THURSDAY, JULY 6, 1905.

THE EMPIRE AND UNIVERSITY LIFE.

WE publish to-day a statement signed by more than forty professors and heads of departments of the University of Oxford setting forth a scheme for large increase in the facilities for research and for teaching. We have no hesitation in stating that these forty signatures include the majority of Oxford workers with a reputation for learning which extends beyond the borders of that ancient university. They also represent, with singular completeness, the varied lines of research which happily are pursued at Oxford; and it is an encouragement among the many unsatisfactory features in the intellectual life of the nation that they are ready and willing to stand side by side, each sympathising with the needs of other workers, each desiring to grant the fullest opportunities for research on the broadest lines.

They doubtless feel in Oxford, as we recognise in London, and as Britain generally is beginning to know, that the real conflict in this country is not between science and classics, between theology and philosophy, or between the true followers of any branches of learning, but that the great educational struggle of our time and race is of an utterly different kind. On the one side are ranged those who hold that the much needed intellectual inspiration of our youth can only be received in an atmosphere of research, can only be given by men who are themselves researchers; on the opposite side stand those who uphold the ancient Chinese and the modern British educational methods. We recognise to the full the Imperial importance of the subject. Young men instructed by purveyors of second-hand word knowledge are not likely to develop the germs of imagination and originality, and to deal effectively with the problems presented in the modern world which deals with things; and the time in which such development is generally possible is all too brief. When once the critical period of intellectual growth has been devoted solely to the collection and re-collection of material for the examiner, any awakening of original power is rare indeed. We have merely created one Briton the more incapable of using his birthright, out of sympathy with the movement which would help others to gain what he has lost; and his want of sympathy may mean a great deal. He may become a journalist and help to frame the opinion of the nation, he may enter Parliament and help to marshal the educational forces upon which our future existence most surely depends, he may be a power in the Treasury and help to determine the expenditure of the national income, he may become a schoolmaster or a college tutor and do unto others even as he has been done by.

It cannot be disguised that things are in many respects worse than they were half a century ago. The University Commissioners of 1850 said of Oxford:—"It is generally acknowledged that both Oxford and the country at large suffer greatly from the absence of a body of learned men devoting their lives to the cultivation of science, and to the direction of academical education."

The commissioners of a quarter of a century later did, indeed, largely increase the number of university professors, but it left them powerless—muzzled lions chained by the leg. The whole power of influencing the passing generations of young men it left in the hands of a score of independent corporations—nearly all of them ancient, and with noble traditions of high learning and profound research; but, in the intellectual backwater of our time, each has strained to become a petty university and the successful rival of all the other petty universities—the successful rival, that is, in the qualities developed by examination, and in nothing higher. To this end each has freely spent its endowment in entrance scholarships to compete with others for the men who will do best in examinations, and each has striven to secure, before and beyond all others, the most successful purveyor of knowledge which will be useful in examinations. We say, intentionally and deliberately, that each college *has* done these things, but are far from implying that all of them have no higher aims at the present time. We are only too glad to recognise in recent years a change of spirit which has led to significant departures from the scheme of the last university commissioners. Magdalen, New College, and Brasenose have been noble leaders in a noble cause—the return of Oxford to ideals of learning which have been suppressed, but not altogether killed, by a false and injurious educational system. We gladly recognise clear evidence of the same spirit in other societies, and we are well aware that others, again, strongly desire to make provision for the highest learning, but are unable to do so while their whole available funds barely suffice to enable them to keep their place in the unfortunate and wasteful inter-collegiate competition which dominates both our ancient universities. There is, however, one college in which the necessity for such competition is reduced to a minimum, and it is precisely here that the last commissioners inflicted the crowning injury upon the intellectual life of Oxford—they set their seal on the existing constitution of All Souls. A college almost without the responsibility and the care of undergraduates is created, it would seem, to be the home of the highest learning and research. And what is it? Well, apart from a distinguished professoriate, a generous assistance to the Bodleian, and a rare and occasional election of men of learning to her fellowships—for all of which we freely and gladly express our gratitude—All Souls merely exists in order to encourage the worst features of an intellectual training which exists by and for examination alone. Only recently the governing body rejected the movement, which happily existed among some of the members, to ask for evidence of original power in the candidates who compete for the fellowships. Yet

All Souls might readily do as much for learning in Oxford by her fellowships as she now does to prevent learning—as she now does to turn the attention of the ablest men towards what will pay in examinations, and to shut their ears to the still small voice of latent imagination and original power. If All Souls gave her two fellowships each year for evidence of research, the ablest of the men studying the subjects of her choice would demand of their teachers inspiration and guidance in the highest work. Where the ablest men lead others would soon follow, and the whole intellectual atmosphere would rapidly change.

All Souls unaided could do an immense deal to induce the other colleges to provide higher teaching, or, even better, to encourage their men to get help outside the college walls. As it is, she provides the strongest of all the forces which chain Oxford to that unhappy infatuation which has had so disastrous an effect on the imagination, the initiative, the resourcefulness of the nation.

The title of this article was chosen in the profound conviction that interests much wider and more important than those of Oxford and Cambridge are at stake. Our ancient universities have heavy responsibilities, extending far beyond their historic walls. Every new university and university college in the Empire draws its teachers from Oxford and Cambridge, and, for good or for evil, moulds the broad features of its intellectual life upon the pattern supplied by these ancient seats of learning.

In the supreme interests of the Empire, as well as of the university itself, we fully sympathise with the aims of those who desire to render Oxford a more efficient instrument of research and the highest and most stimulating teaching, but we have no right to claim their sympathy or support for our own views on university and collegiate life. It may well be that the onlooker sees weaknesses and obvious measures of reform hidden from those on the spot, or appearing to them as a far-off ideal impossible of realisation, at least in this generation. Speaking for those who watch from without, who admire and would preserve and strengthen the truly inspiring elements of the academic life at both our ancient universities, we would gladly see them subject to the following simple, but, as we believe, efficient measure of reform.

The whole of the teaching should be entirely under the control of the university, which in its boards already possesses at least the foundation of the necessary apparatus. The college fellowships should be given in part for university teaching combined with original work and in part for research alone, to be held only during the continuance of investigation. A career would thus be open for originality of a high order, and the ablest men would flock to our ancient seats of learning and render them indeed worthy of the name. Residence in homes of ancient learning would gain added inspiration when the greatest traditions of the past were renewed and maintained. Even with things as they are, Oxford and Cambridge, though much injured by competitive examinations, have been far less injured than England in general; and this they owe to the residential system. Little thought of, perhaps neglected, by the builders, the head-stone of the educational edifice is here to be found. Where mind meets mind in the free intercourse of youth there springs from the contact some of that fire which, under our present system, is rarely to be obtained in any other way; and not only this, but many other priceless advantages in the battle of life are also conferred. To these influences we owe in large part all that is best in the English character, and so valuable are the qualities thus developed, or at least greatly strengthened, that we regard residential colleges as essential to the success and usefulness of the newer universities. The changes we have advocated in the older universities would only add to this beneficent system increased power for good by substituting for the barren pride of first classes and university prizes the enthusiasm for a society which nobly holds its own in those achievements which bring renown wherever the advancement of learning is held in honour—a sufficient answer to the contention that to deprive a college of teaching is to render it a boarding-house and nothing more. That the advancement of learning is the desire of those who have signed the memorial we do not doubt, however much they may disagree with the methods here suggested for the attainment of their ends. On our part we feel such confidence in the beneficent influence of the increase in efficiency for which they plead, that we should gladly see funds provided for the purpose.

In former centuries the highest learning was encouraged in this country by the munificence of "founders and benefactors"; and we are glad to know that one of the needs set forth in the accompanying statement has already been generously met, and even more than met, by the establishment of a department presided over by a Beit professor of colonial history. But the signs of the times do not encourage us to anticipate any very large or fruitful following of this fine example; and we see no prospect of carrying out the suggested scheme in anything like completeness, except by a re-arrangement of the revenues of the university and the colleges, or by the action of a Government which is convinced that the national well-being is imperilled, the national existence at stake.

THE SARCODINE FAUNA OF DEEP LAKES. Les Sarcodinés des Grands Lacs. By Eugène Penard. Pp. 133. (Geneva: H. Kundig, 1905.)

DR. PENARD'S enthusiastic and minute investigations into this group of the Protozoa are well known. In the course of many years' study of the Sarcodina of the Lake of Geneva and of the surrounding country, he became convinced that there is a special sarcodine fauna of deep lakes. The facts on which he founded his theory, already embodied in his

two great monographs of the Rhizopods and Heliozoa, are here presented in a form more accessible to the student. About fifty species and varieties are described and figured, the majority being peculiar to deep lakes, the others characteristic of, though not confined to, deep lakes.

On looking over the diagnoses of the species, it cannot fail to be remarked that many of them are distinguished by very trivial differences from other known species. Considering the intolerable burden of synonymy in zoological nomenclature which results from the practice of describing species on insufficient grounds, it is a pity that Dr. Penard should have conferred a specific name upon a form (*Difflugia curvicaulis*, Penard) which he naïvely admits he regards as scarcely even a fixed variety. Other instances are not wanting in the volume of species which seem to be of very little value. It is obvious that he makes insufficient allowance for the recognised variability of the species of the group. He puts too much reliance on size as a specific character, and gives an exaggerated value to minute differences in the size and form of the scales which encrust many species.

Making all allowance for the slight differences on which he separates the abyssal species from the related species of shallower waters, it appears that there is really some considerable amount of peculiarity among the abyssal Sarcodina. Species tend to appear in the abyssal region under different forms or varieties from those found elsewhere. We would ask, however, whether this peculiarity is any greater than one would expect from the influence which must be exerted by the very different environment upon the individuals produced in this region?

Of interest in this country is Dr. Penard's assertion that some representatives of the abyssal fauna of the Swiss lakes have been found by him in Loch Ness. The difficulty of accounting for the passage of abyssal forms from one lake to another is just touched upon, and dismissed with the short statement that several of the species have also been found at the margins of the lakes, as well as in the depths. One is tempted to make another explanation of this fact, and say that it proves that they are not peculiarly abyssal. Dr. Penard does not say whether he regards this coming to the shore as a normal mode of migration of abyssal species.

In the special case of Loch Ness, there are facts which make it difficult to believe that the abyssal Rhizopods are peculiar species. No abyssal species of any other class has yet been found in Loch Ness. Some of the forms which are regarded as purely abyssal in the Swiss lakes are found in the shallow bays of many Scottish lochs, and even in peat bogs. This may prove an interesting fact in distribution if it can be shown that species which are superficial in Scotland have to descend to some depth in Switzerland in order to find congenial conditions of temperature. Among Dr. Penard's abyssal forms which have been found in Scottish moss may be mentioned *Heliopera petricola*, var. *amethystea*, Penard, and *Cyphoderia ampulla*, var *major*, Penard.

Making due discount for his too high appreciation of minute differences, and appraising his species at our own value, this volume is valuable to students of the Sarcodina, as there is no question of Dr. Penard's painstaking accuracy of observation. His descriptions are clear and concise, while the illustrations in the text are excellent.

STEAM TURBINES.

(1) *Steam Turbines, with an Appendix on Gas Turbines.* By Dr. A. Stodola, of Zurich. Translated from the second revised and enlarged German edition by Dr. L. C. Loewenstein. Pp. xvi+434; illustrated. (New York: D. Van Nostrand Company; London: Archibald Constable and Co., Ltd., 1905.) Price 21*s.* net.

(2) *Bau der Dampfturbinen.* By Prof. A. Musil. Pp. 6+233. (Leipzig: B. G. Teubner, 1904.) Price 8 marks.

(1) THE steam turbine has for some years now, thanks to the inventive genius of Mr. Parsons, become a formidable rival of the reciprocating steam-engine on land, and the past three years have seen a rapid increase in its use for marine purposes. On cross-channel steamers there is no doubt that in a few years it will completely oust its rival, while the adoption of this type of engine for two of the Allan line steamers, and the decision to use steam turbines for propelling the great Cunarders now being built, probably herald the approach of the day when on these big liners also the reciprocating marine engine will be entirely displaced.

It is not surprising, therefore, that there has grown up a rapid demand for good text-books on the steam turbine in which both the theory and the constructive details of the numerous types now on the market are fully dealt with. In addition to numerous papers and articles which have been printed in the Transactions of our leading engineering societies and in the technical journals, we have had two editions of Mr. Neilson's book, and now, by this English translation, the latest edition of Dr. Stodola's classic work is made available to British engineers.

In his preface to the second edition, Dr. Stodola points out that he has been able in the period which elapsed since the issue of the first edition to investigate experimentally several important problems untouched in the first edition, as, for example, the frictional resistance of turbine wheels in air. In the first section, after dealing with the elementary theory of the steam turbine, a concise and clear classification is given of the various types which have so far been practically successful. The more advanced thermodynamic problems which are met with in the theory of the steam turbine form the subject of the second section, and details are given of a series of valuable experiments on the flow of steam from orifices; these experiments are of great importance, and the results are very striking, and will undoubtedly prove of great value to those engaged in the design of diverging nozzles for turbines. In connection with this chapter, Mollier's diagrams for the properties of saturated steam are explained; these diagrams have been reproduced, and, for the English edition, similar

diagrams, expressed in English units, have been prepared by the translator. The design of the details of the more important types of turbines is then investigated, and such details as the shape, the construction, and the strength of the blades, and the design of the bearings of the shafts are fully dealt with.

In section iv., a full description is given of the various types of steam turbine which have so far been constructed and have been practically successful, and, in the case of several, the results of experiments by trained observers are given in detail. This portion of the book will be found of particular value to users of steam power who are anxious to have some knowledge of the relative merits of the various types of turbine now on the market. The application of the steam turbine to marine purposes is scarcely dealt with in as full and comprehensive a manner in Dr. Stodola's book as the rest of the subject, and a little more information might well have been given as to the relative merits of the steam turbine and the reciprocating engine for various purposes.

The last section of the book deals with some of the more advanced scientific problems, treated largely from a mathematical point of view, which occur in connection with the theory and construction of the turbine. We might instance such problems as that of the distribution of pressure in any cross section of an expanding gas or steam jet, the deflection, due to its own weight, of a horizontal disc of variable thickness, and the straightening out of such rotating discs under the action of centrifugal forces.

In an appendix, the possible future of the heat engine is briefly discussed; the main directions in which increased economy may be hoped for appear to be in the decrease of the passive resistances, such as friction, &c., in the supply of the heat to the motor only at the highest possible temperature and in the abstraction of the waste heat only at the lowest possible temperature, and in the avoidance, so far as possible, of all non-reversible changes of condition. Dr. Stodola is of opinion that in the future a heat motor which combines the high thermal results of the gas engine with the constructive advantages of the steam turbine will supplant all other types. Such a motor will be found in the gas turbine, a motor which at present has not reached practical constructive stages.

(2) After a brief account of the history of the steam turbine from the days of Hero, and a discussion of the lines upon which recent invention has proceeded, Prof. Musil gives a very useful bibliography; then, as is usual in books on this subject, there follows a classification of the various steam turbines now in use. The theory of the well known Laval nozzle is then dealt with mathematically, and the proportions of such nozzles are worked out in detail; the results of experimental investigation into this question are given, and the effect on the flow through such nozzles of superheating the steam is discussed. The thermodynamic problems involved in this branch of the theory of the turbine are also treated by the author with the aid of entropy diagrams.

The remainder of the book is devoted to detailed descriptions of several types of turbines, beginning with the Laval, which is described in detail with a number of illustrations. The important problems due to the use of a flexible shaft in this turbine are investigated, also the question of the governing of the turbine. The steam consumption of this type when under test is given in a series of tables, and the relation of the actual steam consumption to the theoretical is dealt with in some detail. The second type of turbine taken up is the Parsons, again illustrated with a number of well drawn plates, and here also the question of the governing of the turbine forms an important section; details of the actual steam consumption under varying loads are given, and the results have been put into the form of a series of curves, which will be of great use to the student.

It may be well to point out that Prof. Musil expressly excludes from the scope of his text-book the application of the steam turbine to marine purposes. The other types of turbines which are dealt with by Prof. Musil include the Zoelly, the Riedler-Stumpf, the Curtis, and the Rateau. For each type good descriptions of the mechanical details are given, with very clearly drawn illustrations, and in the case of the Zoelly and the Rateau results of tests are also given. Prof. Musil's book will be found of especial value by students in engineering colleges, and by draughtsmen in those engineering works where turbines are now built. T. H. B.

OUR BOOK SHELF.

An Angler's Hours. By H. T. Sherringham. Pp. xii+264. (London: Macmillan and Co., Ltd., 1905.) Price 6*s.* net.

MR. SHERRINGHAM deserves the thanks of all anglers who have an idle hour and no fishing for having re-published his essays in book form, and he who is forced by sad circumstances to enjoy his fishing vicariously will find his time well spent in our scribe's company. There is a pleasant and old-world flavour in his style; whether he rises early to catch tench while the dew is still thick, or drowses away his Sunday afternoon in the July heat of a sunny garden, he is an entertaining companion, who boldly confesses to his crimes in the first person or conceals his triumphs, like Julius Cæsar, in the third with equal art. But there is instruction in his essays too, such mild instruction as may best suit an idler, and much shrewd observation of the habits of fishes delicately imparted in pointing the moral of a failure or adorning the tale of a success.

Many important considerations are thus put forward and discussed; for instance, the possibilities of the fly as a lure for other fish than trout and their kind, and the hopes held out to the fisherman who finds himself by some sluggish southern stream if he will only not despair but go forth and tempt the Cyprinids that haunt its troutless waters with flies and tackle suited to their tastes.

Again, there is the harmless, necessary worm; Mr. Sherrington handles him gently (especially when dragging him from his burrow), and adjures us to treat him as a friend in need and no mere despicable device for luring fish to an undeserved and unedifying end. We may be cursed with the instincts of a poacher, but must confess to a leaning towards that conception of the angler's art which advocates the

removal of fish from the water by the most effective means if fish are wanted, and by the most pleasant if amusement is our aim or if the waters hold few fish. We recall a schoolboy who fished for loaches with a gentle if he wanted loaches, but used a kitchen fork tied to the end of a stick if he wanted sport, and we have known others who rose superior to adverse circumstances, one who found all he wanted with a fly rod and small dace on the Cambridge Backs and another who could glory in the capture of eels with a gaff in the same unpromising water.

Mr. Sherringham has not withdrawn the veil that shrouds his early exploits, and he may have been more orthodox; but now he despairs of nothing, but finds good in all; if there are no fish he can study nature, and if there is no water he can shrewdly meditate on the ways of fish and men; an hour with him and his rod by a troutless tarn is as good as an hour by the Kennet in the mayfly time. We will not attempt to cull passages and quote them, or to draw invidious distinctions between one essay and another, but will leave each idle angler to do this for himself, with a candid admission that our own hours with Mr. Sherringham were all pleasant and instructive, but we should like more of them. A word of praise is also due to the publishers, who have produced a book the size and print of which add to its convenience as an adjunct to a pipe, an easy chair, and idleness.

L. W. B.

Botany of Cook's First Voyage. Illustrations of Australian Plants. By Sir Joseph Banks, P.R.S., and Dr. D. Solander, F.R.S. Part iii. Pp. iv+25; with 75 plates. (Trustees of the British Museum, 1905.) Price 25*s*.

INASMUCH as Solander was a pupil of Linnæus, this work furnishes a link with the founder of systematic botany, and it is known that Linnæus himself looked forward with great anticipation to the publication of the results of the collections made on this the first voyage of Captain Cook. The expectation was not fulfilled, and although certain of Solander's original descriptions were transcribed for sending to press, the MS. on Australian plants did not even reach this stage. A draughtsman, Sydney Parkinson, accompanied the expedition and executed a number of drawings, of which less than a third were finished for engraving purposes. Parkinson died on the voyage home, and other artists continued the work. The specimens and drawings were available, and were consulted by Gaertner and Sir Joseph Hooker, but unfortunately Bentham failed to do so when compiling his "Flora Australiensis." Possibly Banks was responsible for some of the work, but the text is taken from a MS. by Solander, and this is reproduced with brief notes and determinations by Mr. J. Britten, who has also written the interesting introduction printed with this part. In the notices of the earlier parts reference was made to some of the generic names, and, at a time when the rules of nomenclature are being discussed, it is appropriate to instance the name Banksia, that the majority of botanists associate with a genus of the order Proteaceæ, whereas Mr. Britten, in accordance with his views, adopts Isostylis, and refers Banksia to the genus of the order Thymelaceæ, otherwise known as Pimelea. This is merely quoted as an illustration of the confusion of names which renders it most desirable that a uniform system should be universally adopted. The present volume, with the two preceding parts, completes the Australian plants, and for this worthy tribute to the authors botany is indebted to Mr. Britten for his careful revision and to the British Museum for the production.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Education in Belgium and Holland.

DURING a recent cycling tour in parts of Belgium and Holland, as well as during the outward and homeward voyages on a Dutch trading steamer plying between a neighbouring Cornish port and Amsterdam and Antwerp, I have been greatly struck by several examples of the apparent educational superiority of Holland and Belgium over our own country, and at the present moment these examples may not be without interest to your readers.

(1) We were staying at a little inn near Dinant, in Belgium, and our hostess, seeing us occupied in drying some botanical specimens, brought us the herbarium of her son, a boy of about thirteen. These specimens were admirably dried and mounted, and were labelled with details concerning the characters of the order, &c., in such wise as to constitute a valuable educational asset. On inquiry, we found that the lad was a pupil at the lycée of Dinant, and that botany was a compulsory subject there, although the lad had not yet reached the stage of learning foreign languages. The boy himself was so bright and intelligent, and so brimful of enthusiasm for botany, that we at once supposed him to be exceptionally intelligent; but some old friends of the family informed us that until a year ago he was shy and "lumpish," and that the transformation had been effected by the lycée. Commend me to such schools!

(2) The skipper of the Dutch steamer on which we returned told me that in the elementary schools of Amsterdam the children are taken at intervals to the "Zoo" to receive object-lessons on the animals about which they read at school, and on other occasions are taken into the fields to receive object-lessons on the wild flowers; and what struck me especially was that this "mere sailor" —this skipper of a tramp steamer—fully appreciated the value of such practical instruction as giving an interest and sense of reality to his children's school-work. It was also rather surprising to hear such a man express the opinion that a little knowledge of astronomy rendered certain theological doctrines impossible of belief.

(3) The skipper of the outgoing Dutch steamer explained to me that the standard for mates' and masters' certificates in the Dutch mercantile marine is higher than in ours, there being three stages of mates' certificates instead of our two, and that before taking out a master's certificate it is necessary to attend a course of simple medical instruction for some months—surely a very reasonable regulation. On the subject of Englishmen's usual inability to speak a foreign language, he opined that this inability was due to our laziness—not realising, probably, the absurdities of our traditional school system.

(4) The second mate of one of these steamers—a rough lad of twenty-one—seeing me reading a volume of verse in a well known "series" with distinctive binding, asked me if I knew a book like that with Longfellow's poetry, for he had it at home and liked it! I cannot imagine an Englishman of the same age and status knowing a poet even in his own language, much less a foreign poet.

I must not occupy your space by drawing from these facts the moral that is obvious enough, but will conclude with two statements on which it is not pleasant to reflect. These Dutch steamers have driven out a line of English steamers which formerly traded between Fowey and Antwerp, and now practically monopolise the china-clay trade between these two ports; and of the total crews of forty-one carried by the two boats mentioned above, thirty-nine were Dutchmen and two were Germans from the Dutch border, whereas everyone knows that on English vessels often only a small minority of the crew are English. Are such results surprising?

F. H. PERRY-COSTE.

Polperro, Cornwall, June 22.

The "Bubbling" Method and Vapour Pressures.

IN the course of an endeavour to determine the osmotic pressure of a solution by measuring the relative lowering of its vapour pressure, we have been led to abandon Oswald and Walker's bubbling method on account of its inherent inaccuracy.

As the disabilities of this method seem to have been overlooked, we think that this note may be of use to other workers in the same field.

Oswald and Walker, it will be remembered, bubbled dry air through the solution, then through the water, and absorbed the moisture by means of sulphuric acid. The loss of weight of the water measures the relative lowering of the vapour pressure of the solution, and the gain in weight of the sulphuric acid represents the vapour pressure of the pure solvent, water.

Assuming the air to be at the same temperature throughout, it can easily be seen that the space occupied by a bubble of air, when leaving the solution, will be less than that which the same bubble will occupy when leaving the water, that is, the bubble expands while travelling up the water column, and will have taken up more water vapour than it should. The expansion of the bubble (and consequently the amount of vapour necessary to saturate the space occupied by it) is proportional to the difference in pressure at the top and bottom of the water column. If the total depth of the latter be, say, 6 inches, and the barometer stand at 30 feet of water, then an error of 1 part in 60 is induced.

This can conveniently be verified by passing air through two or more Winkler's tubes filled with water; it will always be found that the exit tube has lost weight. Owing to the form of the equation connecting osmotic and vapour pressures, the effect of the above error is magnified.

BERKELEY.
Foxcombe, near Oxford. E. G. J. HARTLEY.

Luminosity and Colour.

IN conjunction with my other methods of testing colour vision, I have been using Rayleigh's apparatus for matching yellow with a mixture of spectral red and green. I find that the proportions of red and green depend upon the luminosity of the match (both the mixed colour and the simple one being of similar luminosity); for instance, I require two and a half times as much green in the mixed colour when the match is bright compared with a match at a lower luminosity. Some persons make a match which is nearly the same at several luminosities, others require more and more green as the luminosity is diminished, and others when the luminosity is diminished cannot make a match at all. So three normal sighted persons may make a similar match at one luminosity, and at another one may appear to be an anomalous trichromatic and the other colour blind. I find that a colour blind person (a dichromic with considerable shortening of the red end of the spectrum) may make a match like a normal sighted one. F. W. EDRIDGE-GREEN.

St. John's College, Cambridge.

MEETING OF THE BRITISH ASSOCIATION IN SOUTH AFRICA.

THE arrangements for the forthcoming meeting of the British Association in South Africa have now been completed, and Mr. Silva White, the assistant secretary of the association, sailed for Cape Town in the *Walmer Castle* on Saturday last, July 1. The number of members who will proceed to South Africa to attend the meeting is 385, and of these no less than 276 members have intimated their intention to visit the Victoria Falls at the conclusion of the ordinary work of the association. The official party, consisting of leading representatives of science and guests of the association, with the general and sectional officers for this meeting and the president, numbers 140 in all, and will sail by the *Saxon* on July 29. Most of the other members will proceed to the meeting by the *Durham Castle* and the *Kildonan Castle*, both of which sail on July 22.

In a previous article (May 18, p. 59) the local arrangements for the meeting were described. There will be receptions and social functions, excursions, &c., at Cape Town, Durban, Pietermaritzburg, Johannesburg, Kimberley, and Bulawayo. The central organising committee for South Africa (chairman, Sir David Gill, K.C.B., F.R.S., hon. secretary, Dr. Gilchrist) has carried out the coordinating work of the programme. The lists of local committees and subcommittees contain nearly one thousand names, from which it may be concluded that much interest is taken in the meeting.

As already mentioned, lectures of a popular character will be delivered at the chief towns visited. These lectures have now been definitely arranged as follows:—

Cape Town: W. J. Burchell's discoveries in South Africa, Prof. Poulton; some surface actions of fluids, Mr. C. V. Boys. *Durban:* Mountains: the highest Himalaya, Mr. D. Freshfield. *Pietermaritzburg:* Sleeping-sickness, Colonel D. Bruce. *Johannesburg:* Distribution of power, Prof. Ayrton; steel as an igneous rock, Prof. Arnold. *Pretoria:* Fly-borne diseases, malaria, sleeping-sickness, &c., Mr. A. E. Shipley. *Bloemfontein:* The Milky Way and the clouds of Magellan, Mr. A. R. Hinks. *Kimberley:* Diamonds, Sir William Crookes; bearing of engineering on mining, Prof. Porter. *Bulawayo:* Zimbabwe, Mr. Randall-MacIver.

The president's address to the association will be delivered at Cape Town on August 15, and at Johannesburg on August 30. Mr. G. W. Lamplugh's report on the geology of the Victoria Falls will take the form of an afternoon address to Section C at Johannesburg.

Subjoined is a draft programme of the work of the sections:—

Section A (Mathematics and Physics).—*Cape Town:* President's address; progress of the arc of meridian and geodetic survey of South Africa, Sir D. Gill; to what extent can the ether affect the motion of matter? Prof. J. Larmor; observations of atmospheric electricity in South Africa, Prof. Beattie and Mr. Lyle; leak of electricity from certain heated substances, Prof. Beattie; the foundations of the kinetic theory of gases, Mr. Burbury; application of the kinetic theory of nebulæ, Mr. J. H. Jeans; radiation at low temperatures, Dr. J. T. Bottomley. There will also probably be communications from Mr. Hough on tides, and from Dr. Roberts on the Algol variables. *Johannesburg:* On the teaching of elementary mechanics (jointly with Section L if possible), Prof. J. Perry; on flight, Prof. G. H. Bryan; (1) electrical conductivity in relation to chemical action; (2) magnetic survey of South Africa, Prof. Beattie; report of the seismological committee, Prof. J. Milne; a form of dry Daniell cell, Mr. J. Brown; the strength of winding ropes in mines, Prof. Perry; the experimental foundations of the theory of heat conduction, Dr. C. H. Lees. There will probably be a communication from Mr. Sutton on the meteorology of South Africa.

Section B (Chemistry).—Detailed information regarding papers offered by members in South Africa has not yet been received, but the following provisional arrangement has been made:—*Cape Town:* Recent advances in agricultural science, A. D. Hall; vegetable assimilation, Dr. Horace T. Brown; enzyme action, Dr. E. F. Armstrong. These communications are intended to serve as a basis of discussion of agricultural chemical problems. *Johannesburg:* President's address; reports on various aspects of the metallurgy of gold by local experts. Communications by Dr. H. Marshall on the experimental basis of the dissociation hypothesis, and by H. Ingle on the soils of the Transvaal, have been provisionally accepted.

Section C (Geology).—*Cape Town:* Opening remarks by the president; the continent of Africa in relation to the physical history of the earth, Prof. W. J. Sollas; the classification of the Karroo beds of South Africa, Prof. R. Broom; report of the committee on the fauna and flora

of the English Trias, J. Lomas; extraordinary daily fluctuations in a Karroo well, Prof. A. Young; and other papers on the Karroo or Trias. *Joint meeting with Section E (Geography).*—The physical geography of Cape Colony, H. C. Schunke-Holloway; Glacial periods in South Africa, A. W. Rogers; changes of climate, as shown by movements of the snow line and upper tree line since Tertiary times, Prof. A. Penck; physiographical subject, Prof. W. M. Davis; Baviaan's Kloof, a contribution to the theory of mountain folds, E. H. L. Schwarz; the Stormberg formation in the Cape Colony, A. L. Du Toit; on the geology of South Victoria Land, H. T. Ferrar. *Johannesburg:* President's address; magnetic segregation of sulphide ores, Dr. A. P. Coleman; marginal phenomena of granite domes, Prof. G. A. J. Cole; relation of the igneous rocks to the crystalline schists, F. P. Mennell; the indicators of the goldfield of Ballarat, Prof. J. W. Gregory; petrographical subject, Prof. R. B. Young; the diamond pipes and fissures of South Africa, H. S. Harger; recent work of the Transvaal Geological Survey, H. Kynaston; the Victoria Falls, G. W. Lamplugh; the great laccolitic intrusions of the Bushveld, Dr. G. A. F. Molengraaff; evidences in the Transvaal of Glacial conditions in permo-Carboniferous times, E. T. Mellor; geological notes on the excursion to Pretoria, A. L. Hall; the great West Rand upthrust, Dr. J. T. Carrick; notes on a sedimentary formation older than the Witwatersrand beds, E. Jorissen; interesting outlines of the Witwatersrand formation, Dr. J. T. Carrick.

Section D (Zoology).—*Cape Town:* President's address; the Triassic reptiles of South Africa, with remarks on the origin of mammals, Dr. Broom; a comparison of the Permian reptiles of Russia with those of South Africa, Prof. Amalitzky; South African scorpions, Dr. Purcell; recent work on gametogenesis and its bearing on theories of heredity, L. Doncaster; the migration of birds in the southern hemisphere, W. L. Sclater; the ostrich, A. H. Evans. *Johannesburg:* Pearl oysters and pearls, Prof. Herdman; recent discoveries in the South African deep sea, Dr. Gilchrist; cephalodiscus, Dr. Harmer; the growing-point in vertebrates, Prof. Cleland; South African ticks, Drs. Cooper-Foster and Nuttall.

Section E (Geography).—*Cape Town:* President's address; afforestation of South Africa; the unveiling of the coasts of Africa (lantern views of old maps), H. Yule Oldham; the Ordnance Survey of the United Kingdom, Colonel Johnston; a comparison of the periodicity of the meteorological conditions of London and Cape Town, Dr. H. R. Mill; Gough Island, Rudmose Brown; terrestrial globes as a necessary adjunct to the teaching of geography, Captain Creak; excursions as a means of teaching geography (lantern), J. Lomas. *Johannesburg:* The evolution of Africa, Dr. J. Scott Keltie; a new rainfall map of Africa, A. J. Herbertson and P. C. Waite; boundaries and areas in Africa, J. Bolton; the physical geography of the Transvaal, Tudor Trevor; notes on the geography of Africa south of the Limpopo, F. S. Watermeyer; the game preserves of the Transvaal, Major Stevenson Hamilton, D.S.O.; the Sikhim Himalayas and Tibet, Douglas W. Freshfield; Asiatic subject, Prof. Cordier.

Section G (Engineering).—*Cape Town:* Metcalfe on Zambezi Bridge and Rhodesian railways; ocean turbine boats, Prof. Byles; roller bearings, wire ropes in mines, and probably automobiles. *Johannesburg:* President's address (irrigation); strength of winding ropes in mines, Prof. Perry.

Section H (Anthropology).—*Cape Town:* President's address; the totemism of the Bantu, E. S. Hartland; the musical instruments of the natives of South Africa, Hy. Balfour; American Negroes, Miss Pullen-Burry; artificial deformation in Africa, Dr. von Luschan. *Johannesburg:* arts and crafts among the natives of South Africa, Dr. Schoenland; stone implements in South Africa, Mr. Johnstone; bushman paintings with reproductions, Dr. Squire; the affinities of the Hottentots, Dr. von Luschan; the Modjadje, Rev. Reuter; the Bawenda, Rev. Gottschling; report on Zimbabwe, Mr. MacIver; the Basuto, H. E. Mabille.

Section I (Physiology).—*Cape Town:* Discussion on the effect of climate on health, opened by Sir T. Lauder Brunton (Dr. David Ferrier, Prof. McKendrick, Dr. Gregory, Dr. Jasper Anderson, Prof. Bohr, and Dr. J. A. Mitchell will take part); so-called scurvy of South Africa, Dr. Gregory; on plague, Dr. J. A. Mitchell; leprosy in Cape Colony, Dr. A. S. Black; South African drugs, Dr. Moberley; discussion on horse-sickness and allied diseases, opened by Dr. Edington (Dr. Hutcheon, Mr. du Plessis, Dr. Wm. Robertson, Colonel Bruce, and Prof. Sims Woodhead will take part); stock diseases in South Africa, Dr. Hutcheon; ticks as a means of conveying disease in South Africa, Mr. Lounsbury. *Johannesburg:* President's address; horse-sickness, Dr. Theiler; rinderpest, Dr. G. Turner; a discussion on lung diseases in connection with mining (Dr. Sims Woodhead) is under consideration; nervous diseases, Prof. Ferrier; the life-history of coloured labourers in the Transvaal, Dr. D. Macaulay and Dr. Louis Irvine; dysentery, Colonel Cecil Birt.

Section K (Botany).—*Cape Town:* The present position of our knowledge of seaweeds, Prof. R. W. Phillips; the fossil floras of South Africa, A. C. Seward; educational methods in the teaching of botany, Harold Wager; notes on irrigation farming on the Orange River, F. B. Parkinson. *Johannesburg:* President's address; photography as an aid to œcological research, Prof. F. E. Weiss; the problems of heredity, R. P. Gregory. It is expected that Prof. Engler, Prof. Pearson, and others will contribute papers.

Section L (Educational Science).—*Cape Town:* President's address; the teaching of science, Prof. H. E. Armstrong; the teaching of science in South Africa, Dr. Hahn; rural education, appropriate to colonial life in South Africa, and agriculture, A. D. Hall; the higher education of women in South Africa, Miss Clark; disabilities of South African school boys, W. A. Way; Cape education, its difficulties and development, Rev. W. E. C. Clarke. *Johannesburg:* Changes in the Dutch language since its introduction into South Africa, Dr. Brill; education on the veldt, Mr. Corbett; prospects of secondary schools in the Transvaal, Mr. Hope; teaching of agriculture, F. B. Smith; native education, Hobart Houghton; progress of education in the Transvaal, H. Warre Cornish; education in Rhodesia, G. Duthie; a school of forestry, T. R. Simms; the teaching of architecture, R. G. Kirkby; education in the Orange River Colony, Hugh Gunn; manual instruction in the Transvaal, T. Lowden; recent improvements in the training of infants, with special reference to South Africa, Miss Welldon; discussion with Section A, the teaching of elementary mathematics.

THE PRINCIPLES OF GEOLOGY.[1]

THE principles are, notwithstanding the origin of the word, the last things you attain to in the course of scientific investigation; but they are what you first explain to another who is commencing his study. You may make a further selection of such parts as are for any reason the easiest or most suitable for him to begin with, and call them the elements. Lyell's classic work has pretty well fixed what shall be the conventional meaning of "The Principles of Geology." They are the laws or explanations which we arrive at in respect of the phenomena exhibited in the earth's crust from direct observation of those phenomena themselves or of the recent operations of nature which we see producing analogous results. Their value depends upon the opportunities afforded of obtaining evidence and upon the personal faculty of eliminating sources of error.

In the case of geology, the subject is so vast that its different branches are growing further and further apart, until they seem to have an intergrowth with the branches from other subjects the original stem of which was far removed from their own.

From the observation of rock masses inferences have been drawn as to the conditions which prevailed in past times, and theories have been propounded as

[1] "Structural and Field Geology." By Dr. Jas. Geikie. Pp. xx + 435. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson, 1905.) Price 12*s.* 6*d.* net.

to the forces which have rolled up the strata and produced such varied superficial and deep-seated phenomena. These form the principles of dynamical geology, and it is the description of the resultant structures and the methods of observation which form the chief subject of the interesting handbook just published by Dr. James Geikie under the title "Structural and Field Geology."

The two first chapters are devoted to an examination of the rock-forming minerals. These are very few in number if we leave out all except those which are the essential constituents of the common rocks.

After studying their composition and characteristics in hand specimens or small slices adapted for examination under the microscope, there is much to be

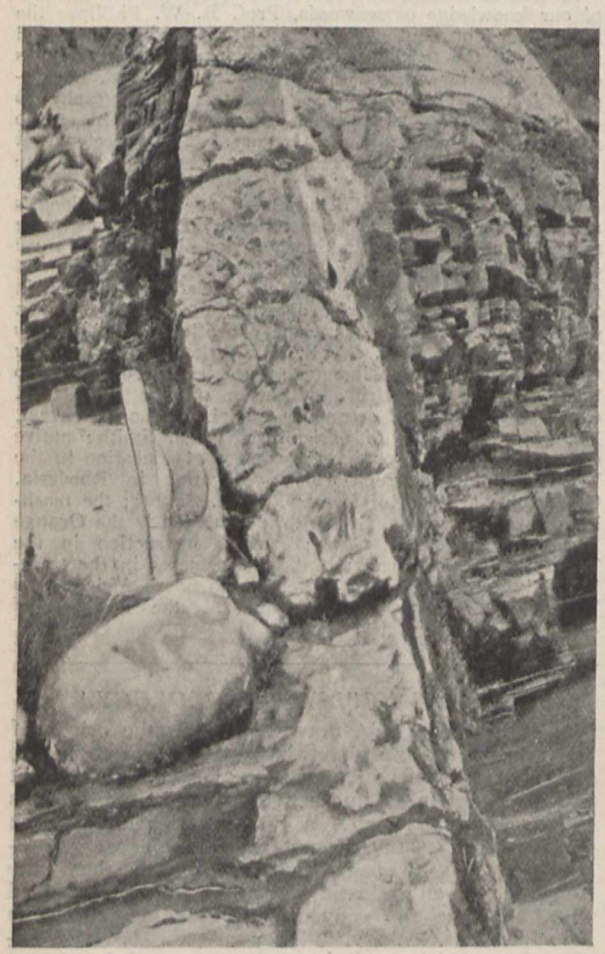


Photo. by H.M. Geological Survey.

Fig. 1.—Fault-rock, River Garry, at Dalnacardoch, Perthshire. (Reproduced on a reduced scale from "Structural and Field Geology," J. Geikie.)

learnt as to the history of the earth's crust from the observation of large masses of rock. We can see whether they were laid down in comparatively tranquil water, or hurled along by torrents, or dashed against a shore. We notice that what was once mud or sand or shingle is now solid rock, and we try to make out in each case whether this was brought about by the introduction of some cementing material or caused by the pressure of superincumbent masses, and whether the changes were helped by the action of the high temperature experienced by rocks depressed to great depths or crushed by irresistible earth movements. Chemical reactions and the crystallisation of various minerals out of the material of the rock produce changes on a small scale, as seen in concretions and drusy cavities, or on a large scale as in the case of the formation of vast beds of crystalline limestone from the calcareous fragments of various organisms. We can infer from a comparison of certain rocks with the products of recent volcanoes that ancient volcanoes also injected molten matter through the riven rocks, poured out vast sheets of lava, and covered wide areas with volcanic ash.

The rocks so formed and so altered have yet to be regarded from another point of view. They have been depressed, uplifted, and thrown into all sorts of positions, now being dragged out, now crumpled up into every variety of fold, the compressible portions often making up by vertical thickening what they lose in horizontal extent, and those that would not yield to such molecular re-arrangement being reduced to the same dimensions by crumpling.

Divisional planes are developed in them, some being due to crush, some to shrinkage, some to the variety in the succession of deposits, and when the strained and bending rock must break it is apt to give along these lines of weakness, so that we find faults commonly coinciding with master joints, thrusts with bedding planes, and so on.

The last seven chapters are more specially devoted to the second subject in the title of the book, namely, field geology. This could not be altogether dissociated from the observations recorded in the earlier part of the work. The information there given is the outcome of original observations in the field, but our author now deals more with the methods employed, and explains what are the most useful appliances for the work and what are the indications which the surveyor must be on the alert to detect. Perhaps, having regard to the numerous monographs which have recently been published on the subject of scenery, he has given greater prominence to the causes than to the effects, to the earth structures to which most scenic features must ultimately be referred rather than to the total result of movement and denudation by which anomalous river flows and abnormal features must be explained.

A study of recent organisms enables us sometimes to establish the relation between the soft and perishable parts and the hard parts which alone are commonly preserved in the rocks, and thus by a comparison of the fossil forms with their nearest recent representatives to learn something of the order of succession of life upon the earth and the conditions under which fossil plants and animals existed. Such analogies must not, however, be pressed too hard. Even such a recent case as the occurrence together of the remains of lion, hyæna, and hippopotamus with the hairy elephant and woolly rhinoceros in our gravel terraces can hardly yet be said to have received an altogether satisfactory explanation. Before we draw inferences from the abundance or rarity of certain fossil organisms we must carefully consider their mode of entombment and the conditions which favour the preservation or the destruction of their remains.

Dr. Geikie has dealt very shortly with these principles of palæontology, but devotes most of his work to the inorganic side of geology.

Even with this limitation of subject the work takes a somewhat encyclopædic character owing to the great number and variety of the observations and inferences which have to be recorded. The treatment is rather dogmatic than critical. With an author so experienced and acute in observation this may be for many an advantage, but students require a discussion of arguments where conclusions differ, and references to other authors where they may find the matters more fully treated which are here of necessity briefly stated.

The formation of ripple marks, for instance, wants fuller explanation than the statement that "they owe their origin to a wave-like motion set up in the semifluid sediment by the water passing over it."

The work is illustrated by a large number of diagrammatic sketches by the author and photographs by members of the staff of the Geological Survey. As examples, we reproduce the pictures of two common phenomena which have many points of general resemblance to one another but a very different origin. Plate xxxix. represents a fissure the strata on either side of which have been relatively displaced by earth movements, either repeatedly in one direction or with a to-and-fro motion, so that the walls of the fissure have been rubbed smooth,

Our author has wisely avoided most of the shibboleths which it is the fashion for specialists to introduce into their explanations of the simplest phenomena, but though students may escape the interruption of having to consider the exact application of mylonisation and schillerisation, which are not in the index, though one is found in the text, they must learn the meaning of such terms as synclinorium or geanticline. Difficulties and absurdities in nomenclature are perhaps characteristic of the present phase of scientific literature, and our author has been wonderfully considerate in this matter, and has given us a very useful handbook, admirable in the freshness and terseness of its descriptions and the clearness and abundance of its illustrations.

Photo. by H.M. Geological Survey.

Fig. 2.—Basalt Dyke Cutting Sandstone and Shale, Kilbride Bennan, Arran. (From "Structural and Field Geology," J. Geikie.)

fluted, and polished by the movement. The triturated rock and the fragments broken off fill the crack, and this débris is often penetrated by mineral matter and consolidated into a mass harder than the rocks through which it passes. The walls of the fissure are sometimes altered mechanically and by infiltering water to a considerable depth.

In Plate xliv., on the other hand, we see a rift in the rocks filled with matter which has welled up from deep-seated rock which has become molten. In this case, also, the immediately adjoining portion of the rock which it traverses is altered, and very commonly shows slickensides when earth movements have acted upon these two rocks of such different tenacity and hardness; but the composition of the traversing rocks is so unlike in the two cases, and the character of the marginal alterations so dissimilar, that there is seldom any room for doubt as to the origin of each.

NOTES.

AMONG those who are the recipients of the King's birthday honours we notice the following:—Lord Rayleigh, O.M., F.R.S., has been made a Privy Councillor; Knighthoods have been conferred upon Prof. T. McCall Anderson, of the University of Glasgow; Mr. E. W. Brabrook, C.B., formerly Registrar of Friendly Societies; Dr. A. B. W. Kennedy, F.R.S., Emeritus professor of engineering and mechanical technology at University College, London, and president of the Admiralty Committee on Machinery Designs; Dr. Boverton Redwood; and Dr. W. J. Smyly, president of the Royal College of Physicians, Ireland. Colonel D. Bruce, F.R.S., has been made a Knight Commander of the Bath. Dr. W. T. Prout, principal medical officer, colony of Sierra Leone, and Dr. J. W. Robertson, late Commissioner of Agriculture and Dairying of the Dominion of Canada, have been made C.M.G.'s. The

honour of Knight Bachelor has been conferred upon Dr. E. S. Stevenson, member of the medical council of the Cape of Good Hope; and Mr. Philip Watts, F.R.S., Director of Naval Construction, is made an ordinary member of the Civil Division of the Second Division, or Knight Commander, of the Order of the Bath.

A MEETING of Members of Parliament, presided over by Mr. Haldane, met on Tuesday last in a committee room of the House of Commons to consider the question of a request for an additional State grant to the National Physical Laboratory. Dr. Glazebrook having made a statement as to the aims and needs of the laboratory, was followed by Mr. Chamberlain, who in the course of his remarks said that the real problem of the nation was how to improve our highest education. He felt convinced that if they were to speak of the whole matter as an investment, it was from higher education that they would gain the largest return. He asked in what way the National Physical Laboratory was distinct from other universities, such as those of Birmingham, Liverpool, Manchester, and Sheffield. He asked this because it was not merely the object of the universities to educate young persons; it was their object to carry on post-graduate research in the largest possible way—to make precisely the experiments which the laboratory was making. They did not want in any way to discourage that work in these separate universities; they did not want to centralise any branch of scientific work. He had himself rather a horror of central institutions, and he had a great belief in the freedom and the competition of a number of separate centres. He was sure that there was no idea of injurious competition in the minds of the promoters of the meeting; but he would like to be certain that it might not have that effect. After all, they were all more or less dependent, and they would be increasingly dependent, upon State aid, of which they had had very little up to the present. Were the universities, each of them, to apply separately and frighten the Treasury, or were they to put their forces together, and go as one body representing the whole and ask for a very largely increased grant, leaving it for consideration afterwards how that grant should be divided? Why were they making a special demand at that time for that particular institution? He was all in favour of giving assistance to any institution of the kind. But he should like to know in what way this was to be distinguished from the University of Liverpool or any of the others where they were carrying on the work of physical research. He would even ask why the promoters of this institution should operate alone—whether they would not do much more if they all came together. In that case they would, of course, have very much larger Parliamentary support. If each institution was to ask for what it wanted he was afraid the chances of success would not be great. He might be considered to be throwing cold water on the matter at the beginning, but as a fact he most entirely sympathised with the general object. He thought that such an institution was absolutely necessary, and if there were no others, then he would say most distinctly that it would have a special claim upon them. But as there were, and as they were all in their infancy, he wished to know in what way it was thought best to treat the matter when they approached the Government, whether as a whole on behalf of scientific instruction generally or whether on behalf of the claims of that particular institution. The chairman said they were all interested in what Mr. Chamberlain had said, and his suggestion of a collective movement in favour of the highest education. He thought the work that the National Physical Laboratory was doing could not be organised in connection with any of the universities. The following resolution was then put to the meeting and carried unanimously:—"That this meeting, being satisfied of the necessity of further State aid to the National Physical Laboratory, at Teddington, as regards both equipment and maintenance, requests the chairman and conveners of this meeting to prepare and present a memorial to the Chancellor of the Exchequer asking for such additional aid, and that the memorial be signed by members here present or who, being absent, may be in sympathy with its objects." Mr. Chamberlain, who had to leave before a decision was arrived at, said that if the meeting decided in favour of the resolution his name might be attached to it.

ON Monday last Mr. Ailwyn Fellowes, President of the Board of Agriculture, was waited upon by a deputation from the Pharmaceutical Society respecting the proposed legislation to extend to other than chemists the right of selling poisonous products used in agriculture and horticulture. It was argued on behalf of the society that it would be dangerous to the public to allow any one to sell poisonous articles; that there was no difficulty in the way of farmers or horticulturists getting the articles through a chemist as cheaply as through any other person; and the public would be safeguarded by the special knowledge of the chemist and druggist. In reply, the President of the Board of Agriculture said he had received an enormous number of resolutions from all over the country in favour of a relaxation of the present law. The new regulations under the proposed Bill would provide:—(1) that no poisonous substance shall be kept in any shop or premises where articles of food are stored or kept for sale; (2) that poisons must be kept in a separate cupboard from other goods; (3) all poisons shall be sold in an enclosed vessel, labelled with the word "Poison"; (4) liquid poisons shall be sold only in bottles or tins easily distinguishable by touch from ordinary bottles or tins; (5) in granting licences the local authority shall have regard to the facilities already existing in the neighbourhood for the purchase of poisonous compounds.

ACCORDING to the Berlin correspondent of the *Daily Chronicle*, Dr. Robert Koch has written from German East Africa stating that he has been studying the nature, habits, and anatomy of the tsetse fly, and that he has discovered a certain parasite in the fly to which he attributes the disease to which the cattle bitten by the fly succumb.

THE death is announced, at the age of fifty-five years, of Prof. von Mikulicz-Radecki, of the University of Breslau, well known as a surgeon and for his numerous papers and memoirs on surgical subjects. About a year ago he delivered the Cavendish lecture before the West London Medico-chirurgical Society, and last year he was the president of the surgical section of the German Association of Men of Science and Medical Men.

THE death is announced of Prof. P. T. Cleve, of Upsala, on June 18. He was born in 1840, and was the leading exponent of chemical research in Sweden. His hydrographical investigations were also of great importance. He was an honorary member of the Chemical Society.

THE Barnard medal of Columbia University has just been awarded to Prof. H. Becquerel for "important discoveries in the field of radio-activity, and for his original discovery of the so-called dark rays from uranium, which discovery has been the basis of subsequent research into

the laws of radio-activity, and of our present knowledge of the same." The medal has been previously awarded to Lord Rayleigh, Sir William Ramsay, and Prof. Röntgen.

A PORTRAIT of Prof. W. Osler has been presented to the University of Pennsylvania by the members of the classes which from 1885 to 1891 studied under Prof. Osler when he occupied the chair of clinical medicine at the university.

A MEDAL has been struck to commemorate the successful completion of the Simplon Tunnel. On one side of the medal is a figure of Mercury and a locomotive emerging from the tunnel, with the inscription "Aux Collaborateurs et Ouvriérs du Percement du Simplon"; on the other is a representation of the meeting of the workmen when the last obstacle had been broken down, and bears the words "Souvenir de la Rencontre des Galeries, Fevr. 1905."

BUSTS of Joseph Lancaster and Michael Faraday—the gift of Mr. Passmore Edwards—were unveiled on Wednesday of last week in the entrance hall of the Borough Polytechnic Institute by Prof. Silvanus P. Thompson, F.R.S., who delivered an address.

To commemorate the anniversary of the one hundred and twenty-fifth birthday of Audubon, the American Museum of Natural History has placed on exhibition a collection of Audubon relics, among which is the portfolio in which Audubon carried specimen plates while securing subscribers to his great work, together with sketches and finished plates.

A SCHEME for the establishment of a Central Research Institute at Kasauli, and a laboratory for scientific, medical, and sanitary work at the headquarters of each provincial Indian Government, to provide more adequate means for the scientific study of etiology and the nature of the diseases of the country, has been published. It is hoped that when the project has been developed, not only will it be no longer necessary for officers to go to Europe to study the bacteriology and parasitology of tropical diseases, but that workers from England and the European Continent will avail themselves of the Indian laboratories and the unrivalled material for study which the diseases of the country afford. The scheme has the approval of the Secretary of State, and the Government of India proposes to appoint as the first director of the Central Research Institute Lieut.-Colonel Semple, M.D., well known for his work in connection with the Pasteur Institute of India.

A NEW society, to be known as the Harvey Society, has been established in New York under the patronage of the New York Academy of Medicine. Its purpose is the diffusion of scientific knowledge of anatomy, physiology, bacteriology, pathology, pharmacology, and physiological and pathological chemistry by public lectures given by men who are workers in the subjects presented. Each lecture is intended to represent the state of modern knowledge concerning the topic treated, and will be addressed to the general medical profession who are interested in the scientific side of medicine. The president is Dr. Graham Lusk. The members of the society consist of two classes, active and associate members. Active members are laboratory workers in the medical sciences residing in New York; associate members are such persons as may be in sympathy with the objects of the society, and reside in New York. The first course of lectures will be given at the Academy of Medicine on Saturday evenings during the winter of the years 1905–6.

A CONVERSAZIONE took place at King's College, London, on Thursday last, when many scientific and other exhibits were on view. An interesting item was a set of various forms of glow-lamps, a demonstration of which was given by Prof. E. Wilson in the Siemens electrical engineering laboratory, and which included mercury-vapour, Nernst, tantalum, and osmium lamps. There was also an exhibition of crystallisation shown on the screen by Prof. Herbert Jackson.

THE annual conversazione of the Institution of Electrical Engineers was held on June 29 at the British Museum (Natural History), South Kensington. It was attended by upwards of 1000 guests.

THE third International Electric Tramway and Railway Exhibition was opened at the Agricultural Hall, Islington, on Monday last by Lord Derby.

THE annual general meeting of the Society of Chemical Industry will begin in London on Monday next, June 10. The society numbers among its members some 1500 Americans, and at the last annual meeting, which, with special reference to the St. Louis Exhibition, was held in the United States, an American, Dr. W. H. Nichols, was elected president in succession to Sir William Ramsay. The American visit was a great success, and the British members of the society have looked forward to the time when they would be able to welcome in Great Britain their president and American and Canadian co-members. The proceedings in connection with the forthcoming meeting have therefore been specially arranged in view of this return visit. Dr. Nichols has already arrived in England, and we understand that the guests of the society will number in all about 120. A lengthy and interesting programme has been arranged.

THE sixty-fourth annual meeting of the Medico-psychological Association of Great Briain and Ireland will be held at 11 Chandos Street, Cavendish Square, on July 20 and 21 under the presidency of Dr. T. Outterson Wood. The annual dinner of the association is to take place on July 30 at the Whitehall Rooms.

THE American Anthropological Association is to meet in San Francisco, Cal., from August 29 to 31 next under the presidency of Prof. F. W. Putnam, when papers relating to ethnology, archæology, prehistoric man, physical anthropology, linguistics, and general anthropology will be read. The museum of the department of anthropology of the University of California at the affiliated colleges in San Francisco, which has recently been installed, but not yet opened to the public, will be the headquarters of the association.

A PRELIMINARY circular has been issued to announce that the tenth International Geological Conference will be held in 1906 in Mexico. An executive committee has been appointed, with M. José G. Aguilera, director of the National Geological Institute of Mexico, as president, and M. Ezequiel Ordóñez, assistant director of the same institution, general secretary. It is expected that the congress will open on September 6, 1906, and last for eight days.

THE Postmaster-General again directs attention to the fact that pathological specimens and articles of a similar nature may be forwarded only by registered letter post and in proper cases. The Post Office regulations provide that any deleterious liquid or substance sent by post must be enclosed in a receptacle hermetically sealed, which receptacle must itself be placed in a strong wooden, leathern,

or metal case, in such a way that it cannot shift about, and with a sufficient quantity of some absorbent material (such as sawdust or cotton wool) so packed about the receptacle as absolutely to prevent any possible leakage from the packet in the event of damage to the receptacle. The packet must also be marked "Fragile with care."

AN exhibition of the results obtained last year by Prof. Flinders Petrie and his coadjutors in the field of Egyptian archæology was opened at University College, Gower Street, on Thursday last, and will remain on view for a month. Last winter excavations were carried on in the peninsula of Sinai. At Sarabit el Khadem the mines were of turquoise, and no copper was found. The interesting feature on this site is the evidence of the Semitic—not Egyptian—worship which was practised. The whole region is scattered over with shelters for pilgrims, usually containing a Bethel stone, some of which have Egyptian inscriptions of the twelfth dynasty. The pilgrims came for oracular dreams like Jacob's, and the shelters are only in the region of the temple. They are quite distinct from the miners' dwellings, such as are common at Wady Maghara. This Bethel custom is a special feature of Semitic belief, and is quite unknown in Egypt. The temple at Sarabit was originally a sacred cave—perhaps as early as Seneferu. It was carved by Amenemhat III., and furnished with altars for the worship of Hathor. In front of it, on the edge of the hill, was an enormous mass of ashes of burnt offerings, showing the burnt sacrifices on high places familiar to Semitic worship. The temple was extended over these burnt offerings by Tahutmes III. and other kings until Sety I. Of the temple itself a beautiful and instructive model is shown, the scale being one-fiftieth. The whole length of the building is nearly 250 feet. Though it has been known since the time of Niebuhr, no clearance had been made; but now many new features have been brought to light from under the rubbish. The primitive shrine of Hathor was a rock cave, and the discovery of a hawk with the finely cut name of Seneferu makes it probable that the shrine is as old as the third dynasty.

IT is announced in the *Electrician* that as a result of the successful experiments with the De Forest wireless telegraphy in moving trains, the Chicago and Alton Railway will supply wireless telegraphy apparatus on its two express trains running daily between Chicago and St. Louis, and ultimately on its whole system. Messages were received while the train was running at fifty miles per hour. For some time while the train was approaching the Mississippi River above the elevated stretch leading to Merchants' Bridge, the increase in strength of the signals was very marked, but when the train entered the framework of the bridge it was found that signals became almost imperceptible owing to the screening action of the bridge. It was observed also that the signals were stronger when the train was broadside on to the transmitting station and running at right angles to it. The fact that the radiations were following the course of the river in preference to overland paths was very marked as the train pulled out of Alton, Illinois. At one point the track runs within a few hundred feet of the river, and at this point the signals from St. Louis, thirty miles away, which had just previously become very weak, were increased in intensity to a surprising degree. No difficulty seems to have been experienced even when the train was many miles from the transmitting station and was threading through the yards and sidings of Chicago, completely hidden by large elevators and steel structures of every description.

THE New York correspondent of the *Lancet* states that a subcommittee of twenty-one coloured physicians and clergymen has been organised by the New York Charity Organisation Society's Committee on the Prevention of Tuberculosis to fight tuberculosis among the coloured people of New York. The New York health board is cooperating with the movement, and has placed its dispensary under the supervision of the medical members of the subcommittee for three evenings a week. A course of illustrated lectures treating of tuberculosis will be given shortly in the churches for coloured congregations. It is stated that there are between 60,000 and 65,000 coloured persons in New York city, and that their death-rate from tuberculosis is 5·33 per 1000, as against 2·37 per 1000 among the whites.

THE first part of the Home Office "Mines and Quarries: General Report and Statistics for 1904" has just been issued. The total number of persons employed at the mines of the United Kingdom was 877,057, of whom 847,553 worked at the 3333 mines under the Coal Mines Act and 29,504 at the 673 mines under the Metalliferous Mines Act. The total number at coal mines is the highest recorded since 1873, and that at metalliferous mines the lowest. The output included 232,428,272 tons of coal, 3,043,045 tons of fireclay, 7,557,733 tons of ironstone, and 2,333,062 tons of oil shale. The coal production is the highest recorded. The deaths from accidents amounted to 1055 in collieries and 35 in metalliferous mines, the death rate per 1000 persons employed being 1·24 in the former case and 1·19 in the latter. It is gratifying to note that the former rate has never been lower.

NO. 21 of the *Publications of the Earthquake Investigation Committee* (Tokyo) contains a lengthy paper by Prof. Omori on horizontal pendulum observations at Tokyo; the most interesting of the results is the conclusion that the first movement is usually towards the origin in the case of near or moderately distant earthquakes, but in a small proportion of the records it is away from the origin. The author attributes this difference to a distinction in the cause of the earthquakes, the first type being due to the sudden collapse of a subterranean cavity, or the crushing down of a horizontal stratum, and the second type to the sudden splitting asunder or widening of a vertical cavity by the expansive action of steam or gases. In another part of the paper, however, he points out that in the case of artificial earthquakes caused by explosions, the first movement is outwards if these take place on the surface of the ground, but inwards if the explosive is buried at some little depth. Other points which are commented on are the resemblance between the records of earthquakes of similar intensity and originating in the same region, and the occasional occurrence of long-period undulations combined with shorter-period vibrations in the first phase of distant earthquakes.

THE investigations of the relation between variation of barometric pressure and sea level on the coast of Japan, which were noticed in NATURE of November 3, 1904, has been continued by Prof. Omori, who shows, in the *Proceedings of the Tokyo Physicomathematical Society* (vol. ii., No. 20), that the relationship found on the Pacific extends to the western coasts of Japan, so that all round these islands the rise of sea-level is greater than that due to the local diminution of barometric pressure alone. The consequence of this is that a low barometer means a

decrease of pressure on land but an increase of pressure on the surrounding sea bottom, the latter being about 1·6 times as great as the former. An interesting result, attributed to this cause, is given in No. 21 of the *Publications of the Earthquake Investigation Committee*, where the behaviour of a horizontal pendulum during the storm of October 10–11, 1904, is described; the low-pressure area passed to the east of Tokyo, and during its passage the horizontal pendulum indicated a tilting, which reached 3·5 seconds of arc, to the east—that is, in the direction of the low barometric pressure—indicating an increase of pressure on the sea bottom in that direction.

WE have received the report of the Government Observatory, Bombay, for the year 1904. This observatory deals chiefly with terrestrial magnetism, meteorology, and seismology; it has issued a long series of valuable publications, and many years ago Mr. Charles Chambers, then director, prepared an elaborate discussion of the meteorology of Bombay. The care bestowed upon the records of the photographic self-registering instruments may be gathered from the fact that the watchmen go round once every hour, night and day, to see that the clocks are all going and the lights burning. Their regular attendance is automatically recorded on the photograms themselves. The total rainfall for the year amounted to only 33·4 inches, being 41·7 inches below the normal value for twenty-four years (1873–96); this is the smallest fall recorded at the observatory. Milne's seismograph registered thirty-five earthquakes during the year.

FROM information received from the president of the International Aëronautical Committee, we find that in the months of January to April last the average monthly number of stations participating in the balloon and kite ascents was sixteen; kite observations were made each month at Oxshott by Mr. Dines, and at Aldershot, by the military balloon section, in February and March. The most notable heights attained, by means of unmanned balloons, were 19,420 metres at Strassburg and 21,733 metres at Berlin. In April kite and unmanned balloon observations were made from the Prince of Monaco's yacht in the Mediterranean. These are the first ascents made with unmanned balloons in the open sea, and these successful experiments show that Prof. Hergesell's idea of obtaining such observations over the oceans may possibly be realised.

BULLETIN No. 35 of the Storrs Agricultural Experiment Station, Conn., deals with the Camembert type of soft cheese. The conclusion is arrived at that the ripening is due to definite moulds and bacteria. One mould (? *Penicillium candidum*) seems to produce the changes which result in the texture of the cheese, and it, together with the *Oidium lactis*, produces the flavour, lactic acid bacteria giving the necessary acidity and retarding the action of other bacteria. It is found possible so to control the process of ripening that the desired result may be obtained with reasonable uniformity.

WE have received the first number of a new periodical, the *Medico-technologisches Journal*, edited by Dr. Berthold Beer, which is to be devoted to medical and surgical instruments and the various apparatus employed in bacteriology, photography, radiography, hygiene, &c., and appertaining to the medical sciences and physical therapeutics. It contains a prefatory article by Dr. Beer, and descriptions of Zeiss's apparatus for the demonstration of ultra-microscopic particles and of various surgical instruments and pharmaceutical preparations, together with photographic and balneological notes and new literature. Such a journal, provided it gives concise descriptions of the principal new inventions of the various countries, and not of Germany only, should supply a decided want.

IN a paper contributed to the June number of the *Zoologist* Mr. J. G. Millais points out that the English black rat—the type of *Mus rattus* of Linnæus—is by no means the blackest representative of the species, that distinction falling to a race which it is proposed to call *M. rattus ater*, and of which specimens have been taken in England. No doubt this is right enough, but when the author proceeds to suggest English names for the various local races of the species in question he follows a course which, in our opinion, cannot but land him in difficulties. The species itself he rightly calls the black rat, but for its local races the name of Alexandrine rat is taken, so that the typical form becomes the northern Alexandrine rat, while the new race is termed the black Alexandrine rat. Their proper designations should be the Alexandrine black rat and the Black Sea black rat.

IN the *Transactions of the Royal Society of Edinburgh* (vol. iii., part iii., No. 22) Sir Charles Elliot describes the nudibranch molluscs collected during the Scottish National Antarctic Expedition. These comprise but two species, two of which are, however, referable to new and interesting generic types. The most remarkable feature is the absence in the collection of all representatives of Doris and its allies, a feature common to the *Discovery* collection of this group, which has been entrusted to the author for description. Certain holothurians of the genus Psolus from the Antarctic present a superficial resemblance to dorids, although this is not regarded as more than accidental.

As a supplement to part iii. of Prof. Herdman's report on the pearl oyster fisheries of the Gulf of Manaar, published by the Royal Society, Messrs. Shipley and Hornell describe several new parasitic worms (some referred to new generic types) obtained from elasmobranch fishes frequenting the pearl-banks. Possibly, although not probably, some of the cestodes may be the parent form of the pearl-producing larvæ. No direct light is thrown by the investigations on the problem of the *provenance* of the pearl-producing parasite.

THE departmental committee appointed to investigate certain matters connected with the sea-fisheries of Sutherland and Caithness reports that cod and ling have of late years been much less abundant than formerly on the coast. As regards a proposed close time for herrings, it was considered that the fishermen themselves are the best judges as to whether such a protective measure is advisable. Trawling in the Moray Forth (which is not permitted to British craft) by foreign vessels is held to be responsible for considerable injury to the fishery.

ACCORDING to the report for 1904, the Marine Biological Association of the West of Scotland has had a very successful year, the only drawback being certain difficulties with regard to the staff. The year witnessed the practical completion of the large extensions of the station generously provided by Mr. J. Coats, jun., which were opened by Sir John Primrose in September last, and promise to meet all present requirements. The hope is expressed that it may be found possible to retain the invaluable services of the S.Y. *Mermaid* during the present season.

Nos. 4 and 5 of the admirable series of Cold Spring Harbour Monographs are respectively devoted to the life-history of the chrysomelid beetle *Chlamys plicata*, commonly called "case-bearer," and of the "mud-snail" (dog-whelk), *Nassa plicata*, E. M. Briggs and A. C. Dimon being the respective authors, or, as some would say, authoresses. The case-bearer is remarkable for the fact that its encased larvæ resemble not only undeveloped buds of the alder, but likewise the fruit of the high-vine blackberry. Of the "mud-snail" the life-history and habits are described in considerable detail, and a number of observations recorded with regard to its reactions to light, &c.

Two addresses, on "Spirals" and "Ambidexterity," which were delivered before the Hampstead Scientific Society by Sir Samuel Wilks, Bart., F.R.S., on April 14 and May 12 respectively, have just been issued in pamphlet form by Mr. S. C. Mayle, of Hampstead. The society is to be congratulated on having the active support of so eminent a man as Sir Samuel Wilks.

At the meeting of the Aëronautical Society of Great Britain to be held on Wednesday next, the following communications will be read:—"Some Remarks on Aërial Flight," by G. H. Wenham; "Demonstration of a Bird-like Flying Machine," by Dr. F. W. A. Hutchinson; "Balloon Varnishes and their Defects," by W. F. Reid; and "The Thrust of Aërial Propellers," by W. G. Walker.

OUR ASTRONOMICAL COLUMN.

Observations of the Satellites of Saturn and Uranus.—An important set of observations of the satellites of Saturn and Uranus, involving some hundreds of individual "settings," was made by Messrs. Frederick and Hammond with the 26-inch equatorial of the U.S. Naval Observatory during 1904. The position angle and distance of each satellite were measured from a second satellite, the angle about the inner body always being taken. The observations extended over the period May 24 to October 11, and the detailed results are published in No. 4026 of the *Astronomische Nachrichten*.

Geodetic Measurements from Solar Eclipses.—The *Journal of the British Astronomical Association* (vol. xv., June 22) contains a paper in which Mr. C. E. Stromeyer points out that if the central shadow of the coming August eclipse be accurately located, all the necessary data will be available for the determination of the geocentric difference of any two observation stations. He proposes two methods for eye observations, and two photographic methods, of which one in particular seems capable of being carried out with the desired precision; it consists in photographing a trail of the central phase of the eclipse on to a moving film.

The method described can be carried out both within and outside the shadow, but the best results will be obtained if the observer is just on the edge of the shadow. The method can also be used with annular eclipses, and if found to be trustworthy would be a valuable means for gradually determining the geocentric distances of various points, even of islands in mid-ocean, which can never be triangulated.

Monochromatic Photographs of the Orion Nebula.—On obtaining a series of spectrograms of the Orion nebula with a small objective-prism quartz spectrograph, Prof. Hartmann found that different parts of the nebula emit light of very different composition, whilst large areas, of characteristic forms, shine solely by the ultra-violet radiation at λ 3727. This variety of the light emitted by the several areas of the nebula led Prof. Hartmann to employ colour screens in obtaining direct photographs with a Steinheil reflector of 24 cm. aperture and 90 cm. focal length. Three screens were used; the first completely absorbed all wave-lengths shorter than λ 4800, but allowed Hβ and the two chief nebular lines, N_1 and N_2, to pass through almost without any diminution of intensity. The second screen freely transmitted all radiations between λ 3880 and λ 3740, but absorbed all others, whilst with the third the absorption commenced at λ 5050, increased rapidly to totality at Hβ, extended to λ 4000, and then quickly decreased until at λ 3727 the transparency was very nearly complete. In this screen the two chief nebular lines were faintly transmitted, but it was an easy matter to eliminate their action by employing a plate of suitable sensitiveness. Combining the first and third screens cut out Hβ, leaving only N_1 and N_2 effective.

Marked differences of the intensities of several areas, as shown on the various photographs obtained with different screens, are plainly seen on the reproductions accompanying Prof. Hartmann's paper. Evidently the radiation λ 3727 is extraordinarily intense in *all* parts of the nebula, whilst in some parts it is almost the sole radiation, producing strong photographic images where the eye sees nothing. The nebula G.C. 1180 surrounding the star *c* Orionis is scarcely visible on the N_1 and N_2 photograph, but it is a prominent feature on that obtained with the ultra-violet light, and is fairly bright on the Hβ plate.

This differential action suggests to Prof. Hartmann the presence of at least *three* gases in the Orion nebula, one of which emits the chief nebular radiations, the second hydrogen, and a third, which emits the radiation at λ 3727 (*Astrophysical Journal*, No. 5, vol. xxi.).

Periodicity of Aërolite Falls.—Among a number of interesting papers published by the Royal Astronomical Society of Canada ("Selected Papers and Proceedings," 1904) we notice one by Mr. W. H. S. Monck in which the author suggests that aërolites, like meteors, effect a certain periodicity. He first shows that the months of May and June stand out prominently in his catalogue of aërolites as the two months of the year in which a greater proportion of known falls have taken place. The number per diem for these two months is 1·34, whilst for the rest of the year it is only 0·81.

In an argument supporting the suggested periodical relation between various aërolite falls, Mr. Monck cites instances in which (1) aërolites fell within one or two days of each other in the same year; (2) aërolites fell on almost the same date in two consecutive years; (3) aërolites fell on nearly the same date after an interval of two or three years; and the number of cases quoted seems to place the matter beyond one of chance coincidences. Further, an analysis of the catalogue dates and numbers indicates a marked tendency for series of falls to congregate about certain dates, and for these falls Mr. Monck tentatively deduces periodicities varying from seven to twenty years.

The Reality of Supposed Changes on the Moon's Surface.—In a paper published in the June number of the *Bulletin de la Société astronomique de France* M. Puiseux discusses at some length the various observations of alleged changes on the lunar surface under the influence of the solar radiation. Going back to the earliest observations of details, he carefully considers each authoritative report of suspected change up to the most recent observations of the reported increase of the diameter of Linné during lunar eclipses. Summing up all the evidence thus examined, M. Puiseux arrives at the conclusion that the case for real changes taking place on the surface of our satellite is not established. He believes that the change of sensitiveness of the retina when observing faint objects is sufficient to account for the changes visually observed, whilst the different conditions of exposure when photographing the eclipsed moon might easily introduce the changes suspected from the examination of photographs.

The Circumzenithal Apparatus.—A new circumzenithal apparatus, devised by MM. Nušl and Frič for the determination of latitude, &c., was briefly described in these columns for August 20, 1903. A full and illustrated description of the instrument, and of the various improvements suggested by experience in its use, is now given in the Bulletin International of the Académie des Sciences de François Joseph I. (Prague, 1904) by the inventors, together with a detailed account of the observations already made and the methods employed in reducing the same.

THE NEEDS OF OUR OLDEST UNIVERSITY.

THE following statement has been drawn up by those professors and heads of departments of the University of Oxford whose names are appended, each being responsible for the details of his own and allied subjects, but expressing also a general sympathy with the scheme as a whole. It indicates the cost at which, in their opinion, all important existing deficiencies (except those of law) may be met by a generous provision for research as well as for teaching.

To carry out the scheme here set forth would require a capital outlay of about 564,000*l.*, and an annual income of about 93,000*l.*

A large proportion of the capital sum proposed for building the new laboratories, together with the whole sum proposed for the purchase of land near the museum, might be saved if the chemical and physical departments were moved from their present position. It is estimated that at a cost of about 60,000*l.* all existing or proposed departments in these branches of science could be accommodated, and space found for other proposed laboratories in the buildings thus set free.

With the sums hereafter named, in addition to her present resources, Oxford could successfully meet every pressing need as well as those demands which it is believed will pour in from many parts of the Empire, from the United States, and from Germany.

The present occasion has been thought a favourable one for stating clearly the full cost which, in the opinion of those who have signed this document, would enable Oxford confidently and hopefully to face the great responsibilities which have been placed upon her. But whatever be the outcome, her professors and heads of departments gladly welcome the inspiring opportunity for research and for education which these new responsibilities will assuredly bring. They will cheerfully attempt to meet the coming needs, even with the present inadequate resources, but they consider it right to point out that their work will be done under the greatest difficulties and therefore inadequately.

The insufficient endowment of many university departments and the necessity for further equipment have been subjects of anxious consideration for many years, culminating in the Vice-Chancellor's letter of February 20, 1902, to heads of institutions and departments—published with the answers in the "Statement of the Needs of the University" (Oxford, 1902). The estimates of expenditure given below have been largely based upon these published replies to a letter which was issued before our necessities became still more pressing in consequence of the will of Mr. Rhodes. Many additional needs not contemplated in the replies to the Vice-Chancellor have also come to light in the course of this inquiry, and are provided for in the following scheme. The published statement of needs is itself introduced by the following sentence (p. 3): "It is hardly necessary to add that in dealing with prospective needs it is generally impossible to form even an approximate estimate of the new and ever-increasing wants which the rapidly-growing requirements of our time may bring, and indeed in some instances (even since these statements were prepared) have already brought within view."

It has been assumed in the following statement that every important university chair, including all those to which the care of a department providing for one of the chief scientific subjects is attached, should be of the value of 900*l.* a year. In fixing this sum the traditions of the last Commission have been followed, but it is necessary to bear in mind that the growth of universities in the future and the competition between them may ultimately render such a sum insufficient to attract and retain the greatest workers and teachers. Under existing conditions we are convinced that it is adequate, but the university would require a large increase of income before she could provide for every important chair the stipend with which it is sometimes erroneously believed to be endowed.

Each new laboratory devoted to one of the principal branches of natural science has been estimated to cost 30,000*l.*, exclusive of site. It is believed that this sum would provide fittings and sufficient apparatus to begin teaching and research on an adequate scale, allowance being made for the material now in the possession of the university. It has been assumed that every important laboratory, both new and old, should receive an income of 3000*l.* a year, for professor's stipend, demonstrators, assistants, apparatus, and material for research and for teaching, and the general expenses of maintenance.

With such an income a professor could encourage several of his most promising men to do original work, giving them employment in teaching or working for the department during a part of their time.

Attention to the large and insistent needs of the existing and proposed scientific departments has been accompanied by a generous provision for the necessities of other subjects, and especially by the suggested increase of the Bodleian income to 23,000*l.* a year—even then less than one-third of the annual sum supplied to the National Library.

We feel that it is not too much to claim that the annual output in research and teaching from the small inadequately endowed—often miserably endowed—departments of the university, justifies the confident conclusion that a liberal provision for existing and imminent needs would be followed by results of the highest importance to the Empire as well as to the university. The results would be threefold—the advancement of learning, which is the highest and noblest function of a university; the adequate teaching of many subjects of the first importance, now imperfectly provided, or not provided at all; the inestimable benefits conferred upon students by living in an atmosphere of research.

H. B. Baker, F.R.S., Lee's reader in chemistry; Henry Balfour, curator of the Pitt-Rivers Museum; R. E. Baynes, Lee's reader in physics; T. K. Cheyne, Oriel professor of the interpretation of Holy Scripture; R. B. Clifton, F.R.S., professor of experimental philosophy; S. R. Driver, Regius professor of Hebrew; F. Y. Edgeworth, professor of political economy; E. B. Elliott, F.R.S., Waynflete professor of pure mathematics; Robinson Ellis, Corpus professor of Latin literature; W. Esson, F.R.S., Savilian professor of geometry; Arthur J. Evans, F.R.S., keeper of the Ashmolean Museum; C. H. Firth, Regius professor of modern history; P. Gardner, Lincoln and Merton professor of archæology; Francis Gotch, F.R.S., Waynflete professor of physiology; H. Goudy, Regius professor of civil law; F. Ll. Griffith, reader in Egyptology; W. Lock, Ireland professor of exegesis of Holy Scripture; A. E. H. Love, F.R.S., Sedleian professor of natural philosophy; R. W. Macan, university reader in ancient history; A. A. Macdonell, Boden professor of Sanskrit; D. S. Margoliouth, Laudian professor of Arabic; Henry A. Miers, F.R.S., professor of mineralogy; W. R. Morfill, professor of Russian; A. S. Napier, Merton professor of English language and literature; E. W. B. Nicholson, Bodley's librarian; W. Odling, F.R.S., Waynflete professor of chemistry; R. L. Ottley, Regius professor of pastoral theology; H. F. Pelham, Camden professor of ancient history; E. B. Poulton, F.R.S., Hope professor of zoology; Arthur Sidgwick, university reader in Greek; W. A. Raleigh, professor of English literature; John Rhys, Jesus professor of Celtic; James Ritchie, reader in pathology; W. Sanday, Margaret professor of divinity; A. H. Sayce, professor of Assyriology; Henry Sweet, university reader in phonetics; W. J. Sollas, F.R.S., professor of geology; John S. Townsend, F.R.S., Wykeham professor of physics; H. H. Turner, F.R.S., Savilian professor of astronomy; E. B. Tylor, F.R.S., professor of anthropology; Sydney H. Vines, F.R.S., Sherardian professor of botany; W. F. R. Weldon, F.R.S., Linacre professor of comparative anatomy; Joseph Wright, professor of comparative philology.

The late Regius professor of medicine, Sir John Burdon Sanderson, F.R.S., has expressed his approval.

Bodleian Library.—Fire-proofing, additional storage, additional reading-room, warming picture-gallery, electric lighting of camera (see also Central University Institution below, which it is suggested might liberate additional space for the Bodleian) (25,000*l.* : —); large increase of staff, filling up deficiencies in and maintaining special departments, printing the catalogue, binding (including arrears) (— : 13,000*l.*).

In this and all other cases the sum placed before the colon indicates capital outlay, that placed after the colon annual expenditure.

Central University Institution.—Containing workrooms and lecture-rooms for professors not otherwise provided for, university chest, delegates' rooms, committee rooms, &c.,

&c. The Clarendon building might be incorporated in Bodleian (cost, including site in a central position, 80,000*l.* :—); custody of same, warming, lighting, cleaning (— : 400*l.*); stipend of librarian for departmental libraries (— : 200*l.*).

Examination Schools.—Installation of the electric light (1000*l.* :—).

Theology.—Oriel professor of interpretation of Holy Scripture, stipend (the chair to be detached from the canonry at Rochester) (— : 900*l.*); Dean Ireland's professor, increase of stipend (— : 500*l.*); two additional professors, ecclesiastical history (—: 900*l.*), Christian archæology (—: 600*l.*); four additional readers (300*l.* each), ecclesiastical history, liturgiology, Rabbinical Hebrew, Biblical archæology (— : 1200*l.*); Grinfield lecturer on Biblical Greek, increase of stipend, making the lectureship equal to a readership, with reader's duties (— : 230*l.*); [additional readers (not exclusively concerned with theology)—Aramaic, Armenian, Coptic, Ethiopic] (— : 1200*l.*); travelling fellowships (2) (— : 400*l.*); capital fund from which payment might be made for occasional lectures (3000*l.* : —).

Greek, New Professor of Mediæval and Modern Greek.—Stipend (— : 900*l.*).

Classical Palæography.—Stipends of new readers, Greek and Latin (300*l.* each) (— : 600*l.*).

New chairs of Pali and Persian philology and literature (700*l.* each) (— : 1400*l.*).

Reader in Prakrit Philology and Literature.—Stipend (— : 300*l.*); increased stipend of 100*l.* to each of the five teachers of Indian vernacular, and additional grant to Indian Institute for purchase and care of Indian antiquities, &c. (300*l.*) (— : 800*l.*).

Ashmolean Museum.—Extension of site, increase of museum, cases and fittings, including a numismatic department and space for growth of the departments mentioned below (30,000*l.* : —); increased staff both for the museum and common service of the Ashmolean museum and university picture-gallery, and stipend of librarian (— : 1000*l.*); post-graduate studentship in archæology, art, &c. (— : 1000*l.*); purchase of specimens, books, &c. (— : 1500*l.*).

Classical Archæology.—Increased stipend of chair, three new readerships (— : 1500*l.*).

Increase required for creation of new chairs of *Greek* and *Roman Epigraphy and Inscriptions* (700*l.* each), *Egyptology* (700*l.*), *Assyriology* (700*l.*), *History of Religions* (700*l.*), *Northern Archæology* (900*l.*), *History of Architecture* (900*l.*) (—: 5300*l.*)

University Picture Gallery.—Extension of site, increase of gallery (10,000*l.* : —).

Slade Professor of Fine Art.—Increased stipend for resident chair, wages of attendant (— : 600*l.*); increase of stipends, purchases, &c. (— : 1000*l.*).

Pitt-Rivers Museum (Ethnology).—Increased space, building (8000*l.*), cases and fittings (4000*l.*), electric lighting (250*l.*), (12,250*l.* :—); increase of stipend, a professorship of anthropology might, at some future time, be combined with the curatorship (— : 700*l.*); assistants, service, general expenses and purchase of specimens (— : 700*l.*).

Astronomy, Savilian.—Building and apparatus (10,000*l.* : —); annual grant to make up a moderately efficient and well-equipped observatory with an income of 5000*l.* (— : 3500*l.*).

Increase required for creation of new chairs in scientific subjects and the building and new laboratories, &c. Under each chair the first-named sum represents capital expenditure for a new building, or for adapting an existing structure; the second sum represents the annual expenditure for the stipend of the chair, provision of demonstrators and assistants, the expenses of research and of service and maintenance :

Engineering (30,000*l.* : 3000*l.*); *Organic Chemistry* (30,000*l.* : 3000*l.*); *Physiological and Applied Botany* (20,000*l.* : 2000*l.*); *Biochemistry* (12,000*l* : 2000*l.*); *Experimental Psychology* (15,000*l.* : 2000*l.*); *Pathology* (—: 1500*l.*, allowing for existing readership); *Pharmacology and Materia Medica* (15,000*l.* : 1500*l.*, allowing for existing lectureship); *State Medicine and Hygiene* (10,000*l.* : 2000*l.*). The Regius professorship of medicine might perhaps be combined with one of the suggested new chairs of medicine.

Increase required for building new or adapting old laboratories and other capital expenditure, for existing chairs in scientific subjects, &c., for increase of the stipend of the chairs, for additional demonstrators and assistants, and for the expenses of research and of service and maintenance. The capital expenditure is placed first, the annual second, under each chair :

Experimental Philosophy, Clarendon.—*Light and Sound* (25,000*l.*, to include provision for elementary students and for examinations : 2000*l.*); *Electricity and Magnetism,* Wykeham (30,000*l.* : 2000*l.*); *Heat,* Lee's (30,000*l.* : 2000*l.*, allowing for Lee's readership); *Inorganic Chemistry,* Waynflete (30,000*l.*, old laboratory for extension of mineralogy, geology, and the Radcliffe library : 2200*l.*); *Physical Chemistry,* Lee's (30,000*l.* : 2000*l.*, allowing for Lee's readership); *Mineralogy,* Waynflete (15,000*l.* : 2200*l.*, including an assistant chair of metallurgy); *Geology* (20,000*l.* : 3000*l.*, including two assistant chairs); *Comparative Anatomy,* Linacre (— : 1000*l.*); *Zoology,* Hope (7000*l.*, chiefly for cabinets (— : 2500*l.*, including the maintenance of a tropical biological laboratory); *Systematic Botany,* Sherardian (— : 1000*l.*); *Animal Physiology,* Waynflete (6000*l.* : 1000*l.*); *Human Anatomy* (— : 1000*l.*).

Secretary of the Museum Delegates and of the Scientific Departments.—Increase of staff for the general purposes of the museum and to enable the secretary to collect all fees of the scientific departments (— : 400*l.*).

Sites for Scientific Departments.—For purchase of land in the neighbourhood of the present museum (50,000*l.* : —).

Geography.—Stipend of new chair (— : 700*l.*); assistant lecturers (— : 750*l.*).

University Chest.—Increased income to meet expenses in connection with additional buildings (— : 2000*l.*).

Modern History.—New chairs of economic history, colonial history, and military history (900*l.* each) (— : 2700*l.*); "seminars," maintenance and equipment of (100*l.* for each of the chairs) (— : 500*l.*); Lectureships—additional payment of existing lecturers and appointment of new lecturers, class expenses (— : 1500*l.*).

Political Economy.—Increased stipend of chair (200*l.*), see also the new chair of economic history proposed under Modern History; lecturers in economic theory, in statistics and applied economics, and in economic geography (200*l.* each); expenditure on examinations, &c. (50*l.*); secretary and clerk (150*l.*), (— : 1000*l.*).

English Language.—Two assistants in English language (— : 600*l.*).

English Literature.—Increased stipend of chair (400*l.*); two assistant lecturers in English literature (150*l.* each); one reader in rhetoric and criticism (300*l.*) (— : 1000*l.*).

Modern Languages.—Increase of stipends of Taylorian teachers to 600*l.* each (— : 1600*l.*); assistant lecturers (— : 1000*l.*).

New Chair of Phonetics.—Stipend (— : 900*l.*).

Total (546,250*l.* : 93,880*l.*).

PRELIMINARY REPORT OF THE DEPARTMENTAL COMMITTEE ON THE ROYAL COLLEGE OF SCIENCE AND ROYAL SCHOOL OF MINES.

TO THE MOST HONOURABLE THE MARQUESS OF LONDONDERRY, K.G., PRESIDENT OF THE BOARD OF EDUCATION.

MY LORD MARQUESS,

We, the Departmental Committee appointed by Your Lordship in April last to inquire into the present and future working of the Royal College of Science (including the Royal School of Mines), and into questions connected therewith, have the honour to submit a Preliminary Report.

I. In conducting the inquiry referred to us, we have held 17 meetings, at which we have examined 21 witnesses, the remainder of the time having been devoted to consideration of the information thus supplied to us. The evidence which we have received has been largely concerned with the history of the Royal College of Science (including the Royal School of Mines), with the character of the instruction now given therein, and with the possibility of attracting students more advanced in their education than the majority of those who now seek admission. On this branch of our inquiry we should be prepared to submit recommendations which we think would conduce

to increase the great usefulness of these institutions, even though conducted in the main upon their present lines; but we have thought it desirable to defer making such recommendations at the present time for reasons which we will now proceed to state.

II. It will be remembered that the terms of reference to the committee were as follows:—"To inquire into the present working of the Royal College of Science including the School of Mines: to consider in what manner the staff, together with the buildings and appliances now in occupation or in course of construction, may be utilised to the fullest extent for the promotion of higher scientific studies in connection with the work of existing or projected Institutions for instruction of the same character in the Metropolis or elsewhere: and to report on any changes which may be desirable in order to carry out such recommendations as they may make."

We recognise the admirable work accomplished by the Royal College of Science not only in training teachers, but in its general method of science teaching and in the promotion of research. Notwithstanding the marked increase in the number of institutions where teachers of science can be trained, the demand has also so increased that the need for teachers of science who have been well trained in scientific method is no less now than when the college was established as a normal school of science. At the same time it is agreed that there is an urgent national necessity for increased facilities for advanced instruction and research in science, especially in its application to industry. In view of this fact, and in view of certain munificent offers of aid towards the provision of such facilities in London, we have felt that it was necessary, in order to discharge the reference to us, to survey the resources available for, and the potentialities of, the principal existing and projected institutions of the character contemplated in our terms of reference. We have now proceeded far enough in this survey to satisfy ourselves that the moment is *primâ facie* opportune for a comprehensive scheme. The accomplishment, however, of such a scheme as we have in mind can only be brought about by the realisation of the offers of aid which are referred to above, and by the cooperation of certain influential bodies possessing an interest in such institutions as are dealt with in our proposals.

It has, therefore, become necessary for us to approach these bodies and the persons who have made these munificent offers. But before we proceed any further in this direction, we feel that our position would be strengthened if we could be assured that our proposals will meet with the approval of the Government, and we have accordingly decided, in view of the stage at which we have arrived, to present this preliminary report, in which we outline the scheme we think desirable, and specify the conditions which in our opinion would make it possible.

III. The conditions which, if fulfilled, would, in our opinion, ensure the success of the scheme are:—(1) The gift of a large capital sum (say not less than 100,000*l*.) for buildings and initial equipment.

(2) The gift of a considerable additional site (say not less than 4 acres) at South Kensington.

(3) The willingness of the Board of Education to allow their college at South Kensington to be brought into a scheme of common government and administration.

(4) The similar willingness of the City and Guilds of London Institute in respect of their college at South Kensington.

(5) The continuance of the Government contribution including the necessary provision for the maintenance of the new laboratories and other buildings of the Royal College of Science, now approaching completion.

(6) The continuance of the support given by the Corporation and Livery Companies of the City of London to the Central Technical College.

(7) The provision (in the proposed College of Applied Science at South Kensington) of instruction in certain departments of engineering either by new foundation or by transfer and enlargement of part of the work of some existing college or colleges (*e.g.* University College or King's College).

(8) The cooperation of the University of London.

(9) The assurance of a sufficient maintenance fund.[1]

IV. Given the fulfilment of the above conditions, we should be prepared to recommend such a scheme as is indicated in outline in the following paragraphs:—

(1) In considering the problem laid before us by the Government, we are impressed by the fact that the most urgent need in scientific education is the establishment of a centre in which the specialisation of the various branches of study and the equipment for the most advanced training and research should be such as ultimately to make it the chief technical school of the Empire.

So large a scheme cannot be carried out in a day, but we believe that the present is a favourable opportunity for making a beginning, and in the suggestions which follow we have kept the above end steadily in view. The existence of the Royal College of Science with the Royal School of Mines and of the Central Technical College in close proximity points to South Kensington as the best position for such a centre as we contemplate; and we have made careful inquiry as to the extent of the accommodation which is at present concentrated in that neighbourhood. It is as follows:—(*a*) Accommodation for about 200 students in the permanent part of the existing buildings of the Royal College of Science and the Royal School of Mines. (*b*) Accommodation for from 300 to 350 students including accommodation for work for about 100 advanced students in the physics and chemistry laboratories in the Royal College of Science, now approaching completion. (*c*) Accommodation for about 300 students in the existing buildings of the Central Technical College.

With the exception of the new laboratories of the Royal College of Science, these buildings are fully occupied by students, but the accommodation for mining and metallurgy is quite inadequate, and is to a great extent merely temporary. Further, the accommodation for engineering, whether in the Royal School of Mines or in the Central Technical College, is insufficient to meet the wants of many qualified students who are annually refused admission for want of space, and in no branch of applied science is sufficient provision made for advanced or specialised work.

There is no doubt that if arrangements could be made between the Government on the one hand and the City and Guilds of London Institute on the other, the resources of the above mentioned institutions could be used with far greater effect and economy.

(2) The buildings and equipment, even if such arrangement were made, though in many respects excellent and extensive, are quite inadequate for existing requirements, and still more for the purpose in view. The provision to be made for the future should include not only a fully developed School of Mining and Metallurgy and departments for the principal branches of engineering, but also for other special subjects.

We do not attempt in this Preliminary Report to draw up a detailed scheme, but the following principal subjects should be within the purview of the institution:—

As preparatory subjects—mathematics, physics, chemistry and geology. Under the general heading of civil engineering—works of construction, mechanical engineering, electrical engineering, mining engineering, marine engineering and naval architecture. Some branches of chemical technology, and certainly metallurgy.

As illustrations of the kind of higher or more specialised application of these subjects, some of which we suggest should be dealt with, we need only mention the applications of engineering to railway, dock, and hydraulic work; the development of electricity in the direction of electric traction, lighting and telegraphy, and electrochemistry. It would be impossible to provide for the whole of the above subjects at once. Some of the more specialised subjects, such as the advanced metallurgy of

[1] For such a maintenance fund we look to the following sources in addition to those mentioned above under headings 5 and 6.

(*a*) Any grant from the vote for university colleges to which the institution may be able to establish its claim.

(*b*) An annual grant from the London County Council.

(*c*) The Bessemer Memorial Fund (so far as not applied to capita expenditure).

(*d*) Fees of students.

(*e*) Endowment of special forms of instruction given by persons or bodies interested.

(*f*) Any portion of funds given for capital purposes which may remain available for income after the necessary capital expenditure.

iron and steel, and certain branches of manufacturing chemistry, would probably be better dealt with in institutions which are, or may be, established in the provinces. Even, however, if the scheme be restricted by the exclusion of such subjects, its realisation would require at least the whole of the site still available at South Kensington, and great advantage would be obtained by grouping the first extensions immediately round the nucleus provided by the Royal College of Science and Central Technical College.

We believe, however, that if the various London institutions concerned were willing to cooperate fully in the matter, and proper arrangements were made for coordination of the considerable resources already existing, the necessary special departments might be established early.

It is quite compatible with an effective realisation of the scheme that separate departments might be conducted in detached colleges.

In view of the terms of reference, we have given special consideration to the provision required for higher education in mining and metallurgy, and we are satisfied that the maintenance of a fully equipped Central School of Mines is desirable. While facilities for advanced instruction in coal mining and in the mining and metallurgy of iron are now available in some of the larger centres of those industries, it is important that there should be a central school affording a full course of instruction in the mining and metallurgy of metals produced in India and the Colonies, but not found, or not found in large quantity, within the United Kingdom. As London is the financial centre of many great engineering, mining, and metallurgical industries in the Colonies, it is in the opinion of several witnesses the best site for a more highly developed School of Mines which shall provide for the needs of the Empire. It has been proved to us that the number of Englishmen who rise to important posts in connection with the mining industries of India, Australia, and South Africa is less than is desirable.

We have, for the present, deferred consideration of the biological department of the Royal College of Science.

(3) We consider that the advantages of the higher technical courses, which we contemplate at South Kensington, should only be available for students who can pass a satisfactory test for admission thereto. The preliminary science and such rudiments of engineering as may be prescribed for candidates before entering on these higher courses might be obtained either in the laboratories of the Royal College of Science and Central Technical College, or elsewhere in London or the provinces. Admission to these higher courses should be restricted to duly qualified students who, it is hoped, would be attracted from all parts of the Empire.

(4) We think it is important that the interests both of pure and applied science should be adequately represented on the body which administers the new institution. It is of the first importance that there should be no divorce between teaching and research in technology on the one hand and in pure science on the other, and we therefore regard it as an advantage that ample provision has already been made by the Government for the teaching of certain sciences on a site which we hope may be connected even more closely than at present with the highest and most specialised branches of technology. With regard to both subjects, we believe that it may be necessary hereafter to limit the instruction to the higher branches of both pure and applied science.

(5) We do not contemplate that either the educational or financial administration of the Central College should be vested entirely in His Majesty's Government. Indeed, in the present case there is a special consideration which makes such an arrangement practically impossible. Our scheme, if carried into effect, will entail the hearty union and cooperation of several independent bodies in a common enterprise, and it would be an advantage to be able to accord to each cooperating institution an adequate share in the general control.

These considerations point to the creation of a council representing all the large interests concerned, including, of course, His Majesty's Government, who must always remain by far the chief supporters of the institution. We do not now enter into the details of an arrangement of the constitution of the council, as such details will largely depend on the success of negotiations which must await the decision of His Majesty's Government on the outlines of our proposals as now submitted.

Should the above proposals be accepted, it will follow that the State contribution to the institution will take the form of an annual grant in aid, the governing body retaining the power to carry over any balance remaining unexpended at the end of a year.

V. We feel that we should not be justified in inquiring whether the Board of Education would be willing to give their support to the foregoing scheme, depending as it does on the fulfilment of all or most of the conditions previously mentioned, unless we had taken steps to ascertain what prospect there is of their being fulfilled. We have good reason to believe that private munificence is prepared to provide a capital sum in excess of the minimum which we consider necessary to a successful issue, and that the Commissioners of the 1851 Exhibition are prepared, with their accustomed liberality where the advancement of higher education is concerned, to make available for a scheme, such as we have sketched, the additional site which will be required. We also confidently look for the cooperation of the University of London. Further, although public bodies or local authorities which contribute largely to the funds of the proposed institution may fairly ask for the reservation of some accommodation there for scholarship holders sent to it by themselves, yet it would appear that a considerably increased income would be available for the support of such an institution from the fees of fee-paying students. With this nucleus of additional resources thus provisionally secured, we feel justified in approaching the Board of Education. We accordingly desire to ask whether the Board are in a position to inform us (1) that, if it is found possible to establish a scheme such as we have sketched in outline, they will be willing to allow the Royal College of Science (including the Royal School of Mines) to be brought into it under a common government and administration; and (2) that the existing Government contribution to the support of these institutions will be continued under the new conditions on the scale already made necessary by the provision of the new laboratories of the Royal College of Science.

With such an assurance, and with such new resources as we have mentioned above, we feel that we could approach, with good prospect of success, other bodies whose cooperation we believe to be desirable, if not necessary, for the complete success of our proposals.

In conclusion, we desire to observe that absence of detail where it might have been looked for in certain portions of our proposals is not to be taken as meaning that we have not considered in some detail the ends which we wish to see attained. Our proposals at the present stage indicate only in outline what we have in view: how near an approach can be made to its attainment must depend on the resources which prove to be available, and cannot, therefore, from the nature of the case, be estimated with precision at the present time. Without, however, attempting now to exhaust the subject, we have submitted proposals framed in such a way as to suggest the establishment of an institution which will be pre-eminent in its combination of advanced teaching in certain branches of applied science, with instruction in pure science also developed to a very high standard.

We have the honour to be, My Lord Marquess, Your Lordship's obedient servants, R. B. Haldane, chairman, W. de W. Abney, E. H. Carbutt, W. S. Church, A. H. Leech, Philip Magnus, Walter McDermott, Francis Mowatt, F. G. Ogilvie, Reay, Arthur W. Rücker, Sidney Webb, J. Wernher, W. H. White, J. C. G. Sykes, secretary, F. E. Douglas, assistant secretary.

Letter from the Board of Education to the Secretary of the Departmental Committee on the Royal College of Science, &c.

BOARD OF EDUCATION, WHITEHALL, S.W., *April* 3, 1905.

Sir,

I am directed by the Board of Education to state that careful consideration has been given to the very valuable Preliminary Report of your Committee, dated February 20,

and I am to say that, while the point raised in subsection (2) of paragraph V. on page 5 of that Report cannot yet be definitely decided, the answer to subsection (1) in that paragraph is in the affirmative.

In sending this information, with the consent of His Majesty's Government, I am directed to express the warm appreciation of this Board for the great care with which this difficult subject has been thus far investigated by your Committee, and to say that the necessary discussions with His Majesty's Treasury upon the point involved in subsection (2) of paragraph V. will be completed with the least possible delay and, on a settlement being reached, information will be promptly sent to you as to these financial arrangements.

I have the honour to be, Sir, Your obedient Servant,

ROBERT L. MORANT, *Secretary of the Board of Education.*

Extract from the Speech of the Marquess of Londonderry, President of the Board of Education, at the Annual Dinner of the Institution of Mining and Metallurgy, May 10, 1905.

"I need not say that we have the hearty goodwill of the Treasury in endeavouring to carry out the recommendations of this strong Committee presided over by my friend, and I am able to tell you that, so far as the question of money—and, after all, money is the important question—is concerned, I have good grounds for believing that the Treasury, or rather the Chancellor of the Exchequer, has been very carefully considering the financial aspect of the new condition of things that will be brought about in regard to the Royal College of Science, if the changes I have hinted at actually take effect, and that he will see his way to make a reasonable increase in the sums at present devoted towards the expense of the Royal College of Science, so that the College, in its immensely enhanced possibilities of usefulness, owing to its large new buildings, may bring to the common aid, so to speak, not only its fabric and its excellent equipment, but also a satisfactory annual income, as a substantial contribution to what must be a heavy annual expenditure involved in the great work to be carried through."

NATIONAL LEAGUE FOR PHYSICAL IMPROVEMENT.

A MEETING, over which the Lord Mayor presided, was held at the Mansion House on June 28 for the purpose of establishing an association which for the time is described as a National League for Physical Education and Improvement, but the precise official title of which has not yet been decided. Among those present were the Bishop of Ripon, Sir Lauder and Lady Brunton, the Lord Chief Justice, Sir William Broadbent, Sir James Crichton Browne, Sir Norman and Lady Lockyer, Sir Henry Cunningham, Sir Henry Craik, Sir Benjamin Baker, Prof. Howard Marsh, and Sir Victor Horsley.

The chief objects of the association are to stimulate public interest in the physical condition of the people throughout the kingdom, to establish close association and centralisation of all societies and individuals trying to combat such influences as tend to produce national physical deterioration, to aid existing organisations, and to start organisations for physical health and well-being wherever none exists. As the purposes of the league are closely connected with medicine, it has been thought advisable to have it strongly backed by medical men before other classes of the community are asked to join, because most of them are less able to judge of its merits or demerits than medical men, and will consequently be led to decide their action in regard to it chiefly by the example of the leaders of the medical profession.

The council has published a draft scheme of the proposed association, according to which it would consist of territorial branches working in connection with a central body. It is suggested that each branch should see that instruction is furnished to the people on the laws of health generally, to mothers on the care of their own health and on the nurture and care of children, to girls on the methods of domestic and personal hygiene, and of cooking and housekeeping. Physical exercises and opportunity for open-air games should be obtained for both boys and girls; while the natural desire of young men to become volunteers should be encouraged, and marching drill, shooting practice, and all healthy sports fostered. A plan is outlined also for securing the cooperation of all persons in authority in different centres of population so that each section of the community may receive ultimately physical education of a suitable kind.

The following resolutions were adopted at the meeting:—

(1) That the causes which tend to impair the health of the nation, as disclosed by the report of the departmental committee, ought to be combated by united action. It is, therefore, recommended that all the agencies at present engaged in isolated work for that purpose should have the opportunity of combining, and thus cover the whole country.

(2) That this meeting assembled at the Mansion House, under the presidency of the Lord Mayor of London, therefore heartily approves of the federation designed for this purpose, and of the proposed effort to start organisations in those parts of the country where none exist.

In proposing the first resolution, the Bishop of Ripon said the result of the inter-departmental committee's report had been to point out that there are certain conditions at work which are not creditable to the civilised community. The report states that still-births ought to be registered, and that infantile mortality is very great; and that whereas during the last fifty years an improvement has taken place in the health of the people and in their dwellings, and the average length of life has been increased, it yet remains true that the percentage of infantile mortality has not decreased. The number of deaths in a year per thousand among children was 154 in the decade from 1851 to 1860, and the figure was the same in the decade 1891 to 1900. This shows that the benefits of the improved conditions go to the adult and not to the child. Conditions exist which must be remedied if the health of the population is to be sturdy, robust, and vigorous. The awakened interest in the question is largely due to the agencies which have been toiling to better the conditions and health of the people. If these agencies or societies and individuals have been able to achieve such admirable results by isolated effort, then by federation they could do a great deal more. The federation needs the cooperation of three great classes of public workers—the practical, the scientific, and the Parliamentary. A council would thus be formed of well digested and well considered thought as to the best means of helping forward every agency and initiating every kind of new enterprise which might contribute to the health, well-being, and physical stature, as well as to the moral greatness of the people of this country.

In seconding the resolution the Lord Chief Justice urged that innocent amusement and healthy education be provided throughout the country, through the municipal authorities, for a reasonable proportion of the lads and girls, so that their tastes may have an opportunity of being developed in a wholesome and healthy way.

THE UNIVERSITY COLLEGE OF SOUTH WALES.

THE Prince of Wales, in his capacity of Chancellor of the University of Wales, visited Cardiff on June 28 for the purposes of laying the foundation-stone of the new University College buildings in Cathays Park and of conferring a number of honorary degrees of the University of Wales.

The ceremony of laying the foundation-stone took place in the afternoon in the presence of a large and distinguished assembly. The president of the college, Sir Alfred Thomas, read an address of welcome to the Prince of Wales in which he outlined briefly the events which have led up to the possibility of the provision of buildings worthy of the educational work being accomplished by the University College of South Wales. The address stated that the Government in 1882 invited proposals from public

bodies for the location of the University College of South Wales and Monmouthshire. In their memorial the corporation of Cardiff promised that, in the event of Cardiff being selected, they would make adequate provision for the college.

The address continued:—"How they recognised their obligations is manifest by the noble site upon which we now stand. Your Royal Highness, by your presence here to-day, places the seal of your approval on the manner in which the corporation has redeemed the pledge which I, then as mayor, made in their name. We have had the good fortune to secure the services of an architect whose plans and designs have won the enthusiastic approval of educational experts. By the contributions of the people of South Wales and the splendid munificence of the Worshipful Drapers' Company, we are now in a position to build and maintain the arts, the administrative, and the research departments of the college. Our treasurer, to whom and to whose family we are so deeply indebted, trusts that this ceremony will prove such a stimulus to the patriotism of our people that the work now begun by Your Royal Highness will not cease until the whole scheme is completed."

During the course of his reply, the Prince of Wales remarked:—"As Chancellor of the University of Wales I am delighted to take part in this important ceremony and to lay the foundation-stone of the first block of what is hoped will some day grow into a building beautiful and dignified in design, complete and practical in its equipments. I congratulate you and all here present to-day in the proud fact that it is the liberality of the people of South Wales and Monmouthshire that makes it now possible to carry out a portion of the great scheme for the establishment in Cardiff of buildings worthy of their University College and worthy of the conception of its founders. I further note with great satisfaction that one of the largest of the London city companies has shown a practical sympathy in this great undertaking, and that the library buildings, one of the most important features in any college, will be the gift of the Worshipful Company of Drapers."

After referring to the fact that the site of the new buildings was formerly a monastic centre of learning, renowned at home and abroad, His Royal Highness continued:—"The new teaching and training differs in character from that which in the past rendered her colleges famous, for the Welsh people have determined that their university education shall be compatible with the modern wants of a new world. Its promoters and its authorities have recognised that this university should not exist merely for the purpose of the literary or the academic life, but should place itself in touch with and try to serve every form of intellectual activity, and to-day Cardiff is a constituent of the university, for under the charter the town council appoints two members of the university court, and by a standing ordinance of the town council the mayor is *ex officio* one of the members. So our university is by its constitution interwoven more closely perhaps than any other with the national life of the country; and this is no mere sentiment on the part of the people of Cardiff, for they have not only given this site for the college, but also presented to the university itself another site in this park and 6000*l.* for the erection of its registry."

The University College at Cardiff was founded in 1883 and incorporated in 1884, and is the largest of the three colleges constituting the University of Wales. It began with 150 students. In 1893 the number had increased to 347, and in 1903 to 647. Since its foundation the college has been housed in temporary quarters which used to be the premises of the Cardiff Infirmary. In 1895 the Government promised a grant of 20,000*l.* on condition that an equal amount was raised from private sources, and this was done. Then the Drapers' Company offered 10,000*l.*, which has subsequently been increased to 15,000*l.* The town gave the site, and altogether 132,000*l.* has been contributed. The total cost of the new buildings is estimated at 290,800*l.*, so that about 159,000*l.* is still required.

The conferring of degrees took place later in the day, and among the recipients of honours was Sir John Williams, upon whom the honorary D.Sc. was conferred.

THE LIÉGE MINING AND METALLURGICAL CONGRESS.

AT the International Congress of Mining, Metallurgy, Mechanics, and Applied Geology held at Liége on June 25 to July 1, of which a brief report was published in NATURE last week, numerous papers of great scientific interest were read.

In the geological section an important paper on the continuation of the Saarbrücken Coal-measures into the territory of Lorraine and of France was submitted by Mr. B. Schulz-Briesen (Düsseldorf). In recent years numerous coal discoveries have been made in the Saarbrücken field by the Prussian Government in an area that had been untouched up to the end of the last century, the beds of quicksand above the coal having proved an obstacle. In French Lorraine coal was discovered last year at a depth of 650 metres. A map accompanying the author's paper indicated the coal-bearing area that has been proved, and showed the vast economic importance of the discovery. The genesis of metalliferous deposits and of eruptive rocks formed the subject of a paper by Mr. Paul F. Chalon (Paris). He summed up the matter in the following rules:—primary metalliferous deposits are not met with in stratified rocks that are not traversed by eruptive or igneous rocks; rocks with a fragmental structure contain more metalliferous deposits than compact rocks; in extended areas traversed by eruptive rocks the deposits are never regularly or irregularly distributed, but are concentrated at one or more centres; metamorphic rocks indicating the vicinity of eruptive rocks are favourable for prospecting, particularly in mountainous districts. The geological structure of the mining district of Iglesias, in Sardinia, was described by Mr. G. Merlo. The district is one of considerable economic importance, there being 117 mines in operation, and the value of the mineral output is more than 21 million francs annually. The principal deposits are veins of galena and blende, and contact deposits of galena and calamine. The Palæozoic beds of the district are, in descending order, as follows:—(1) Monteponi sandstone; (2) Gonnesa schist of Silurian age; (3) Cambrian sandstone; (4) metalliferous limestone; (5) Malacalzetta slates. There are thus three horizons of the Cambrian system. The mineral deposits of the banks of the Meuse and of the east of the province of Liége were described by Mr. G. Lespineux. He showed that these calamine masses, like those of the Moresnet district, are not the results of erosion of mineral veins, but were formed in their present condition. The deposit of cinnabar at Monte Amiatia, in Tuscany, was described by Mr. V. Spirek. The deposits occur exclusively in serpentine, and were divided by the author into four classes.

In the metallurgical section the papers read were mostly of a practical character. Mr. Hadfield gave a summary of his researches on the effect of the temperature of liquid air on the properties of steel. Mr. F. Jottrand described a method of cutting metals by a jet of oxygen. The oxyhydrogen blowpipe is directed against the portion to be cut, and heats it to whiteness. The hydrogen is then turned off, and a rapid current of pure oxygen cuts the metal. In practice two blowpipes are used simultaneously, one for heating and one for cutting. The double blowpipe moves at a velocity of 20 centimetres per minute in cutting a steel plate 15 mm. in thickness. The metal is cut almost as cleanly as with a saw. The width of the slit is not more than 2 mm. for plates 15 mm. thick, and is only 3 mm. for plates 100 mm. thick. In order to cut a plate 15 mm. thick there is required per metre cut 540 litres of hydrogen and 540 litres of oxygen, the operation lasting five minutes. Tubes and curved sections can also be cut. Mr. H. Hennebutte described the use of coal poor in agglutinating materials for the manufacture of coke. Mr. E. Bian gave an account of the methods of cleaning blast-furnace gases. Mr. P. Delville read a paper on the influence of titanium on iron and steel. The manufacture of blast-furnace slag cement was dealt with by Prof. H. Wedding and by Mr. C. de Schwarz. Mr. P. Acker described the new modifications of the open-hearth steel process. Mr. R. M. Daelen discussed the methods of obviating "piping" in steel ingots. Electric steel-making processes were dealt with by Mr. G. Gin and by Mr. R.

Pitaval. Mr. L. Guillet, Carnegie scholar of the Iron and Steel Institute, submitted an elaborate monograph on special steels. Of the nickel steels described, the most remarkable are Guillaume's *invar*, with 36 per cent. of nickel, with an elastic limit of 70 to 75 kg. per square mm., a breaking stress of 45 to 55 kg. per square mm., and an elongation of 35 to 25 per cent.; and *platinite*, with 46 per cent. of nickel, with an elastic limit of 60 to 70, a breaking stress of 30 to 40, and an elongation of 45 to 35 per cent. The latter is used instead of platinum in incandescent lamps. The paper summarises in an admirable manner the existing knowledge of nickel, manganese, chromium, tungsten, molybdenum, vanadium, silicon, and aluminium steels. Other papers read in this section dealt with the application of electricity in rolling mills, by Mr. L. Creplet; the double hardening of large steel forgings, by Mr. A. Pierrard; the metallographical examination of iron and steel, by Mr. H. Le Chatelier; and an apparatus for charging mercury furnaces so as to obviate the liberation of deleterious gases, by Mr. V. Spirek.

In the mining section, papers on shaft sinking were read by Messrs. Bodart, Portier, Tomson and Duvivier, and on winding engines by Mr. Henry. The use of superheated steam was dealt with by Mr. Weiss, and the use of steam accumulators by Messrs. Rateau and Chaleil. Modern pumping engines were described by Mr. Schulte, the De Laval high-lift centrifugal pump by Mr. Sosnowski, and the Sulzer high-lift centrifugal pump by Mr. Ziegler. The water-flush system of packing colliery workings was described by Mr. Jüngst and by Mr. Lafitte. Fire-damp detection was dealt with by Messrs. Chesneau, Watteyne, Stassart, and Daniel. Electric haulage was discussed by Messrs. Lapostolet, Halleux, and Henry; and the driving of the great adit-level from Gardanne to the sea was described by Mr. Domage. Altogether the programme was one of great interest, and the discussions on the papers were well sustained. The president of the congress was Mr. Alfred Habets, and the presidents of the sections were:—for metallurgy, Mr. A. Greiner, member of council of the Iron and Steel Institute; for mining, Mr. E. Harzé; for mechanics, Mr. Hubert; and for geology, Mr. Max Lohest. Among the honorary presidents of the sections who presided in turn were:—for metallurgy, Mr. R. A. Hadfield, president, and Mr. H. Bauerman, honorary member of the Iron and Steel Institute; and for mining, Mr. H. C. Peake, chairman of the Institution of Mining Engineers.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following is the text of the speech delivered by Prof. Love in presenting Prof. G. H. Darwin for the degree of D.Sc. *honoris causa* at the Encænia on June 28:—

Salutamus Georgium Howard Darwin, magni patris magnum filium, non solum inter astronomos insignissimum, sed, ut decebat tali patre ortum, quasi clavis repertorem qua altissima naturæ arcana reseraret. Ille quidem, Carolum dico, de vita animantium doctor insignissimus, ostenderat quo modo sensim immutata figura simplicioribus et rudioribus perfectiora animalia succederent: hic noster docuit quo modo ipsa mundi compages lentas mutationes subiret. Duces quidem in hac re secutus est Newtonum, Laplacium, Kelvinum, sed suis viribus fretus est magis. Quid enim? Omnia quæ de reciproco maris motu litteris tradita sunt ipse denuo pertractavit, siderum cælo decurrentium meatus summa diligentia et scientia amplissima investigavit: idem tenuissimo quoque et subtilissimo mathematicæ genere instructus, ingenio audaci et vegeto pollens, luculentissime ostendit quo momine et nutu variæ maris agitationes tam multiplices gignantur: quod cum faceret id assecutus est ut terræ, lunæ, solis, planetarum primordia et vices satis clare adumbraret. In hoc viro agnoscimus hominem, dictu mirum, mundorum nascentium annales conscribentem.

CAMBRIDGE.—The Raymond Horton-Smith prize for 1905 has been awarded to Dr. W. L. H. Duckworth, of Jesus College, for a thesis for the degree of M.D. entitled "On the Nature of Certain Anomalous Cases of Cerebral Development."

SUBJECT to the Enfield Council agreeing to contribute one-third of the total cost of the buildings and necessary alterations, it has been decided by the Middlesex County Council to acquire the Ediswan Institute, Ponders End, the object being to convert it into a technical institute for the eastern portion of Enfield, that suitable technical instruction may be given to those engaged in the Small Arms Factory, Enfield Lock, the works of the Edison and Swan Co., &c.

A NEW movement for the encouragement of tropical research has been inaugurated in connection with the University of Liverpool. The school of research, of which Lord Mountmorres is to be the first director, will seek in every way to inquire into the natural resources of the tropical possessions of the Empire. Sir Alfred Jones, of the Elder-Dempster line of steamers, has promised to contribute 1000*l.* a year for four years towards the expenses of the movement.

ACCORDING to *Science*, the following appointments have recently been made in America:—Dr. A. W. Harris, president of North-western University; Dr. C. H. Smyth, professor of geology at Princeton University; Dr. N. Senn, professor of surgery, and Dr. F. Billings, professor of medicine, at the University of Chicago; Dr. H. K. Wolfe, professor of philosophy and education at the University of Montana; Mr. I. E. Wallin, professor of natural history in Upsala College, New Orange, N.J.

THE department of general pathology and bacteriology of King's College, London, announces a course in clinical and practical bacteriology suited to the requirements of medical practitioners and senior students. The course, which will begin on July 26 and end on August 5, will consist of lectures, demonstrations, and practical work. In connection with the same department there will be from July 27 to August 4 a vacation course in clinical pathology consisting of demonstrations and practical work. Further particulars may be obtained from Prof. Hewlett or the secretary of the college.

DURING the coming session courses of general and experimental psychology will be held at King's College, London. During the first and second terms Prof. Caldecott will deliver a series of lectures on general psychology. Prof. W. D. Halliburton, F.R.S., will lecture during the first term on the general structure and histology of the nervous system and of the organs of sense. During the second and third terms lectures on experimental psychology, accompanied by demonstrations and laboratory work, will be given by Dr. C. S. Myers in the new psychological laboratory. A departmental library has been opened at the college containing the principal English and foreign books and journals devoted to psychology.

THE Department of Agriculture and Technical Instruction for Ireland has issued its regulations and syllabuses to guide the teaching of science in Irish day secondary schools for the session 1905–6. The complete conditions regarding regulations for grants, qualifications of teachers, syllabuses of subjects, and a list of official forms are now issued in a single volume. The regulations are materially the same as those which were in force during last session. Some few syllabuses have been modified in the light of the experience gained in the last two years. It is announced that the summer courses for teachers will be continued as heretofore, but it is hoped they will, after 1908, develop into "post-graduate courses on special subjects for those already qualified."

THE British University Students' Congress met on June 28 at University College. All the universities of the United Kingdom were represented except Oxford and Cambridge, these having no organisation which can send delegates to represent their undergraduates generally. The report of the subcommittee appointed last year to consider the question of residential halls at home and abroad was presented. Fourteen British universities and colleges,

eleven American universities, and four Australian universities have been communicated with. It was resolved to elect a committee to formulate recommendations as to what should be done to help to develop the residential system. It was decided also to extend the scope of the constitution of the congress so as to include delegates from the universities of Ireland as well as of England and Wales, and to invite universities of Scotland also to send representatives annually.

IT is announced that Mr. J. D. Rockefeller has given 2,000,000*l.* to the General Educational Board, a body incorporated by a recent Act of Congress for the purpose of promoting education in the United States, and the income is to be used for the extension of higher education in the United States. Mr. Rockefeller has also presented 200,000*l.* to Yale University. It is stated the gift to the Educational Board is to be held in perpetuity, and the income, after payment of administrative expenses, is to be used for the benefit of such institutions as the Board may select for periods, in amounts, for purposes, or on conditions to be determined by the Board, which may also employ the income in such other ways as it may deem best adapted to promote a comprehensive system of education in the United States. The income is to be used without distinction of locality, and its use is to be confined to higher education. It is designed especially for colleges as distinguished from the great universities, although there is no prohibition of grants to universities. The benefits of the donation are to be open to all, although the fund cannot be employed for giving specifically theological instruction. The fund may be used for endowment, for building, for paying off debts, or meeting current expenses.

THE report for the year 1904 of the council to the members of the City and Guilds of London Institute has been received. We notice that the number of university students attending the Central Technical College continues to increase, and that more than 110 such students are in attendance during the current session. At the last degree examination in engineering for internal students of the university, open to all engineering schools in London, eleven degrees in all were conferred, and of these eight were obtained by this college. The total number of students in the college during 1904 was 409, as compared with 304 in the preceding year. This increase in number of the students has made it necessary to provide an increase in the teaching staff, and the appointment of five new assistants has been sanctioned at a cost in salaries of 800*l.* a year. The council, in their last report, announced the steps which had been taken towards the extension of the building of the Technical College at Finsbury. Since then the plans of the new building have been approved, a tender accepted, the foundations excavated, and the building begun. In settling the details of the plans and on the question of the equipment of the new building, the committee had the benefit of the advice of Sir William White, K.C.B., F.R.S. The work of the department of technology of the institute continues to increase with the growing demand for instruction in the application of science and art to specific industries and trades. There are two directions in which, in the opinion of the council, improvements might be effected in the technical education of artisans. First, in the preparation of students before entering upon their courses of evening technical instruction, and secondly, in the standard of qualifications of the teachers nominated by local authorities to give such instruction. It is satisfactory to find that in the different branches of technology the number of students registered as attending classes in the United Kingdom was 41,089, as compared with 38,638 in the previous year. The report as a whole is an excellent record of a substantial year's work.

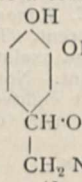
SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, June 7.—Mr. F. Merrifield, president, in the chair.—An earwig, *Apterygida arachidis*, Yers., found by Mr. Annandale, of Calcutta, in a box of specimens received from the Andaman Islands: M. **Burr.** When placed in a small box the earwig was alone, but next morning there were five larvæ present; two disappeared, apparently being consumed by the parent, and the remaining three were those exhibited. Mr. Burr also showed a locustid of the family Pseudophyllidæ, taken in Queensland by Mr. H. W. Simmonds among twigs and plants which it greatly resembled, together with a photograph of the insect in its natural position.—(1) Three examples of *Gnorimus nobilis*, L., taken at Woolwich on May 20 last under the bark of an old dead cherry tree, a beetle supposed to be becoming extinct in Britain; (2) a malformed specimen of *Lochmaea suturalis* which had the left posterior tibia bifid for about one-third of its length, and two tarsi, one of which had the joints considerably enlarged: E. C. **Bedwell.**—A living specimen of *Omophlus betulae*, Herbst, a beetle not known to occur in Britain, found near Covent Garden, and probably imported: O. E. **Janson.**—One ♂ and three ♀♀ of *Agrion armatum* taken this year by Mr. F. Balfour Browne, and sent to the exhibitor alive: W. J. **Lucas.**—Four specimens of the rare *Acrognathus mandibularis*, Gyll, captured on the wing towards sunset near Woking at the end of May: G. C. **Champion.**—Two aberrations of *Biston hirtaria*, Cl., both females, taken at rest on tree-trunks at Mortehoe, North Devon, April 23: Selwyn **Image.** The first aberration was tolerably normal in general coloration, but the anterior half of the fore-wings was much suffused with fuscous, and at the costa was broadly emphasised with rich black. The second aberration was semi-transparent black all over both fore- and hind-wings, the veins strongly delineated with black, powdered with ochreous.—Empty pupa-cases of *Zonosoma pendularia* demonstrating the wide variation of methods in the placing of the silken girth round the pupa: W. J. **Kaye.**—Leaves of strawberry, *Berberis japonica*, and cherry-laurel which had been attacked by a minute fungus—in the case of the Berberis identified by Prof. S. H. Vines as *Phyllosticta japonica*, Thnem.: Prof. E. B. **Poulton.** The attack was local, leaving a roundish or oval window outlined with brown, sometimes in the form of a narrow line, sometimes spreading peripherally into the leaf for a greater or less distance. In the strawberry leaves the edges of the windows were somewhat ragged, but those of the other two leaves had smooth contours, and resembled strikingly the oval transparent areas upon the fore-wings of *Kallima inachis*, *K. paralekta*, &c. Prof. Poulton had believed that these "windows" of Kallima represented holes gnawed by larvæ, and that the altered marginal zone reproduced the effect of the attacks of fungi entering along the freshly exposed tissues of the edge. But he now desired to withdraw his earlier hypothesis in favour of the more probable and convincing suggestion made by Mr. Grove.—Photograph of the fungus-like marks on the wings of the Oriental Kallimas: Prof. **Poulton.**—The variability of the genitalia in Lepidoptera: Dr. Karl **Jordan.**—Scents in the male of Gonepteryx: Dr. G. B. **Longstaff.** It was mentioned that whereas in *G. cleopatra* ♂ the odour was strong, the author had been unable to detect any appreciable fragrance in *G. rhamni* ♂. Such a difference, he said, seemed to imply a physiological difference of the two forms pointing to specific distinction. Dr. F. A. Dixey, in connection with Dr. Longstaff's observations, exhibited and explained the several forms of Gonepteryx occurring in the Palæarctic region.—The geographical affinities of Japanese butterflies: H. J. **Elwes.** Summing up his remarks, the author said that during the winter and spring months the plants and insects of Japan were, like the climate, Palæarctic in character, yet during the summer and autumn they were tropical.—New African Lasiocampidæ in the British Museum: Prof. C. **Aurivilius.**—Memoir on the Rhynchota taken by Dr. Wyllie chiefly in Beira and Lifù: G. W. **Kirkaldy.**

Chemical Society, June 14.—Prof. R. Meldola, F.R.S. president, in the chair.—Influence of various sodium salts on the solubility of sparingly soluble acids: J. C. **Philip.**—The dielectric constants of phenols and their ethers dissolved in benzene and *m*-xylene: J. C. **Philip** and Miss D. **Haynes.**—Synthesis by means of the silent electric discharge: J. N. **Collie.** The facts of special interest are that ethylene under the influence of the silent electric discharge at the ordinary temperature will unite with carbon

monoxide, and will also polymerise, yielding a series of complicated hydrocarbons; the chief substances formed boil at about 150°–160°, and apparently approximate in composition to $C_{10}H_{20}$.—The ultra-violet absorption spectra of aromatic compounds, part i., benzene and certain mono-substituted derivatives: E. C. C. **Baly** and J. N. **Collie.** The ultra-violet absorption spectra of benzene and of some of its mono-substituted derivatives were described. It has been found that benzene presents seven separate absorption bands, and it was shown how the formation of these may be accounted for by attributing each one to a separate and distinct process of dynamic isomerism connected with the linkage changes within the benzene molecule. A similar explanation of the absorption spectra of benzene mono-substituted derivatives was given.—The ultra-violet absorption spectra of aromatic compounds, part ii., the phenols: E. C. C. **Baly** and E. K. **Ewbank.** The absorption band produced by the dynamic isomerism existing in solutions of acetylacetone and similar tautomeric substances of the aliphatic series occupies very nearly the same position as the band given by phenol. The existence of a similar type of dynamic isomerism in the case of phenol is suggested as explaining the difference between the spectra of phenol and its ethers.—Association in mixed solvents: G. **Barger.**—Synthesis of substances allied to epinephrine: G. **Barger** and H. A. D. **Jowett.** The authors have attempted to synthesise a compound having the formula



proposed by one of them (*Journ. Chem. Soc.*, 1904, lxxxv., 192) for epinephrine, but although the methylene and dimethyl ethers were prepared, the base itself could not be isolated.—The determination of melting points at low temperatures: L. F. **Guttmann.** A method has been worked out for readily determining melting points at low temperatures (−142° to −55° is the range so far used) by means of a constantan-copper couple connected to a delicate galvanometer.—The action of water on diazo-salts, a preliminary note: J. C. **Cain** and G. M. **Norman.** One of the authors has shown that little or no hydroxy-compound is obtained by boiling certain ortho-substituted diazo-salts of the diphenyl series with dilute acids. A number of similarly substituted compounds which are said not to yield phenols on boiling with water or acids have now been examined.—A precise method of estimating the organic nitrogen in potable waters: J. C. **Brown.** The process consists in distillation to dryness of a mixture of a portion, without previous evaporation, with potassium hydroxide and potassium permanganate. The ammonia evolved is estimated by Nessler's solution.—Synthesis of 1 : 1-dimethyl-Δ^3-tetrahydrobenzene: A. W. **Crossley** and Miss N. **Renouf.**—Bromine in solutions of potassium bromide: F. P. **Worley.**—The solubility of bromine in aqueous solutions of potassium bromide has been determined over a wide range of concentrations at 18°·5 and 26°·5. There are indications that with the higher concentration of bromine, compounds more highly brominated than KBr_3 are produced.—Tetramethylammonium hydroxide: J. **Walker** and J. **Johnston.** A solution of tetramethylammonium hydroxide is readily prepared by mixing alcoholic solutions of tetramethylammonium chloride and potassium hydroxide.—Tetrethylsuccinic acid: J. **Walker** and Mrs. A. P. **Walker.**—The ultra-violet absorption spectra of aromatic compounds, part iii., disubstituted derivatives of benzene: E. C. C. **Baly** and E. K. **Ewbank.**—Studies in chlorination, ii., the action of chlorine on boiling toluene, preliminary notice: J. B. **Cohen,** H. M. **Dawson,** and P. F. **Crosland.** The results show that, under the conditions of the experiments, electrolytic chlorine enters the nucleus only, and also that the rate of chlorination appears to be more rapid than with ordinary chlorine evolved from pyrolusite and hydrochloric acid.—Purpurogallin: A. G. **Perkin.** A description of various derivatives is given.—The electrolytic oxidation of hydroxybenzoic acids: A. G. **Perkin** and F. M. **Perkin.**

PARIS.

Academy of Sciences, June 26.—M. Troost in the chair.—On a determination of the constant of aberration by means of observations of three stars very close to the pole: H. **Renan** and W. **Ebert.** Arising from researches on the determination of latitude and of the absolute coordinates of the circumpolar stars, a long series of accurate observations has become available for the calculation of the constant of aberration. An advantage of this method is that no correction is necessary for the variation of latitude. The final value obtained is 20″·434, with a probable error of 0·030s.—On isothermal surfaces: L. **Raffy.**—The motion of the earth and the velocity of light: M. **Brillouin.** An analysis of the method proposed by M. Wien and M. Schweitzer for solving the problem as to whether the ether is carried on by the earth, in which the author shows that the desired result will not be attained.—An apparatus for controlling actions produced at a distance by means of electric waves: Édouard **Branly.** An account of alterations in an apparatus already described, the chief improvement being the substitution of an electric motor for the clockwork movement.—On the specific inductive power of metals: André **Broca.** In a preceding note the author, with M. Turchini, has shown that the experimental results are not in accord with the theory for the resistance of fine metallic wires for continuous currents and alternating high frequency currents, the calculations being carried out according to Lord Kelvin's hypothesis. In the present note it is shown that the introduction of the specific inductive power, neglected in the first calculations, will account for the observed differences.—On the phenomena of the singing arc: A. **Blondel.**—An apparatus and method for measuring coefficients of magnetisation: Georges **Meslin.** A modification of the arrangement proposed by MM. Curie and Chenéveau.—The hydrolysis of very concentrated solutions of ferric sulphate: A. **Recoura.** A concentrated solution of ferric sulphate in a well closed vessel becomes slowly converted into a solid basic sulphate and a soluble acid sulphate. From the time required for this change the author regards this action as not due to a simple hydrolysis, but as due to a molecular transformation.—Combinations of aluminium chloride with carbonyl chloride: E. **Baud.** Three compounds of these substances are shown to exist, containing aluminium chloride and carbonyl chloride in the following molecular ratios, 1 : 5, 1 : 3, and 2 : 1. The last is found in commercial aluminium chloride.—The constitution and properties of steels containing tin, titanium, and cobalt: Léon **Guillet.** These metals enter into solution in the iron, the carbon being in the form of carbide. The mechanical properties of these steels are such as to prevent their commercial application.—On the reduction of aldoximes: A. **Mailhe.** Aldoximes can be readily reduced to amines by the Sabatier and Senderens reaction, but the primary amine is not the only product. Acetaldoxime gave a mixture of the primary, secondary, and tertiary amines, and œnanthaldoxime behaved similarly; owing to the decomposing action of the reduced nickel on benzaldoxime the reduction of this compound was irregular.—On the bromination of paraldehyde: P. **Freundler.** At a low temperature bromoacetaldehyde can be obtained; under different conditions tetrabromobutyric aldehyde is produced.—On some new β-ketoaldehydes: F. **Couturier** and G. **Vignon.**—The iodomercurates and chloroiodomercurate of monomethylamine: Maurice **François.**—On some derivatives of butyroine and capronoine: L. **Bouveault** and René **Locquin.**—On a bivalent phytosterine alcohol: T. **Klobb.** This alcohol, described in a previous paper under the name of arnisterine, a neutral crystalline principle extracted from *Arnica montana*, has now been shown by its reactions with acetic anhydride, benzoyl chloride, and phenyl isocyanate to be an alcohol containing two hydroxyl groups, and it is proposed to revise the name to arnidiol.—A method for determining the purity of cocoa butter: E. **Milliau.**—The toxicology of mercury-phenyl: E. **Louise** and F. **Moutier.** This substance proves to be only very slightly toxic in comparison with the corresponding compounds of the fatty series.—On the combustion of sulphur in the calorimetric bomb: H. **Giran.** In a preceding paper the author has attributed the variation of the heat

of combustion of sulphur with pressure to the formation of persulphuric acid, but calorimetric determinations carried out with this substance show that this view is incorrect. The effects observed are due to the presence of traces of hydrogen and nitrogen in the compressed oxygen employed.—Oxyhæmoglobin from the guinea-pig, and its reaction with fluorides: M. **Piettre** and A. **Vila.**—On the simultaneous variations of the organic acids in some plants: G. **André.**—On the production of a soft cider: G. **Warcollier.** The must prepared for fermentation is freed as far as possible from oxygen, and the fermenting liquid is protected from the air during the process.—The genus Alabes of Cuvier: Léon **Vaillant.**—The physiological signification of the urate cells in solitary honey-bearing insects: L. **Semichon.**—The hæmolytic action and general toxicity of eel serum for the marmot: L. **Camus** and E. **Gley.**—On the presence of poison in the eggs of the viper: C. **Phisalix.** At the moment of ovogenesis in the viper the active principles of the venom accumulate in the ovules, and probably play a part in the development.—On the problem of statical work: Ernest **Solvay.**—The treatment of cutaneous cancer by radium: Jules **Rehns** and Paul **Salmon.** A description of two cases in which radium was used with successful results.—On the existence of a remarkable Pliocene layer at Tetouan, Morocco: Louis **Gentil** and A. **Boistel.**—On the origin of eoliths: Marcellin **Boule.**—The drawings of the lion and cave bear and of the *Rhinoceros tichorhinus* on the walls of caves by man in the reindeer epoch: MM. **Capitan, Breuil,** and **Peyrony.**

GÖTTINGEN

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts i. and ii. for 1905, contains the following memoirs communicated to the society:—

February 11.—O. **Wallach**: Researches from the university chemical laboratory, xiv.:—(1) on the constituents of the sage-oils; (2) on the proportion of phellandrene in the ethereal oil of *Schinus molle*, L.; (3) on the occurrence of an alcohol with the properties of pinocarveol in the ethereal oil of *Eucalyptus globulus*; (4) on the semicarbazone of *d*- and *l*-fenchone, and the occurrence of *l*-borneol ester in Thuja-oil; (5) on the preparation and behaviour of methyl(1)-phenyl(2)-hexene; (6) on the bromine-substitution-products of cyclohexanone and cyclopentanone.

January 28.—A. **von Koenen**: On the underground effects of earth-pressure in salt-mines.

February 2.—Dr. H. **Schering**: Seismic records at Göttingen in the year 1904.

February 11.—W. **Blitz**: Further contributions to the theory of tinctorial processes. (1) Measurements relating to the formation of inorganic analogues of substantive dyes; (2) on the "affinity of condition" of certain sulphuretted dye-stuffs.

February 25.—W. **Nernst** and H. **von Wartenberg**: On the dissociation of water-vapour. W. **Nernst** and H. **von Wartenberg**: On the dissociation of carbonic anhydride. E. **Wiechert**: Remarks on the motion of electrons with velocities exceeding that of light. C. **Carathéodory**: On the general problem of the calculus of variations. L. **Maurer**: On the differential equations of mechanics. M. **Laue**: On the propagation of radiation in dispersive and absorptive media. T. **Tamaru**: Determination of the piezoelectric constants of crystallised tartaric acid. (1) General sketch of theory and method of observation; (2) pressure arrangements and the piezoelectric excitation; (3) electrometric methods; (4) results. D. **Hilbert**: Contributions to the calculus of variations.

NEW SOUTH WALES.

Royal Society, May 3.—Prof. Liversidge, F.R.S., vice-president, in the chair.—On the occurrence of calcium oxalate in the barks of the Eucalypts: Henry G. **Smith.** The author announces the presence, in large quantities, of calcium oxalate in the barks of several species of Eucalyptus. It is similar in form and appearance in all species, being well defined monoclinic crystals in stout microscopic prisms, averaging 0·0174 mm. in length and 0·0077 mm. in breadth, and containing one molecule of water. A peculiarity of these is the tendency to form twins geniculate in appearance, twinned forms being pronounced in some species. From botanical and chemical evidence it is assumed that *Eucalyptus salmonophloia* of West Australia and *E. oleosa* of New South Wales belong to the same species, and that the latter tree, which most often occurs as a "mallee," is only the degenerate stage of the former. The theory is advanced that some of the "mallees," or shrubby Eucalypts, have been formed through the poisoning effect of the excess of oxalic acid acting for a long time upon species which originally grew as large trees. The tannins in those Eucalyptus barks containing a large amount of calcium oxalate are of very good quality, light in colour, astringent, easily soluble, and should make leather of good quality. On evaporating the extract to dryness on the water bath but little darkening takes place, and the product is still readily soluble. This class of Eucalyptus barks should, therefore, make excellent tanning extracts. From the bark residue the calcium oxalate should be profitably extracted, and the oxalic acid obtained cheaply from this, practically as a by-product. The air-dried bark of *Eucalyptus salubris*, the "gimlet" of West Australia, gives 30·5 per cent. of total extract and 18·6 per cent. of tannin absorbed by hide powder, and contains 16 per cent. of calcium oxalate. The bark of *Eucalyptus gracilis* contains 16·66 per cent. of calcium oxalate, that of *E. Behriana* 16·5 per cent., of *E. oleosa* 10·64 per cent., of *E. dumosa* 9·8 per cent., and of *E. salmonophloia* 8·34 per cent. The barks of all the Eucalypts tested contain calcium oxalate, although in some species in very small amount.—Notes of astronomical interest, dealing with the past eighteen months, showing the progress and deductions made during that period: H. A. **Lenehan.**

DUBLIN.

Royal Irish Academy, May 22.—Prof. R. Atkinson, president, in the chair.—On the vegetation of the southern part of county Dublin: G. H. **Pethybridge** and R. Lloyd **Praeger.** The paper dealt with the plant associations of this area, which extends from sea-level to nearly 2500 feet, and embraces more than 200 square miles. A coloured vegetation map and photographs were shown in illustration of the subject.

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