

complete day technological courses in the whole of the United Kingdom. If only day students of technology more than eighteen years of age are considered, there are less in our country than in any large technical institution in Germany or America, as indicated in Fig. 2. With facts like these to consider, the future of our country cannot be contemplated without misgiving. When will our political leaders take up the subject of secondary and technical education seriously, and insist upon proper provision being made for it by greatly increased funds from national and local sources? The apathy displayed in regard to technical training by both employers and employed is largely due to the drifting policy of the Government and the sacrifice of future interests to present expediency.

### SOCIETIES AND ACADEMIES.

LONDON.

**Royal Society**, December 5, 1901.—“Preliminary Account of the Prothallium of *Phylloglossum*.” By A. P. W. Thomas, M.A., F.L.S., University College, Auckland, N.Z. Communicated by Prof. G. B. Howes, F.R.S.

The sporophyte generation of *P. Drummondii* is a small plant, growing from a tuber, which forms a tuft of a few cylindrical tapering leaves. The tuber is apparently comparable to the protocorm of *Lycopodium cernuum*, except that it is repeated annually on the formation of a new protocorm. The prothallia have been obtained amongst the parent plants, and very special conditions, which are not of regular annual occurrence, are necessary for germination of the spores, the most important being the presence of a fungus with which the prothallium lives symbiotically, like that of the Lycopods. One of the simplest prothallia observed consisted of an oval tuber below, with a simple cylindrical shaft with rounded apex, akin to that of the oldest prothallium of *L. cernuum* described by Treub. In older prothallia the crown is commonly separated by a slight constriction from the much enlarged body, which bears the embryo on one side. Below this swollen part the body contracts to a cylindrical shaft, which passes downwards and swells out again to terminate in the primary tubercle, from which more especially rhizoids are produced.

The prothallia are monœcious, and the archegonial necks, which vary from two to twenty in number, are a conspicuous feature of the crown. The oosphere lies at a little depth below the surface layer, and the antheridia are sunk in the crown, with their enclosed cavities elongated at right-angles to the surface. The sex-organs would seem to resemble those of *L. cernuum* more closely than those of any other species of *Lycopodium*.

Studied by means of microtomic sections, the development appears to be also much like that of *L. cernuum*. The embryo grows obliquely downwards and outwards, the part near the archegonial venter is the foot, and at the opposite end are the stem-apex and leaf, the tip of the leaf being the first part of the embryo to appear outside the prothallium. Immediately on escaping from the prothallium the embryo forms a protocorm, apparently in the same manner that the adult plant forms its annual tuber. The pedicel of the tuber elongates downwards until the latter is placed at a safe depth. In the meantime the leaf grows up, and although no root-formation has been observed during the first year, rhizoids may be developed on the pedicel and protocorm. The leaf becomes green even before it escapes from the prothallium, and as soon as it reaches a little above the soil stomata are formed, and a slender strand of tracheids in the centre. The first protophyll has the structure of a small leaf as produced in later years, and the later development of the sporophyte appears to be slow, the plant coming up in many cases a second and a third year with only a single leaf. A young prothallium was found quite colourless, except for a yellow tinge at the upper end, while two others still without sex-organs bore but scanty chloroplasts. But never was there a fully developed prothallium which was not green above. The prothallium is distinctly of Lycopod type, on the whole most nearly resembling that of *L. cernuum*, except that it lacks the leaf-like assimilatory lobes of this, and the simplicity of structure favours the view that *Phylloglossum* is a primitive form of Lycopod. It is recognised as a permanently embryonic form, but the simplicity of structure of the mature saprophyte does not necessarily prove it to be a primitive form of the Lycopodiaceous phylum.

Branching occurs in two ways. The spike or strobilus occasionally branches, and the branching always takes place above the lowest sporophyll, sometimes at the base of the spike or even near the apex of the strobilus. Even when the strobilus forks there is no transition of form between sporophyll and protophyll, and such leaves as have been observed on the peduncle some distance below the rest of the strobilus have always been of sporophyll type. Twenty was the largest number of protophylls found on a plant, but there is never a transition between protophylls and sporophylls. The view is entertained that the former may have arisen from the differentiation of the lower region of a sporogonium or its homologue, in which this region had acquired sterilised tissues, and that the sporophylls arose from the upper fertile region of the sporogonium. There appears to be no connection between the number of protophylls and reproduction by spores. The formation of two new tubers is common, and these may be found on opposite sides of the plant in a manner favourable to dispersion.

*Phylloglossum* is not semi-aquatic. It may grow upon a hill-top and as well upon a slope, and it was never found in actual swamp. There is little evidence that it owes its simplicity to reduction, and it is regarded as possibly the most primitive of existing Pteridophytes, while the simple character of the gametophyte and comparison of the mature sporophyte with the embryo of *Lycopodium cernuum* favour the view that it is the most primitive of existing Lycopodinae.

The author has finished and despatched to London an elaborate and fully illustrated memoir upon this most important organism.

December 12, 1901.—“Contributions to the Chemistry of Chlorophyll. No VIII. Changes undergone by Chlorophyll in passing through the Bodies of Animals.” By Edward Schunck, F.R.S.

The conclusions to which the experiments described lead are summarised as follows:—

(1) The fæces of animals supplied with green vegetable food only—such at least as have so far been examined—contain no chlorophyll, but in its place substances which must be supposed to be derivatives of chlorophyll, formed partly by the action of acids on the chlorophyll of the food, partly by some agency to which the latter is subjected in its passage through the body.

(2) Of these substances, one seems to be identical with phylloxanthin, a well-known product of decomposition of chlorophyll. Another is a substance of well-marked properties, nearly resembling, but not identical with, phyllocyanin. It has not, so far as the author's experience goes, been hitherto observed as a result of any process of decomposition to which chlorophyll has been subjected outside the animal body. He considers it as a body *sui generis*, characterised by its fine purplish-blue colour and its brilliant metallic lustre. The existence of other products in addition to these two is possible. On one occasion, indeed, a definite crystalline substance was obtained, which seemed to be peculiar, but that it was in any way connected with chlorophyll could not with certainty be maintained.

**Royal Astronomical Society**, December 13, 1901.—Dr. J. W. L. Glaisher, president, in the chair.—The secretary read a paper, by Prof. S. C. Chandler, on Sir G. Airy's reflex zenith tube. The history of this instrument had passed through various phases—in the beginning of great hopes, later of grievous perplexity, and finally of severe disappointment. All attempts to obtain parallax or the constant of aberration produced quite discordant results, and the observations had at last been practically abandoned. But Dr. Chandler now showed that these anomalous results were due to the relative motions of the earth's axes of rotation and figure discovered by him some ten years ago, and that the zenith-tube observations, so far from being useless, had provided us with an invaluable record of these phenomena. An analytical proof of these statements was given in the paper.—Prof. R. A. Sampson gave an account of the original MSS. of the late J. C. Adams on the perturbations of Uranus between the dates 1841 and 1846. It was shown that Adams made no less than six different solutions of the problem in this period, and that the first, completed in 1843, was much more complete than had been supposed.—Prof. Turner read a paper on a simple method of accurate surveying with an ordinary camera, in which he showed that results of great accuracy could be rapidly obtained by the photographic method.—Mr. Hinks gave a paper on the accuracy of measures on photographs,

especially in reference to recent papers on the subject by M. Lœwy and Mr. H. C. Plummer.—Other papers were taken as read.

**Zoological Society, December 17, 1901.**—Prof. G. B. Howes, F.R.S., vice-president, in the chair.—A communication was read from Mr. G. Metcalfe, M.A., of New South Wales, concerning the reproduction of the duckbill (*Ornithorhynchus anatinus*). The author stated that he was of opinion, after many years' observation of the animal, that the duckbill was viviparous and that the young were not, as was generally supposed, hatched from the eggs after they had been deposited.—Dr. C. I. Forsyth Major exhibited the skull of a fossil aquatic musteline animal, *Enhydrictis galictodes*, gen. et sp. nov., from the Pleistocene ossiferous breccia of the island of Sardinia, which he stated had affinities with both the neotropical Galictis and with the genus Trochictis from the Middle Miocene of European deposits.—Mr. J. S. Budgett read a paper (illustrated with lantern slides) on the structure of the larval Polypterus. His observations confirmed the belief that the Crossopterygians were a very generalised group of vertebrata, and he concluded that the particulars of structure in which other more recent groups agreed with these ancient types were probably of a primitive rather than of a secondary nature.—Mr. L. A. Borradaile read a paper on the spawn and young of a polychæte worm of the genus Marphysa from Ceylon, allied to, or identical with, *Marphysateretiuscula*, Schmarda.—Dr. P. Chalmers Mitchell read a paper on the anatomy of gruiform birds, with special reference to the correlation of anatomical characters. The communication was based on dissections of birds belonging to the Rallidæ, Gruinæ, Araminæ, Psophiinæ, Dicholophidæ, Otididæ, Rhinocetidæ, Eurypygidæ and Heliornithidæ, the material consisting chiefly of birds that had lived in the Society's gardens.—Prof. F. G. Parsons read the first portion of a paper, prepared by himself and Prof. B. C. A. Windle, F.R.S., on the muscles of the Ungulata. This part dealt with the muscles of the head, neck and fore-limbs of these mammals.—Mr. F. E. Beddard, F.R.S., gave an account of the minute structures in the spermatophores of the earthworms of the genus Benhamia.—Mr. G. A. Boulenger, F.R.S., read some further notes on the African batrachians which he had recently described under the names *Trichobatrachus robustus* and *Gampsosteonyx batesi*. A communication was read from Dr. A. G. Butler consisting of a list of thirty species of butterflies of which specimens were contained in a collection sent home by Major A. H. Cowie, R.E., from St. Lucia, West Indies. One of the species was new to science, and was described under the name of *Cystineura cowiana*.

#### PARIS.

**Academy of Sciences, December 23, 1901.**—M. Fouqué in the chair.—On the periods of double integrals, by M. Emile Picard.—On the cultivation of clover on soils deprived of lime, by MM. P. P. Dehéraïn and E. Demoussy. The experiments described furnish two interesting examples of the influence of inoculation and of the medium on the growth of Leguminosæ; the clover grows in the soil of Brittany whenever lime and phosphates are used, that is, as soon as the medium becomes favourable to its vegetation; it remains poor, on the other hand, in a heath soil, in spite of the creation of a favourable medium, because garden earth does not carry the necessary bacteria.—Remarks by M. Bouquet de la Grye on the work done by the third general conference of weights and measures.—Remarks by M. E. Guyou on the annual of the Bureau des Longitudes for 1902.—On the measurement of the meridian of France by Méchain at the end of the eighteenth century, by M. G. Bigourdan. If to the measurements of Méchain, which formed the basis of the metric system, the corrections of Delambre are applied, the results are brought more nearly into line with the recent observations of Perrier.—On the observation of the annular eclipse of the sun of November 11, 1901, by M. A. de la Baume-Pluvinel. The observations, which were partly photographic and partly ocular, were made in Lower Egypt. Owing to the early hour at which the eclipse took place the ocular observations were the most satisfactory. One point to which especial attention was directed was the examination of the spectrum of the sun in the neighbourhood of the edge of the moon. A thickening of some of the Fraunhofer lines here would indicate the existence round the moon of a gaseous atmosphere capable of producing a sensible absorption. But no evidence of such a thickening could be obtained either from the nega-

tives or from the direct observations, thus confirming the absence of a sensible atmosphere round the moon.—Remarks on the note of M. de la Baume-Pluvinel, by M. J. Janssen.—The calculation of real roots of equations, by M. A. Pellet.—The progressive calculation of the integrals of certain differential systems, by M. Riquier.—On the separation and calculation of the real roots of equations, by M. Raoul Perrin.—On the numbers  $e$  and  $\pi$  and transcendental equations, by M. Edmond Maillet.—On the most general motion of a solid body which possesses two degrees of freedom round a fixed point, by M. René de Saussure.—The laws of electrical energy, by M. E. Carvallo. A criticism of the two laws enunciated by Maxwell.—On a new application of optical observations to the study of diffusion, by M. J. Thovert. The two solutions are superposed in a plane-sided box and the deviation of a horizontal light ray measured. The deviation is proportional to the rate of change of the concentration with the vertical ordinate. The diffusion of a solution of sodium chloride into water was measured by this method and the results were found to be in accord with the theoretical expression.—Contribution to the study of Geissler tubes in a magnetic field, by M. H. Pellat.—The cooling power and conductivity of air, by M. P. Complan. An experimental determination of the velocity of cooling of a blackened copper ball in dry air at different pressures. The velocity of cooling could be expressed by the formula of Dulong and Petit for pressures between 760 mm. and 15 mm.; for pressures below this the rate of cooling falls off much more rapidly than would correspond to this formula.—Observation of an antisolar corona on the Puy de Dôme, by M. Bernard Brunhes.—On a petroleum ether thermometer, by M. L. Baudin. By the use of a light petroleum ether possessing a density of 0.647 at 15° C., a thermometer can be constructed which does not solidify at the temperature of liquid air, and which can be used to measure temperatures down to that point. It was graduated at four fixed points, the boiling points of oxygen, nitrous oxide, methyl chloride and the melting point of ice.—On the dilution constant of saline solutions, by M. Albert Colson.—On metallic strontium and its hydride, by M. Guntz. Strontium can be prepared by the electrolysis of an aqueous solution of strontium chloride with a mercury cathode and then driving off the mercury from the amalgam by very cautious heating. Heated in hydrogen at a moderately high temperature it forms a hydride, fusible at a red heat of the composition  $\text{SrH}_2$ . The properties of strontium resemble those of barium, except that strontium does not appear to form an ammonium compound with liquid ammonia.—On the plurality of the blue oxides of molybdenum, by M. G. Bailhache.—On methylene chlorobenzoate and dibenzoate, by M. Marcel Descudé. These two compounds are obtained simultaneously by the action of benzoyl chloride upon trioxymethylene in the presence of zinc chloride.—On the hypsulphites of the aromatic amines, by M. A. Wahl.—Some new reactions of the organo-metallic derivatives. Synthesis of ketones, by M. E. E. Blaise. Magnesium organo-derivatives react with nitriles to form compounds immediately decomposable by water with the formation of ketones. The reaction appears to be general, and details are given of the preparation of ethyl-*o*-tolyl ketone, benzyl-*n*-propyl ketone, benzylisoamyl ketone, *o*-methyldeoxybenzoin, *n*-butyl-*p*-tolyl ketone, *n*-propyl-*p*-tolyl ketone, *n*-propylisoamyl ketone, ethyl-propyl ketone and ethylphenyl ketone. The semicarbazides of these ketones were also prepared, and their melting points are given.—On the basic properties of oxygen and its quadrivalency in the xanthene series, by M. R. Fosse.—The action of normal propyl and butyl alcohols upon their sodio-derivatives; the synthesis of dipropyl and dibutyl alcohols, by M. Marcel Guerbet.—The study of fermentation amyl alcohol, by M. G. Bemont. Fermentation amyl alcohol boils at 131° and gives on oxidation a valeric acid boiling at 175°, probably methyl-ethylacetic acid.—On the variation of the kidney and its excretion in fowls fed with meat, by M. F. Houssay. Under a meat diet the urea excreted is nearly three times the amount with a grain diet, and the kidney would also appear to increase in weight by about one-third.—A new contribution to the search for the typhoid bacillus, by M. R. Cambier. The author has shown in a previous note that the typhoid bacillus can make its way fairly readily through the walls of a porcelain filter immersed in a nutrient broth. The *Bacillus coli communis*, which is also very mobile, can grow through the walls in a

similar manner. In the present paper an account is given of an attempt to diminish the mobility of the latter bacillus by the addition of alkali and common salt. Particulars are given of an application of these facts to the determination of the presence of the typhoid bacillus in drinking water.—Study of the variations of the organic matter during germination, by M. G. André.—A method for separating glutamic acid and leucine by means of hydrochloric acid gas, by M. A. Étard.—On the bluing of certain fungi, by M. Gabriel Bertrand. On breaking certain fungi of the genus *Boletus*, the tissue exposed to the air takes on a fine transient blue colour. It is shown that this effect depends on six different factors: the substance boletol, the oxygen of the air, laccase, manganese, water and a metal belonging to the series of the alkalis or alkaline earths.—On the root of *Iboga* and *ibogine*, by MM. Lambert and Heckel. A physiological study of the active principle of *Iboga*. The alkaloid *ibogine* possesses anæsthetic properties resembling those of cocaine.—An attempt at the measurement of cytological activity, by M. Rémy Saint-Loup.—Observations on the root nodosities in the Leguminosæ, by M. Emil Laurent.—The causes of sterility in peaty soils, by M. J. Dumont.—A new case of variation in the vine following mixed grafting, by M. A. Jurie.—On the aging of the embryo in the Graminacæ, by M. Edmond Gain.—On the refracting globules of the chlorophyllian parenchyma of leaves, by M. Louis Petit.—Considerations on the sexuality of certain yeasts, by M. A. Guilliermond.—Proof of the existence of the Trias in Greece. The stratigraphical position of the Cheli limestone, by MM. L. Cayeux and Ed. Ardaillon.—Observations on the synclinal of Amielles-Bains, by MM. Léon Bertrand and O. Mengel. The dislocation in the quartz at Éveaux and at Saint-Maurice (Creuse), by M. L. de Launay.—On a new Miocene layer in the interior of Corsica, by M. E. Maury.—Some new proofs relating to the contamination of the springs in the chalk in France, by M. Martel. The case is considered of streams which flow above ground for some distance and become polluted and then disappear into fissures of the chalk, and after undergoing a certain amount of filtration reappear in the form of springs. Confirmation is given of the possibility of danger from this source.—On the project of crossing the Sahara by balloon, by M. Deburax.

## NEW SOUTH WALES.

**Royal Society**, November 6, 1901.—Mr. H. C. Russell, C.M.G., F.R.S., president, in the chair.—The following gentlemen were elected hon. members of the Society:—Prof. J. W. Judd, C.B., F.R.S., Prof. Simon Newcomb, and Sir Benjamin Baker, K.C.M.G., F.R.S.—The Clarke memorial medal for 1901 was awarded to Mr. Edward John Eyre, Waleddon Manor, Tavistock, England, for his exploring work.—The Thurawal language, by Mr. R. H. Mathews. In this paper the author describes the structure of the native speech of the aborigines of the region between Jervis Bay and Port Hacking. An appendix exhibits the elements of some other dialects adjoining the Thurawal tribes on the north and west, the whole concluding with an extensive vocabulary.—Note on the sesquiterpene of Eucalyptus oils, by Mr. Henry G. Smith. In this paper the author showed that a sesquiterpene occurs in many Eucalyptus oils and that it is this constituent that gives the pink coloration to Eucalyptus oil when testing for eucalyptol with phosphoric acid.—Current papers, No. 6, by Mr. H. C. Russell, C.M.G., F.R.S. In the year November 1900 to November 1901, 130 current papers were received, and these form the basis of the present paper. In this list there was a marked increase on the tracks Sydney to Canada and United States. Previously very little was known of the drift of bottle papers in that sea; but during this year an appreciable increase of interest has been manifested in the current papers found amongst the islands. These show very clearly the presence of a very rapid current near the equator, somewhat similar to that in the Indian Ocean. For instance, current paper 598 made daily a drift near Fiji of 11.1 miles per day; near Gilbert Island, No. 671 travelled at the rate of 19.5 miles per day; and near Phoenix Island the current paper No. 674 travelled 16.8 miles per day; and so on. At first it seemed that current papers aggregate in certain months, but upon the monthly papers which have been received in five years there is not much to support the idea. But there is good reason to believe that the current paper is affected by the wind as well as by the currents, and that strong persistent winds alter the landing places of current papers.

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## DIARY OF SOCIETIES.

## THURSDAY, JANUARY 2.

RÖNTGEN SOCIETY, at 8.30.—On the Function of an Auxiliary Electrode in X-Ray Bulbs: C. E. S. Phillips.—On Radiography applied to Dental Surgery: Prosper H. Marsden.—Mr. H. W. Cox will demonstrate a New Method he has devised for exciting Several Tubes simultaneously from One Coil.

## FRIDAY, JANUARY 3.

GEOLOGISTS' ASSOCIATION, at 8.—On the Waves of Sand and Snow: Dr. Vaughan Cornish.

## MONDAY, JANUARY 6.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Report of the Joint Arsenic Committee of the Society of Chemical Industry and of the Society of Public Analysts will be presented by the Chairman.—The Retarding Influence of Aldehydes on the Maturation of Spirits: Prof. J. T. Hewitt. VICTORIA INSTITUTE, at 4.30.—Modifications in the idea of God, produced by Modern Thought and Scientific Discovery: Rev. Chancellor J. J. Lias.

## WEDNESDAY, JANUARY 8.

SOCIETY OF ARTS, at 5.—Photography and its Applications, II. (Juvenile Lecture): Sir Henry Trueman Wood.

GEOLOGICAL SOCIETY, at 8.—A System of Glacier-Lakes in the Cleveland Hills: P. F. Kendall.—The Glaciation of Teesdale, Weardale and the Tyne Valley, and their Tributary Valleys: A. R. Dwerryhouse.

ROYAL GEOGRAPHICAL SOCIETY, at 4.30.—Waves: Dr. Vaughan Cornish.

## THURSDAY, JANUARY 9.

MATHEMATICAL SOCIETY, at 5.30.—Non-uniform Convergence, and the Integration of Series: the President.—Network: S. Roberts, F.R.S.—On Quartic Curves with a Triple Point: A. B. Basset, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Discussion of the Technical Reports on the Institution Visit to Germany, 1901, by the Committees on Traction, Light and Power; Manufacturing, and Telegraphs and Telephones.

## FRIDAY, JANUARY 10.

ROYAL ASTRONOMICAL SOCIETY, at 8.

MALACOLOGICAL SOCIETY, at 8.

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