varied assortment of iron objects, such as knives, chisels, axes with flanges on one or both sides, axe-hammers with transverse sockets, scythes and sickles very similar to those from Oppidum La Tène, buckles, shears, shovels, ploughshares and coulters, the central portion of a bridle-bit, &c.

A bronze statuette.—One of the late Hallstatt graves contained a bronze figure of a beardless man, 12 centimetres in height. The body is clad in a closely-fitting tunic with a prominent girdle, leaving the neck, forearms and legs exposed. On the left arm is an armlet, on the left leg an anklet, and on the head a helmet. The bare feet rest on a small round pedestal. The gaze is directed to the palm of the upraised right hand, while the left arm is bent sidewards as if the half-closed fist were grasping the handle of an upright spear.

One of the most novel features of the cemetery was the proportionately large number of agricultural and domestic implements which it contained. While analogous cemeteries in other localities, such as the neighbouring necropolis of Santa Lucia, have yielded an endless array of objects of personal adornment, as well as others intended exclusively for votive purposes, here at Idria the grave-goods consisted of utensils, implements, weapons, tools and ornaments actually used in everyday life. Mr. Szombathy, however, observes that this peculiarity was more noticeable in the interments of the later half of the period during which the cemetery was in use.

Another equally noteworthy feature was that objects of different periods were not unfrequently found in the same grave—a fact accounted for by the tendency to continue old customs in secluded mountain valleys, such as that of Idria. This overlapping of different culture periods complicates, to some extent, the task of delineating the successive phases of the early Iron Age civilisation.

As to the racial question, Mr. Szombathy speaks by no means dogmatically. The earlier grave-goods indicate a civilisation so like that of Santa Lucia that its founders were probably of the Illyrian stock; but whether the same people continued in the Idria valley during the intrusion into it of the later Celtic and Roman culture-elements there is no evidence to show. Possibly the deciphering of the inscriptions on the bronzes, of which there are three or four, may help to solve the problem.

The frequency with which the generic expressions "Hallstatt" and "La Tène" are now used in the archæological literature of Europe renders it essential for British antiquaries to acquire precise ideas of the culture-elements represented by them. For the origin of the word "Hallstatt" we have to go back to the investigation of a cemetery in a small valley of the Noric Alps in the vicinity of Lake Hallstatt, and for that of "La Tène" to the well-known station of that name at the north end of Lake Neuchâtel. Subsequently these terms were used to designate similar remains found in widely-separated districts, just in the same way as the term "Mycenæan" is no longer restricted to the discoveries at Mycenæ. Practical researches have now greatly extended the culture-elements, both in number and types, which have to be classified under Hallstatt and La Tène, and it has often been mooted whether a better nomenclature could not be devised. I do not think it would now be advisable to make any change in this respect. What, however, is urgently required with regard to these terminal links in the development of the Iron Age in Europe is an authoritative work dealing with the essential characteristics of the relics discovered within their respective archæological areas. For records of the rich finds made in Central Europe since the appearance of "Das Grabfeld von Hallstatt" by v. Sacken, and in the cemeteries of Glasinac and Jezerine in Bosnia, as well as in those of the Istrian peninsula and the valley of the Po, we have to hunt in the *Transactions* of so many societies that they are, practically, inaccessible to all but a few specialists. Knowing the competency of Austrian archæologists for executing such a work, and the ample resources, by way of illustrations, at their command, I trust this suggestion will not remain fruitless.

ROBERT MUNRO.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE difficulty in connection with Mr. Carnegie's offer to found a National University (see p. 164) has been solved by the donor's arranging to convert into Government bonds the ten million dollars' worth of United States Steel Corporation bonds, the acceptance of which was an obstacle to the adoption of the scheme.

OUR national deficiencies in regard to provision for higher scientific and technical education are obvious to all who take the trouble to inquire into the matter. For many years men of science have been watching with a feeling akin to envy the opportunities provided for scientific instruction and investigation by foreign nations, and comparing them with the elementary efforts at technical education here. The facts which have been given in these columns week after week have made our readers familiar with existing conditions of technical education; and it is impossible not to be dismayed at the country's prospects in the industrial wars of the future when the inadequate way in which our industrial leaders are trained is understood. A pamphlet just published by the Association of Technical Institutions, giving a comparison of technical education at home and abroad, again brings the subject before the attention of the public. In the matter of buildings and equipment for the highest kinds of technical work we are still far behind Germany, Switzerland and America. Two diagrams published in Nature in 1898 (vol. lviii. p. 54) show clearly how Continental institutions for instruction and research work in technical or applied science are provided on a scale which vastly exceeds ours both as regards areas of sites and areas of buildings. Both these diagrams are reproduced in the pamphlet just mentioned, and also those which

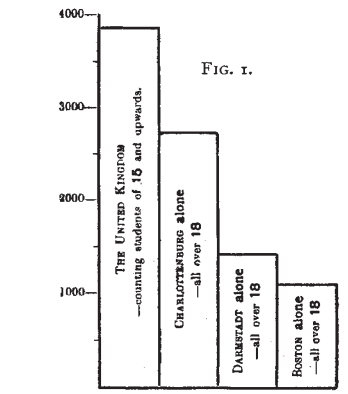

FIG. 1.

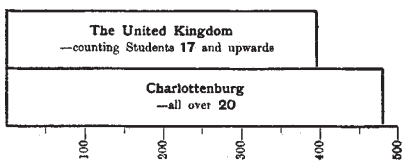

FIG. 2.

FIG. 1.—Diagram comparing approximately the number of Students above 15 years of age taking complete Day Technological Courses in the whole United Kingdom, with the numbers of similar Students above 18 in single Institutions in Germany and America.

FIG. 2.—Diagram comparing approximately the number of third and fourth year Students above 17 years of age taking complete Day Courses in Engineering in the United Kingdom, with the number of similar Students above 20 in a single German Institution.

accompany this note. In these diagrams we have some results of an inquiry made by the association as to the number of day students fifteen years of age or more who are taking complete regular day technological courses of not less than twenty hours a week. Statistics were obtained from Universities, University Colleges, technical schools and all similar institutions where day technological courses are given. The results of the inquiry show that in comparison with other countries our attempts at technical education are utterly futile. In the whole country there are only 555 third-year students of technology satisfying the conditions described, and 113 fourth-year students. The total number of third-year students in engineering is only 347, and of fourth-year students 52, and this number is only obtained by counting students who begin their studies at the immature age of fifteen. As the accompanying diagram (Fig. 1) shows, there are more than two-thirds as many regular day students above eighteen years of age at the Charlottenburg Technical High School, Berlin, as there are above fifteen years of age taking

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 Lycopodinæ.

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 phyll-oxanthin, 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,