both cases there is a single main ventral gallery, which runs in a longitudinal direction through the stem, giving off a lateral gallery to each branch and a dorsal one to each leaf-cushion. The galleries are formed by the breaking down of a large-celled, thin-walled tissue, which in the youngest parts of the stem appears to function as a water-reservoir. Though undoubtedly closely allied species, these ferns have been placed by many authorities in different genera.

Mr. George Brebner gave an account of the anatomy of *Danaea* and other Marattiaceæ. In *Danaea simplicifolia* the primary vascular axis is a simple concentric stele. The pericycle may be absent or only imperfectly represented. There is a definite endodermis, but it is not clear that the constituent cells are always the innermost ones of the extrastelar tissue. When the cotyledon-trace is about to be given off, the xylem of this vascular axis, or "protostele," is separated into more or less unequal portions by a layer of parenchyma. The parenchyma increases in amount, and ultimately the cotyledon-trace is separated from the central stele. The cotyledon-trace is collateral. The next few leaf-traces are given off in the same manner, and are also collateral. The stele resumes its simple "protostelic" appearance. As further leaf-traces depart from, and root-traces join, the vascular axis, the primitive structure is gradually modified, and it may become more or less crescentic, forming an incomplete, or even complete, gamostelic ring. The spaces left by the departure of the leaf-traces now constitute leaf-gaps. The vascular tissue of this stage may be described as a "siphonostele with leaf-gaps." In describing the stele of the Marattiaceæ, the author confirmed and extended Miss Shove's statement (*Annals Bot.*, 1900) as to the internal position of the protophloem.

On the anatomy of *Todea*, with an account of the geological history of the Osmundaceæ, by A. C. Seward, F.R.S., and Miss S. O. Ford. In this paper the authors dealt with the anatomy of the stem of *Todea barbara*, which in the main agrees with that of *Osmunda regalis*, as described by Zanetti (*Bot. Zeitung*, 1895). The paper included an account of the origin of the leaf-traces, the anatomy of the "seedling" plants and a summary of the geological history of the Osmundaceæ.

Remarks upon the nature of the stele of *Equisetum*, by J. T. Gwynne-Vaughan. The vascular bundles of *Equisetum* are usually compared with those of a monostelic phanerogam, both in structural detail and with regard to their course into the leaf. Observations made upon the stems of *E. Telmateja*, &c., show that this comparison cannot be satisfactorily maintained.

The xylem of the so-called vascular bundle of *Equisetum* was described as consisting of three strands, two of which are lateral and cauline, while the median, or carinal, strand is common to both stem and leaf. The fact that only a small portion passes out as a leaf-trace, and not the bundle as a whole, constitutes an essential point of difference between it and the bundle of a phanerogam. Potonié has established a comparison between the secondary vascular tissues of the *Calamariae* and the *Sphenophyllaceae* by mentally doing away with the central mass of primary xylem that exists in the latter. By inverting this procedure, and considering it possible that the ancestors of the equisetums may have possessed a xylem that extended to the centre of the stem, one is led to derive their structure, as it exists at present, from the modification of a stele with a solid central mass of centripetal xylem, such as that of *Sphenophyllum*, or of certain Lepidodendreæ.

It is suggested that the lateral xylem strands in the vascular bundles of the existing equisetums may perhaps be taken to represent the last remnants of a primitive central mass, and that this would be entirely in agreement with their apparently centripetal development, and in particular with their cauline course.

Fossil Plants, &c.—On a primitive type of structure in Calamites, by D. H. Scott, F.R.S. Palæontological research has afforded evidence that the horsetails and lycopods had a common origin. The class sphenophyllales, restricted, so far as we know, to the Palæozoic epoch, combines in an unmistakable manner the characters of equisetales and lycopodiales, while at the same time presenting peculiar features of its own.

The synthetic nature of the sphenophyllales, indicated clearly enough in the type-genus *Sphenophyllum* itself, comes out still more obviously in the new genus *Cheirostrobus*. So far nothing has been found to bridge the gulf which separates the anatomy of the Calamarieæ (Palæozoic equisetales) from that of the sphenophyllales or the lycopods.

Dr. D. H. Scott gave an account of a calamite from the Calciferous Sandstone of Burntisland, in which each vascular bundle is characterised by the possession of a distinct arc of centripetal wood on the side towards the pith. The carinal canals are present, as in an ordinary calamite, and contain, as usual, the remains of the disorganised protoxylem. They do not, however, as in other equisetales, form the inner limit of the wood, but xylem of a considerable thickness, and consisting of typical tracheides, extends into the pith on the inner side of the canal, which is thus completely enclosed by the wood. That the organ was a stem, and not a root, is proved, not only by the presence of the carinal canals, but by the occurrence of nodes, at which the outgoing leaf-traces are clearly seen. This appears to be the first case of centripetal wood observed in a calamarian stem, and thus serves to furnish a new link between the Palæozoic equisetales and the sphenophyllales, and through them with the lycopods.

Provisionally, the new stem may bear the name of *Calamites pettycurensis*, from the locality where it occurs.

In a paper on the past history of the Yew in Great Britain and Ireland, Prof. Conwentz (Danzig) gave an account of his researches into the causes of the disappearance of this species from nearly all parts of middle and northern Europe. He expressed the view that the genus *Taxus*, which has now passed its zenith, is of no great geological antiquity; most of the Tertiary fossils described as species of yew were found to have been incorrectly determined. Prof. Conwentz dealt with a mass of evidence which he had examined, proving that the yew had been formerly widely distributed in regions where it has ceased to exist. The

evidence was derived from the microscopical examination of subfossil wood, the occurrence of prehistoric and historic antiquities preserved in the British Museum, in the Science and Arts Museum in Dublin and elsewhere, and from the abundance of place-names in England, Scotland and Ireland which owed their origin to the former existence of yew trees.

On the distribution of certain forest trees in Scotland, as shown by the investigation of post-glacial deposits, by W. N. Niven. The author gave a summary of facts obtained from various topographical books and other sources concerning the distribution of the following trees:—Hawthorn, elder, common ash, birch, alder, hazel, oak, willow, yew and fir, all of which, with the exception of the ash, are considered natives of Scotland. The cones of the silver fir have been dug out of the peat in Orkney, but this tree is not now indigenous to Scotland. Several shrubs, including the juniper and raspberry, as well as many flowering plants, have also been discovered. Mr. Niven pointed out that there are few parts of Scotland, however treeless at the present day, that were not in remote, and even in comparatively recent, times covered with woodlands. This is also shown by the place-names.

The evidence, which is obtained by the examination of the various post-glacial deposits, indicates in a very clear manner that the trees recorded should be considered truly indigenous to Scotland.

Prof. Potonié, of Berlin, read a paper on "Die Silur- und Culm-Flora des Harzes." On certain points in the structure of the seeds *Aethiotesta*, Brongn. and *Stephanospermum*, Brongn., by Prof. F. W. Oliver. The author gave some account of the anatomy of the fossil gymnosperm seed named by Brongniart *Stephanospermum akenioides*, and of another seed nearly allied to the foregoing which he provisionally recognised as *Aethiotesta subglobosa*, Brongn. Attention was drawn to the mantle of tracheal tissue which invests the nucellus in both cases. The possible physiological significance of this tissue was considered, and some suggestions were offered as to the conditions which led to the evolution of the seed in this group. The author expressed the opinion that there was considerable probability that the seed habit was at its origin a xerophilous adaptation.

The structure and origin of jet, by A. C. Seward, F.R.S. The author has recently examined several sections of Yorkshire jet in the British Museum, which he believes demonstrate the origin of this substance from the alteration of coniferous wood and, in part at least, of wood of the Araucarian type. Sections cut from specimens, which consist in part of petrified wood and in part of jet, enable us to trace a gradual passage from well preserved Araucarian wood to pure jet, which affords little or no evidence of its ligneous origin. The conclusion arrived at is that the Whitby jet owes its origin to the alteration of coniferous wood. The fact that jet frequently occurs in the form of flattened blocks of wood in all probability admits of the natural explanation that the jet has been derived from the wood, the form of which it has assumed, and not that the jet was formed elsewhere and permeated the tissues of the wood as a fluid bitumen.

Mr. E. A. N. Arber described a number of specimens contained in the Clarke collection of fossil plants from New South Wales. The collection, which is now in the Geological Museum, Cambridge, is noteworthy as being one of the earliest (1839–44) obtained from the continent of Australia.

A chapter of plant evolution, by A. C. Seward, F.R.S. The author described the chief features in the floras ranging from the Rhætic to the Wealden; he drew attention to the dominant types which characterised this long succession of stages in the earth's history and discussed the progress of plant-evolution from the close of the Triassic period to the appearance of angiosperms in rocks of Lower Cretaceous age.

Morphology.—Cuticular structure of *Euphorbia Abdelkuri*, by Prof. Bayley Balfour, F.R.S. *Euphorbia Abdelkuri* is an interesting succulent plant which has been brought home from a small island in the vicinity of Sokotra by the Ogilvie-Forbes Expedition. The outer surface of the plant in the fresh condition appears to be covered with a crust which readily cracks off, and on examination this is found to consist of a number of prisms. At first sight these may be taken for some form of mineral incrustation, but they are not of this nature, being formed by the cuticle of the epidermal cells. This does not form an uninterrupted layer over the epidermis, but the cuticle of each cell is separable from that of the adjacent ones, and the prisms are merely blocks of cuticle, each one belonging to a single cell. This is a construction different from that which is ordinarily met with in plants with a thick cuticular layer.

Miss A. M. Clark described abnormal secondary thickening in *Kendrickia Walkeri*, a tropical epiphytic climbing shrub. The anatomy of the young stem is typical of the family Melastomaceæ. At an early stage numerous small patches and several large wedge-shaped areas of thin-walled unlignified wood-parenchyma are cut off from the inner side of the completely circular cambium ring. Tylosis is of frequent occurrence, and the tylosed cells may develop into sclerotic cells inside the vessels and racheids. At a later stage, the unlignified wood-parenchyma cells at the central margin of the wedge area take upon themselves new growth accompanied by cell-division. The product of this new growth proceeds to split the axial woody ring into a number of portions, with subsequent destruction of the identity of the wood elements. Later, the quiescent cambium lying between the original internal phloëm and the axial woody ring takes upon itself new growth, and proceeds to lay down xylem on the one side and phloëm on the other.

The histology of the sieve tubes of *Pinus*, by A. W. Hill.—The author's researches have proved that the results obtained by Russow are, in the main, correct; the mature sieve-plate is traversed by groups of callus rods, which are interrupted at the middle lamella by median nodules, and each callus rod contains from three to seven striæ—or spots if examined in surface-view—which are strings of slime. The youngest sieve-plates or pit-closing membranes, which could be examined, showed "connecting threads" like those in ordinary tissue; but in the so-called "boundary cells"—*i.e.* the youngest thick-walled sieve-tubes—a change takes place, namely, the appearance of the callus. Callus first appears on one surface of the sieve-plate, at the places where the groups of "connecting threads" occur, and it gradually spreads as a rod along a group of the threads to the middle lamella; a similar change then takes place on the other side of the lamella. The lamella itself, however, is not converted into callus, but a refractive median nodule appears separating the two portions of the callus rod. Accompanying this change the protoplasmic threads become converted into slime strings. The changes described were considered by the author to be due to the action of ferments.

Dr. Lotsy dealt with examples of heterogenesis in conifers. The expressions heterogenesis (Korschinsky, "Flora," 1901), mutation and spontaneous variation have practically the same meaning, and are applied to phenomena which illustrate one method by which new species may be formed. The author exhibited a specimen of *Capsella Heegeri*, given to him by Count Solms-Laubach, who recently described this species as a new form which appeared to have arisen suddenly from *Capsella bursa pastoris* (*Bot. Zeitung*, 1900). Reference was made to Hugo de Vries' important publication ("Mutationstheorie") in which several new species are described as having been formed as the result of sudden variations, which were manifested during certain periods of spontaneous variation. Dr. Lotsy drew attention to two genera of conifers—*Cupressus* and *Thuya*—which he described as passing through a period of spontaneous variation. Among a large number of seedlings of *Cupressus Lawsoniana* two plants were raised which exhibited marked differences—*C. Lawsoniana Wisseti* and *C. Lawsoniana lycopodioides*, forms which would undoubtedly be described as new species if their common origin were not known. *Thuya occidentalis Spaethi* was also described as a new form which had been produced as the result of sudden variation.

Mr. John Paterson read a paper in which he dealt with the biology and anatomy of *Stellaria holostea* and allied species. He gave a brief comparative account of the anatomical structure in *Stellaria graminea*, *S. media*, *S. glauca* and other Caryophyllaceæ.

Mr. W. C. Worsdell submitted a paper on the morphology of the ovule; an historical sketch. The same author communicated a note on the morphology of the "flowers" of *Cephalotaxus*, containing an account of original observations on proliferated inflorescences and flowers, which afforded evidence in support of the foliolar theory of the ovule as put forward by Celakovsky.

Physiology, &c.—Prof. Kny (Berlin) read a paper on Correlation in the growth of roots and shoots, in which he dealt with certain criticisms directed by Heering (*Pringsheim's Jahrb.*, 1896) against a communication on the same subject published by the author in 1894 (*Annals Bot.*). In the first paper the final results, and not a detailed account of the experiments, were published. Prof. Kny stated that his recent experiments had shown

that in cuttings of *Ampelopsis quinquefolia*, as in those of certain species of *Salix*, the continual removal of the young shoots was soon followed by a less vigorous development of roots, and *vice versâ*. In *Salix* the retarding influence is first apparent in the roots, while in *Ampelopsis* the shoots were found to be the more sensitive.

Dr. F. F. Blackman and Miss Matthaei contributed a paper on natural surgery in leaves (*Annals Bot.*, 1901). If patches of leaf-tissue be killed in any way, the leaf reacts by forming an "absciss"-line round the injured spots at a little distance off in the healthy tissue. Separation soon takes place at this "absciss" line, so that the dead tissue which might be a source of danger is cut right round and drops out of the leaf. The same authors gave a paper on the relation between CO_2 production and vitality. This communication chiefly dealt with the effect of loss of water upon the CO_2-production in leaves. Even a small loss of water causes a very marked increase of the CO_2, and this effect continues until the water is restored

On the absorption of ammonia from polluted sea-water by *Ulva latissima*, by Prof. Letts and John Hawthorne. In a previous research (*Proc.* Roy. Soc. Edin. 1901) it was shown that the occurrence of this sea-weed in quantity in a given locality is associated with the pollution of the sea-water by sewage, the evidence being of three kinds: (1) The high proportion of nitrogen contained in the tissues of the *Ulva*; (2) an examination of certain localities in which the sea-weed occurs in abundance, and of others from which it is virtually absent; and (3) experiments on the assimilation of nitrogenous compounds by the growing *Ulva* from sea-water artificially polluted.

The following conclusions were drawn from recent experiments:—(1) The absorption of ammonia by the sea-weed is very rapid, and with the mixtures used practically all the ammonia was absorbed in five hours (with one exception, when 75 per cent. was lost). (2) The amount absorbed is greatest during the first hour of contact, and then rapidly falls off. (3) Although the concentration of the ammonia exercises some effect on the proportion absorbed, it is by no means so considerable as might have been expected. (4) The sea-weed absorbs ammonia both in daylight and in darkness, but the proportion in the latter case is rather less than in the former. (5) The effects of an increased area of the sea-weed on the proportion of ammonia absorbed are not so great as might have been expected. These results may be of practical importance in those districts where a serious nuisance results from the decay of large quantities of the *Ulva*, which have been washed ashore, or have accumulated in shallow water.

The diameter increment of trees, by A. W. Borthwick. There are two methods by which the rate of growth in thickness or diameter increment of trees can be ascertained. One of these methods is to measure annually or at certain intervals the diameter or circumference by means of tree callipers or a tape. The only other method of investigating the diameter increment on standing trees is by means of a very useful instrument known as Pressler's increment-borer. Mr. Borthwick stated that through the kindness of Prof. Bayley Balfour he had recently had the opportunity of testing whether the increment-borer would yield the same results as those furnished by the tape. A comparison of results showed a close agreement between the two methods.

Dr. R. J. Anderson described an apparatus for studying the rate of flow of solutions in plant stems, and gave a preliminary account of experiments on which he is at present engaged.

On the strength and resistance to pressure of certain seeds and fruits, by Prof. G. F. Scott Elliot. The author described experiments which he had made in order to determine the amount of weight which seeds can endure without breaking. The experiments were generally conducted by means of a spring balance weighing up to 50 lbs.; seeds and fruits which withstood a pressure of 50 lbs. were tested with a Wicksteed's single-lever vertical testing machine. The paper dealt also with the relation between the resisting power and the shape and structure of seeds. Attention was called to various peculiarities of fruits and seeds which serve as important aids to their resisting power.

Forestry.—Mr. Samuel Margerison communicated a paper on the transport of British timber. He drew attention to the fact that imported fir sold at a less price than that at which British fir can be delivered, and urged the desirability of bearing in mind the question of transport in the scientific development of our forests.

Mr. G. P. Hughes gave an account of Government plantings in the Isle of Man.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. David B. Monro, Provost of Oriel, succeeds the Rev. Dr. Fowler, President of Corpus Christi College, as Vice-Chancellor.

CAMBRIDGE.—The moderators for the mathematical tripos, 1902, are Mr. W. Burnside, F.R.S., Pembroke, and Mr. J. Greaves, Christ's. The examiners are Mr. J. G. Leathem, St. John's, and Mr. J. H. Grace, Peterhouse.

The outgoing Vice-Chancellor, Mr. Chawner, Master of Emmanuel College, in his valedictory address, stated that the amount received for the Benefaction Fund was more than 66,000*l.* This, though it falls short of what is required even for the pressing needs of the University, has made it possible to enter into contracts for the Botany School, and a substantial portion of the Medical School buildings. Dr. Lawrence Humphry has been appointed assessor to the regius professor of physic, and Sir R. S. Ball an elector to the Isaac Newton scholarships. Prof. W. R. Sorley has been elected to a professorial fellowship at King's College. Prof. Somerville has informed the Vice-Chancellor that, having accepted a post in His Majesty's Board of Agriculture, he will resign the chair of agriculture at the end of the present term. Mr. K. Lucas, of Trinity College, has been nominated to occupy the University table in the Marine Biological Laboratory at Plymouth. Mr. J. H. Jeans, second wrangler 1898, Smith's prizeman 1901, and Mr. H. A. Wilson, research student in physics 1899, have been elected to fellowships at Trinity College.

IN delivering the opening address of the winter session of St. Andrews University last week, Principal Donaldson spoke on the subject of Mr. Carnegie's recent gift and the relation of the universities to the trade and commerce of the country. With reference to the first part of his subject Principal Donaldson said that the gift of Mr. Carnegie rendered it possible for every Scotsman to obtain a university education if he was capable of it; its second purpose was to increase the usefulness and influence of the Scottish universities by furnishing them with lectureships, laboratories, scholarships of research, and every form of equipment that could enable them to do their work most effectively. It was impossible to estimate the value of this part of the gift, of the possibilities which it created, and of the good that it would do to the whole community. It would bring all the various departments of study up to a high level, and especially it would promote in the highest degree original inquiry and investigation. For want of means they had fallen behind in this department, but the difficulties were now removed. Every student who had the ability to conduct original research would have his opportunity, and they might expect Scotland to take a foremost place in those scientific discoveries and inventions which were the prominent feature of our age.

SPEAKING on Saturday last to the Medical Faculty of University College, Liverpool, Prof. Oliver Lodge, F.R.S., Principal of Birmingham University, said a year ago he did not expect to find the full University ideal so prominently to the front; but any hesitation that might have been felt at urging it too hastily or inopportunely had been removed by the resolution of their council—their college council and likewise their city council—that a University for Liverpool was a necessity, and that any step towards furthering of that object would be welcome. The multiplication of municipalities, said Dr. Lodge, was wholly good. Why should the multiplication of Universities be considered bad? Let every city become a University when it was worthy, but it must make itself worthy first. Proceeding, he said that one of the functions of a University was the increase or improvement of knowledge, what was called "research." The ancient formula of the Royal Society stated that it existed "for the improvement of natural knowledge." He commended to their notice this word "improvement." Their primary aim should be improvement. The guardians of knowledge must be improvers of it, else it began to decay and to be lost. A University was the corporate repository of learning, not of ancient learning only, but of modern learning too; the most recently discovered fact of science there found its natural guardians, and there it was that new facts should be born. He commended this notion of "improvement of knowledge" to students, to every class of student. An atmosphere of constant effort towards the