A REVISED schedule of subjects in natural science for the *ordinary* B.A. degree at Cambridge has just been issued. This is for the third or final examination, and a pass in one subject is sufficient to give a degree. Is it supposed at Cambridge that a year is to be fully employed in dealing with botany in an *elementary* manner? The schedule says the questions (all elementary) will include the description and classification of plants; the form, structure, and development of stem, root, leaf, flower, and fruit; inflorescence, cross-fertilisation, germination, and nutrition. Twenty-one "natural orders" are specified for special attention, including one cryptogamic group, Filices. This seems a vague syllabus, not likely to encourage the study of botany. How much and how little knowledge of physiology and histology will satisfy such terms as "nutrition," "structure"? No doubt the present is better than the old in omitting to insist on technical terms, some of them antiquated. But cannot more definite requirements be suggested for ensuring some practical insight into vegetable life on the part of the man who is to be stamped as an elementary botanist? Surely the best way is to let the knowledge be good, and sound, and practical, as far as it goes, giving some training in scientific method, and capable of further development in after life. We believe many would welcome a change giving the ordinary B.A. for a lower standard of attainment in the first part of the natural science tripos, thus doing away with the recognition of *dilettante* work in a single subject as a sufficient basis for a B.A. degree. A very satisfactory schedule is presented for zoology, requiring a knowledge of the anatomy of certain selected principal types, as well as the characters of orders, and the comparative anatomy and functions of the systems and organs as exemplified in the animal kingdom. Further, the general development of the embryo chick, the leading facts and conclusions respecting the geographical distribution of animals are included in the subjects. The schedule is to be discussed next Saturday.

THE Cambridge Council of the Senate has framed a draft statute to carry out the grace passed in December last in favour of the appointment of a general Board of Studies, representative in character, to report upon the proposals of each special board of studies as they arise, and so aid in holding the balance among the various interests concerned. The draft statute provides that the new Board shall consist partly of persons appointed on the nomination of the Boards of Studies, but abundant freedom is left to the senate to add other members and to vary from time to time the composition, mode of appointment, and duties of the new board.

AT the next meeting of the Governors of Addenbrooke's Hospital Mr. J. W. Cooper will propose: That a memorial be presented to Her Majesty's Commissioners for the University of Cambridge, under the seal of the Governors, representing that Addenbrooke's Hospital is extensively used as a place of study by the Medical Students of the University; that it is essential in the interests of the Medical School that it should not cease to be a recognised place of medical study; and, further, that as large endowments have been left to various colleges for the promotion of medical study, some adequate endowment should be made for Addenbrooke's Hospital out of the funds at the disposal of the Commissioners. There cannot be much chance of success for such a proposal unless it be made more definite. The hospital can only properly benefit by educational endowments by being the locus of the study and appliances of research in therapeutics, sanitation, and pathology.

GEOLOGICAL students at Cambridge will have plenty of work provided for next term. Prof. Hughes will give one course on the geology of the neighbourhood of Cambridge, and another stratigraphical course, beginning with the Permian, and ascending. Prof. Bonney will continue his lectures on elementary physiography, and will give weekly demonstrations on microscopic lithology. Mr. Tawney will be demonstrating the principal genera of fossil invertebrata; and both he and Dr. R. D. Roberts will give practical instruction in petrology. Lectures begin April 25. The first geological excursion of the term is fixed for Saturday, May 3.

MR. THOMAS W. BRIDGE, B.A., of Trinity College, Cambridge, and Demonstrator of Comparative Anatomy in the University of Cambridge, has been appointed to the Professorship of Zoology at the Royal College of Science at Dublin, vacant by the resignation of Dr. Leith Adams, F.R.S.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 13.—"The Contact Theory of Voltaic Action," No. III. By Professors W. E. Ayrton and John Perry. Communicated by Dr. C. W. Siemens, F.R.S.

The authors commence by referring to the experiments that had been made prior to 1876, on the difference of potentials of a solid in contact with a liquid, and of two liquids in contact with one another, and they point out that:—

1. The earlier experiments were not carried out with apparatus susceptible of giving accurate results.

2. Owing to the incompleteness of the apparatus assumptions had to be made not justified by the experiments.

3. *No direct* experiments had been performed to determine the difference of potential of two liquids in contact, with the exception of a few by Kohlrausch, using a method which appeared to the authors quite inadmissible as regards accuracy of result.

In consequence of this great vagueness existed as to whether the contact difference of potentials between two substances, when one or both were liquids, was a constant depending only on the substances and the temperature, or whether it was a variable dependent upon what other substance was in contact with either. Some authorities regarded it as a variable, Gerland considered he had proved it to be a constant, but first, the agreement of the value of the electromotive force of each of his cells with the algebraical sum of the separate differences of potential at the various surfaces of separation, and which was the test of the accuracy of his theory, was so striking, and so much greater than polarisation, &c., usually allows one to obtain in experiments of such delicacy, that one could not help feeling doubtful regarding his conclusions; secondly, his apparatus did not allow of his experimenting with two liquids in contact, consequently he could not legitimately draw any conclusion in this latter case. And although Kohlrausch had made some few experiments on the difference of potentials of liquids in contact, still since he employed moist blotting-paper surfaces instead of the surfaces of the liquids themselves, the authors considered for that reason alone, if for no other, that his results did not carry the conviction the distinguished position of the experimenter might have led them to anticipate.

They therefore designed a method and an apparatus for carrying it out, by means of which they could measure the difference of potentials, in volts, at each separate contact of dissimilar substances in the ordinary galvanic cells, from which they could ascertain whether the algebraical sum of all the contact differences of potential was, or was not, equal to the electromotive force of the particular cell in question. From the results they obtained, and which are given in Papers Nos. I. and II., *Proc.* Roy. Soc., No. 186, 1878, they concluded within the limits of their experiments that if $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, &c., were the contact differences of potential measured *separately* of the substances A in contact with B, and neither in contact with any other conductor, B in contact with C, &c., then, any one or more of the substances being solid or *liquid*, if any number $A, B, C \cdots K$ were joined together, and the electromotive force of the combination $\overline{AK}$, measured, the following equation was found true:—

$$\overline{AK} = \overline{AB} + \overline{BC} + \overline{CD} + \cdots + \overline{JK},$$

which proved that each surface of separation produced its effect independently of any other.

Their method, by which any single contact difference of potentials was measured, was as follows:—Let 3 and 4 be two insulated gilt brass plates connected with the electrodes of a delicate quadrant electrometer. Let 1 under 3, and 2 under 4 be the surfaces whose contact difference of potential is to be measured; 3 and 4 are first connected together and then insulated, but remain connected with their respective electrometer quadrants. Now 1 and 2 are made to change places with one another, 1 being now under 4 and 2 under 3, then the deflection of the electrometer needle will give a measure of the difference of potentials between 1 and 2.

The apparatus employed by the authors in the present investigation is then explained in detail, and it is shown how, by improving on their earlier form, they have removed a difficulty which formerly existed, and which prevented their previously experimenting on pairs of substances having very different weights, such as a vessel of mercury and a sheet of metal.

The authors explain that the results they have obtained in this investigation have divided themselves into three groups:—

1. The contact difference of potentials of metals and liquids at the same temperature.

2. The contact difference of potentials of metals and liquids when one of the substances is at a different temperature from the other in contact with it—for example, mercury at 20° C. in contact with mercury at 40° C.

3. The contact difference of potentials of carbon and platinum with water, and with weak and with strong sulphuric acid.

They mention, however, that they give only the results under head No. 1 in the present communication, reserving those they have obtained under heads Nos. 2 and 3 for a future occasion.

Then follow arranged in the order in which they were obtained from January to May, 1878, some 150 results of experiments (each result given being on the average the mean of ten observations), representing the contact differences of potential of nine solids and twenty-one liquids. The authors explain that many of the results they obtained are not mentioned in the paper, having been rejected on account of inaccuracies arising from the great delicacy of the experiments. These remarks especially apply to the authors' attempts to measure the contact difference of potentials between a liquid and a paste—for example, mercury and mercurous sulphate paste, great difficulty being introduced by the extremely thin layer of water on the surface of the paste acting inductively instead of the paste itself. They mention that this difficulty is a very good example of the inaccuracies that must have been introduced by former experimenters using a moist blotting-paper surface instead of the surface of the liquid itself.

A large number of discordant results were obtained in March, 1878, and their explanation led to the interesting result that the apparent contact difference of potentials between a metal and mercury, as measured inductively, varied much with small additions of temperature. The investigation of this apparent change of contact difference of potentials with temperature led to a consideration of the contact difference of temperature of mercury with air, since, of course, in all these inductive experiments two air contacts are included in the result.

It has usually been thought that the differences of potential of liquids in contact with one another were so small as to be almost inappreciable in comparison with the differences of potential of metals in contact; but the authors have ascertained, among other results, that strong sulphuric acid in contact with distilled water, solutions of alum, copper sulphate, and zinc sulphate, has a measured difference of potentials of 1·3 to 1·7 volts, or an electromotive force more than twice as high as that of zinc and copper in contact. And hence the great importance of an apparatus that can directly measure the difference of potentials of two liquids in contact.

Zoological Society, March 18.—Prof. St. George Mivart, F.R.S., vice-president, in the chair.—The Secretary called the attention of the meeting to the herd of Japanese Deer (*Cervus sika*) in the park of Viscount Powerscourt, at Powerscourt, in Ireland, now about eighty in number, and gave an account of their introduction and history, from particulars supplied to him by Lord Powerscourt.—A communication was read from Dr. G. Hartlaub, containing the description of a new species of Barn Owl, from the island of Viti-levu, which he proposed to call *Strix oustaleti*.—Mr. Edward R. Alston read a paper on female deer with antlers, showing that these weapons are not unfrequently abnormally developed in fertile females of certain species of *Capreolis* and *Cariacus*, and giving reasons for believing that in the ancestral forms of deer they were probably common to both sexes.—Mr. Sclater made remarks on some of the rarer parrots living in the Society's Gardens. The whole series of this group in the Society's collection was stated to consist of 170 individuals belonging to ninety-eight species.—A communication was read from Prof. Garrod, F.R.S., containing notes on the visceral anatomy of the Tupaia of Burmah (*Tupaia belangeri*). The cæcum coli in this animal was stated to be small, whilst in a specimen of *T. tana* it was ascertained to be wholly wanting.—A second communication from Prof. Garrod contained notes on the anatomy of *Helictis subaurantiaca*, in the course of which he showed that the hippocampal gyrus of the brain is partly superficial in this animal, which is not the case in any other carnivorous animal yet recorded.

Linnean Society, March 20.—William Carruthers, F.R.S., vice-president, in the chair.—The Rev. G. E. Commesford Casey was elected a Fellow of the Society.—A paper by Mr. Fred. Smith, on new aculeate hymenoptera from the Sandwich Islands, collected by the Rev. T. Blackburn, was read. The author states the general aspect of the series is certainly North American, with mixture of a few South American forms. The ants are most diverse in character, some being cosmopolitan in range. The house ant of Madeira is common, and the little European ant (*Ponera contracta*) unexpectedly turns up here.—Some observations on the reproduction of ferns, by Mr. T. R. Sim, were also read by the Secretary in the absence of the author. Among the great collection of living ferns at Kew a marked feature is the large number of species that regularly bear adventitious buds. Of a thousand species there grown barely fifty are ever found without buds, and some forms produce them regularly, though the normal forms do not. The above number seems very high when compared with Phanerogams, where adventitious buds, with some few exceptions, may be said never to be normal. Among viviparous ferns the contrary obtains, and the buds are always on the same part of the plant in all the individuals of a species. *Polystichum angulare*, for example, bears a bud on the rachis in the axil of almost every pinna on the lower part of the frond, in some all up the rachis. Some Aspleniums produce them on the veins of the upper surface of frond, but never directly through from a sorus. Great variety in position, however, is manifested in different genera and species where budding occurs, various examples of which the author gives. Where buds become detached, considerable difference obtains as to size and stage of separation, whereof many instances are pointed out and other curious instances of deviations related by the author. In commenting on the subject, Sir J. D. Hooker stated his belief that ferns at Kew were more bulbiferous than in their natural state, possibly from more constant nutrition and warmth.—The fifth contribution to the ornithology of New Guinea, namely, recent collections from the neighbourhood of Port Moresby, was read by the author, Mr. R. Bowdler Sharpe. The interesting series dwelt on were obtained by Mr. Kendal Broadbent, and usefully compare with those got by Signor Albertis from the Fly River. A parrot of the genus *Aprosmictus* closely resembles one from the Fly River, but nevertheless is specifically distinct, offering thus a parallel case to the crowned pigeons, *Gonra albertisi*, inhabiting Port Moresby, and *G. sclateri*, the Fly River. At present the affinities of the South-Eastern species seem to be with those of Australia, a few to those of the Aru Islands.—Mr. W. T. Thiselton Dyer exhibited *Helichrysum vestitum*, a perennial everlasting, from the Cape of Good Hope.

Anthropological Institute, March 11.—Mr. E. Burnett Tylor, D.C.L., F.R.S., president, in the chair.—The president read a paper entitled "The Geographical Distribution of Games," in which attention was called to the games of Polynesia and America as proving that a drift of civilisation from Asia reached these regions before they were known to Europeans. The draughts played in the Sandwich Islands and New Zealand were not our modern game, but apparently some variety related to the ancient classical game (which is alive in Egypt to this day). It may have reached the South Sea Islands from Eastern Asia, together with kite-flying, at which they were experts, and which they perhaps had before the comparatively modern time when it reached England.

Royal Microscopical Society, March 12.—Dr. Beale, F.R.S., president, in the chair.—The following papers were read:—Contribution to the knowledge of the British Oribatidæ, by A. D. Michael, F.R.M.S.—The development and retrogression of fat cells, by G. and F. E. Hoggan.—Microscope with swinging sub-stage and improved motions, by J. Beck, F.R.M.S.—The use of osmic acid in microscopical preparations, by T. J. Parker, F.R.M.S.—Other papers by Prof. Keith, Mr. Tolles, and Mr. Crisp were taken as read, or postponed in consequence of want of time.—The new $\frac{1}{18}$ oil immersion objective by Zeiss was exhibited, with remarks by Prof. Abbe on the Stephenson homogeneous immersion system.—A large number of objects were exhibited illustrative of the papers read and otherwise, together with microscopes and apparatus by Mr. Crisp.—Lord Justice Bramwell and six other gentlemen were elected Fellows.

Photographic Society, March 11.—James Glashier, F.R.S., in the chair.—Papers were read: On coloured glass suitable for the developing-room, and on the employment of quinine as a substitute, by Capt. Abney, R.E., F.R.S., who, in illustration of his paper, exhibited photographs of the solar spectrum taken through various stained glasses, and stated that a combination of cobalt and stained red glasses secures immunity from the actinic action of light, and that collodion-films on both sides of a glass, stained with either magenta, aurine, or chrysoidine,

practically are also non-actinic. Quinine, he found, cuts off the ultra-violet rays, and no others.—Mr. C. Bennett, on the gelatine emulsion process, enforced the fact that the extreme sensitiveness of his process was produced by the long time he allowed the gelatine and salts to emulsify or ripen before eliminating the bromide and silver not taken up.—Mr. W. Wainwright, jun., note on Bennett's gelatine emulsion process; also, Mr. Howard Grubb exhibited some new forms of stereoscopes, one designed to exhibit pictures of a much larger size than ordinary.

Institution of Civil Engineers, March 11.—Mr. Bateman, president, in the chair.—The paper read was on movable bridges, by Mr. James Price, M. Inst. C.E.

PARIS

Academy of Sciences, March 17.—M. Daubrée in the chair.—The following papers were read:—On an electric burner and blowpipe, by M. Jamin. Two carbons are supported vertically abreast, hinged below, and drawn together at the top by a spring. A current is sent up one (A), down the other (B), then round a rectangular circuit inclosing the two, and passing first round A; by current attraction the carbons are drawn apart, and the arc appears at the top and descends gradually, consuming one or both carbons. When the action of the rectangle is sufficient, the arc driven beyond the points is like a gas flame, and M. Jamin receives it on a piece of lime, magnesium, or zirconium, getting intense light. It is also so hot as to fuse the lime, and the author recommends it as a blowpipe to chemists and physicists.—On a meteorite belonging to the group of eukrites, which fell on July 14, 1845, in the Commune of Teilleul (Manche), by M. Failli.—M. Larrey communicated a letter from M. Tholozan, Persia, on the plague, which he shows to have sprung up and died out in certain localities in the absence of restrictive measures. The French Government have sent Dr. Zuber to Astrakhan to study the disease.—On a new type of anomalous stems, by M. Cornu. This relates to supplementary cortical ligneous bodies anastomosed together, in certain *Sempervivum* and *Cressula*; their *rôle* seems to be to strengthen the fragile stems when they have to bear a large inflorescence.—On the amyloid granules of the yolk of eggs, by M. Dareste. He urges reasons for thinking the granules starch, and not lethicine (as has been affirmed). They are difficult to study.—On the correspondence between Chladni's acoustic figures and liquid systems produced on vibrating circular plates, by M. Decharme. It was stated that the Italian Society of Natural Sciences had formed a service of antiphylloxeric vedettes, to survey vineyards, and report the first suspicions of the disease.—On a new catadioptric telescope, by MM. Paul and Prosper Henry. The tube of a reflecting telescope is hermetically sealed by means of a thin crown glass lens of the same size as the mirror, very slightly concave, and not detracting from the optical power of the instrument. The instrument has given remarkable results.—Demonstration of the convergence of a double series met with by Lamé in his researches in mathematical physics, by M. Escary.—On the integration of a differential equation, by M. Halphen.—On the determination of the imaginary roots of algebraic equations (concluded), by M. Farcas.—On a system of light signals permitting the determination of differences of longitude between different stations not connected electrically, of a triangulation of parallel or meridian, by M. Liais. This system has been adopted in Brazil. M. Liais shows the advantage of making rhythmic signals commanded by a clock, and received at the other station by a chronographic inscription. In this way there is no variable personal equation to be concerned about. The point is to make a screen, with aperture, beat seconds (*e.g.*, by a clock commanding an electro-magnet) so as to give an instantaneous appearance of light each second. The receiving-station may either register with a chronograph or (better) compare directly the clocks of the two stations by the method of coincidences; a screen, with aperture, passing before the objective of the telescope, and the light seen only when the two clocks are in coincidence.—On the distribution of heat on the sun's surface; results of the first series of observations at the Imperial Observatory of Rio de Janeiro, by MM. Cruls and Caille. These researches fully confirm the results got by Secchi, though there are some differences as to absolute value of radiations. The absolute radiation of the whole disk was estimated at $\frac{22}{100}$, the absorption, $\frac{78}{100}$.—Determination of the approximate value of a coefficient relative to the viscosity of water, by M. Geoffroy.—New experiments on telephones without a diaphragm, by M Ader. He gets better results than with an ordinary telephone from a thin piece of wire (with small helix round it) fixed at one end in a wooden board (a microphonic speaker being used), better if the two ends are in contact with metallic masses. Voice is reproduced, too, from a mere bobbin without core, if the windings are very free. He supports M. du Moncel's view that the sounds in the telephone are from contractions and elongations of the magnetic rod.—M. Du Moncel described some observations in the same sense.—M. Resis presented a note on a hydro-electric telephone, in which the variations in intensity of the current are reproduced by variations in resistance of a liquid column, which serves as receiver (without any electro-magnetic organ).—On new combinations of hydrochloric acid with ammonia, by M. Troost. The two specified are the tetra and hepta-ammoniacal chlorhydrates.—Combinations of phosphuretted hydrogen with cuprous chloride, and its determination in gaseous mixtures, by M. Ribau.—On the crystalline form of combinations of stannmethyls and their homologues, by M. Hiertdahl.—On a new process of treatment, by the dry way, of iron and copper pyrites, by M. Simonin. This relates to Mr. Holloway's method.—On the state in which precious metals are found in some of their combinations; ores, rocks, products of art, by MM. Cumenge and Fuchs.—On the constitution of coal, by M. Guignet. He treated powdered coal with phenol, nitric acid, &c. With the latter he obtained, *inter alia*, *trinitroresorcine* (oxypicric acid), probably from resinous or waxy matters retained in the coal. No resorcine was found.—On alcoholic fermentation, by MM. Schutzenberger and Destrem. Yeast prevented from developing and multiplying still retains its power of decomposing sugar; and yeast acting on sugar deassimilates more nitrogen than that kept in presence of water, but without sugar and oxygen.—On the determination of glucose in the blood, by M. Cazeneuve. He criticises Bernard's method (by cupropotassic liquor) as inexact, and thinks the study of glycæmia should be taken up again when a more precise method is acquired.—On the derivatives of normal methyloxybutyric acid, by M. Duvillier.—Analysis of some fodders, and observations on damage done to Italian beans by weevils, by M. Grosjean.—Comparative evolution of the male and female genital glands in the embryos of mammalia, by M. Rouget.—On the non-excitability of the grey cortical substance of the brain, by M. Couty.—Note on the history of pedunculer expansions, by M. Bitot.—On the nature of the albumen of hydrocele, by M. Bechamp.—Experimental researches on a leptothrix found during life in the blood of a woman attacked with grave puerperal fever, by M. Feltz.—On the modifications of the physical properties of starch, by M. Musculus.—On ferruginous particles observed in dust brought by a blast of sirocco to various parts of Italy, by M. Tacchini. This was in February. He thinks the phenomenon of so-called *meteoric* spherules must in many cases be attributed to this phenomenon.—Morphology of the dental follicle in vertebrates, by MM. Legros and Magitot.—Pathogeny and treatment of intermittent convergent strabism, without operation, by use of mydriatics and myosics, in children, by M. Boucheron.

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