THURSDAY, NOVEMBER 24, 1904.

NATURDENKMÄLER.

Die Gefährdung der Naturdenkmäler und Vorschläge zu ihrer Erhaltung. By H. Conwentz. Pp. xii+207. (Berlin: Borntraeger, 1904.) Price 2 marks.

READERS may naturally ask, "What is a Naturdenkmal?" and, since the word is a comparatively new one to the German vocabulary, necessitating its elucidation by the author even for German readers, it may not be out of place if we explain its meaning, as near as possible, in his own words. The usual meaning of "Denkmal" to the German mind suggests a monument or memorial to commemorate some famous personage or victory (for example, Gœthe-Denkmal, Sieges-Denkmal). But in addition to this the title is often applied to outstanding works in science, literature, music, &c. Further, the remains of ancient buildings or works of art of whatever kind which have a historical, technical, or educative value, are spoken of as Bau- and Kunst-Denkmäler. Also the term is applied to prehistoric remains, such as lake-dwellings, burying mounds, urns, tools and weapons of stone or metal; however, the author points out that all those Denkmäler are of artificial origin, that is, the result of man's work and ingenuity. The term Naturdenkmal has a wider application, and includes certain results of nature's handiwork, for example, the elaborately carved stone obelisk is a Denkmal of recent times, and the rough stone-block, erected by the hand of man to commemorate the dead, forms a prehistoric Denkmal; while the Glacial boulder, carried from afar in a former epoch and deposited on the plain by natural forces, forms a Denkmal of nature, or as the artificially built up cairn and rampart wall of a former age may form prehistoric Denkmäler, so the hill and mountain range, formed without man's intervention, are Denkmäler of nature.

Also the whole natural landscape, with its various soil formations, with its water courses and lakes, with its special plant and animal communities, as well as single rare species and individuals of the original flora and fauna, represent "Naturdenkmäler." Although only virgin lands, together with their plants and animals undisturbed by man, should come within the strict sense of the term, still we must here and there allow a certain latitude in its application, because undisturbed localities are scarcely to be found in many of the modern cultured States. For example, any striking feature in the landscape, even if it is a deserted valley or village, must not be struck off the list. Also a natural forest growth which, by self-seeding, has followed the destruction of the original forest by man, must also be reckoned a Naturdenkmal.

On the other hand, artificially planted trees, such as are found in many villages, avenues, and parks, no matter how interesting they may be, cannot be regarded in the strict sense of the term as Naturdenkmäler. In many cases the local conditions must be taken into account in reckoning any natural phenomenon as a Denkmal, for example, a part of the forest which has remained unexploited by man (virgin forest) or the still living representatives of a disappearing species of plant or animal, is universally regarded as a Naturdenkmal; but in other cases, according to the country and locality, we find certain exceptions, for example, in north Germany the traces of glaciers on the rocks are among the greatest rarities, and must, therefore, be regarded as Naturdenkmäler. But on the coast of Scandinavia their occurrence in places is so frequent that there they are no longer Naturdenkmäler. In like manner the Cornel (*Cornus Suecica*) occurs in a few localities in north-west Germany, and in the east it is only found in one place, hence here it is a Naturdenkmal; but in north Russia, Finland, Sweden, &c., its occurrence is frequent over large areas, hence there it is no longer a Naturdenkmal. Similar examples may be given for many other plants and birds. From the foregoing it will be seen that a number of different factors determine whether a natural object can be reckoned a Naturdenkmal or not, and a decision can only be come to by taking the surrounding conditions in each case into account.

The dangers which threaten those natural curiosities and rarities are many, and the author devotes almost one-half of the above memorial to an enumeration of many cases where, through ignorance, indifference, or natural causes, many unique Naturdenkmäler have been considerably damaged, if not entirely destroyed. As an example of the damage which may be done through ignorance or indifference, the author points out the way in which the most beautiful parts of the forests, within reachable distance from Berlin, are often rendered anything but attractive by the traces which trippers and picnic parties so commonly leave behind them. Frequently, also, the most beautiful spots are disfigured by unsuitable and unattractive buildings, principally for the accommodation of visitors. The author also complains that many of the most picturesque hill-tops are disfigured by monuments and towers which are entirely out of harmony with their beautiful, natural surroundings. Then, again, the landscape is subjected to considerable disfiguration by the many devices employed by the advertising agent. Those in high authority are themselves not always free from blame. In one of the German Federated States it was at one time proposed that, in order to preserve the banks and channels of the water-courses, all trees and shrubs should be removed from the sides of brooks and streams. This movement was, however, happily frustrated, otherwise not only the æsthetic features of the landscape would have been entirely destroyed, but also many plant and animal communities would also have disappeared.

The author then brings a long list of charges against tourists and visitors, showing how in many places characteristic plants of the coast and mountains have been almost entirely rooted out. The so-called sportsman, too, is responsible for the wanton destruction of many song-birds in certain parts of the Continent, especially Italy. The author further mentions the extremely regrettable manner in which the reindeer, now confined to Spitsbergen, Nova Zembla, Greenland, Siberia, &c., is systematically hunted and wantonly destroyed in the name of sport. Two cases are mentioned where well educated people in high posi-

tions organised expeditions to the native haunts of the reindeer, where in one or two days more than 100 head were killed, and the greater number of them allowed to lie and rot on the ground. The author further gives a long list of birds which are threatened with extinction unless something is done for their preservation. The dangers to which Naturdenkmäler are exposed through the drainage and reclamation of lands, utilisation of water-power, stone-quarries, exploitation of moors for peat, &c., also the dangers of scientific forestry, leading to the disappearance of all the virgin forest, the uprooting of certain plants for commercial purposes, trapping of birds for cages, and collecting by ornithologists, are too numerous to mention in detail.

Around the ever-increasing centres of industry in Germany the pollution of air and water is becoming greater every day, with the result that plant and animal communities, as well as the whole natural landscape, are undergoing a rapid and radical change, which is necessarily accompanied by the disappearance of rare and valuable Naturdenkmäler. The proposals put forward by the author for their preservation occupy the larger part of the book. Generally speaking, they fall into three groups, viz. :—making a record of the various Naturdenkmäler for the different States throughout the Empire; providing for their protection in the various places; and making them generally known. In carrying out these proposals, it is necessary that the Government should take an active part by the passing of certain laws and allowing the active cooperation of different officials in the various departments. Also communities, societies, and private individuals are called upon to lend their aid. The various details in this proposed organisation for the protection of nature's "monuments" seem quite reasonable and eminently practical, but with laudable modesty the author does not insist that they should be accepted in their entirety. He puts them forward more as a working basis, the details of which may be subject to alteration from time to time as experience and trial should suggest. He is, however, confident that the time will come when the "monuments" of nature will receive the same care and reverence as that which has for long been bestowed upon the monuments of early art and civilisation.

PRINCIPLES OF FUEL COMBUSTION.

Smoke Prevention and Fuel Economy. By Wm. H. Booth and John B. C. Kershaw. Pp. 194. (London: Archibald Constable and Co., Ltd., 1904.) Price 6s. net.

IN the preface the authors state their object to be the "bringing before the fuel using public the principles of fuel combustion," more especially in relation to the smoke question and the economic use of fuel. They express their belief in the possibility of burning bituminous coal perfectly, and that black smoke is merely so much evidence of improper design. "Both on humanitarian and economic grounds its suppression is called for."

The general principles are clearly stated, and a brief description of selected types of furnace arrangement, stokers, &c., illustrated by good diagrams, makes the whole a useful compilation. It cannot be claimed that any addition has been made to our general knowledge of the subject, for the importance of proper air supply, perfect mixing of the gases and air for combustion, the maintenance of a sufficiently high temperature for unchecked combustion, and other points have long been recognised in books dealing with boiler management. Smoke, in fact, is possibly not so much the result of ignorance as of conservatism and false economy.

The book contains many statements in reference to water-tube boilers which few who have had practical knowledge of their working will altogether agree with. Thus "when moderately worked, some degree of safety, or at least a danger much less than attached to the discarded Howard boiler." Surely the rapid adoption of boilers of this type in the large electric lighting and power stations, engineering works, &c., is a sufficient answer to this.

After a reference to the development and satisfactory working of water-tube boilers with anthracite coals in America, the authors refer to the same boilers being erected in this country to burn bituminous coal, and "being set exactly as in America, the results have been hopelesly bad, *and the present smoke of London is due to this boiler more than anything else*" (p. 19). It cannot be denied that the total sum paid in fines for permitting smoke from steam plant of this type has been fairly large, but does the total number of water-tube boilers in London, many of them giving grand results, bear any large proportion to boilers of the old pattern, in spite of the rapid adoption of the former in recent years? The statement we print in italics is far too sweeping and altogether unjustified.

As the authors point out, in many cases boilers, presumably those in which the tubes are more nearly horizontal than vertical, were often set too near the fire, so that combustion was checked by the chilling action of the tubes; but this certainly does not apply to another type of water-tube boiler in use where the tubes are more nearly vertical than horizontal, for here ample combustion space is provided. Several excellent furnace arrangements are described and illustrated which provide for the maintenance of a high temperature until combustion is complete with these boilers, including the excellent one due to Mr. Miller. Engineers, however, do not seem very favourably disposed to much firebrick in the furnace, for it is not easy to ensure its standing the high temperature for any length of time, and water-tube boiler makers rather fight shy of such arrangements owing to the excessive heating of the lower tiers of tubes.

Closely connected with this question is that of the chain grate. As mentioned by the authors, this practically fell into disuse until the advent of the water-tube boiler resuscitated it, and yet we find the statement "it (the chain grate) must fail under the straight ascending flow of the usual setting of the water-tube boiler." Everything turns on the *usual* setting. There must be a number of unusual settings about, or it is not easy to understand why this grate has been so extensively adopted for these boilers. Certain it is

that with no further elaboration of the furnace than a short firebrick arch at the fore-part (illustrated in Fig. 15) they will perform their work very efficiently, and with practically no smoke when using a bituminous coal.

A chapter is devoted to the chemistry of the combustion process. In referring to the hydrogen in fuels, the statement occurs, "it is generally assumed to be present combined with carbon to form hydrocarbons. The most important of these for the fuel user are —methane, ethylene and acetylene." A small amount of at least the first may be present in coal, but are we to assume the authors to mean that these are the important hydrocarbons existing in the coal before it has been heated?

In view of Bone's work (mentioned in a short footnote) it is a pity the authors did not revise their theory to account for the formation of smoke, seeing that the book was not published until a twelvemonth after Bone and Wheeler's paper appeared in the *Journal* of the Chemical Society (August, 1903), and Armstrong's paper in the same number, in which it is definitely stated "neither hydrogen nor carbon being burnt preferentially." J. S. S. B.

SCHOOL MATHEMATICS.

New School Arithmetic. Part ii. By Charles Pendlebury, assisted by F. E. Robinson. Pp. vi+207 to 468+xliv. (London: George Bell and Sons, 1904.) Price 2*s.* 6*d.*

New School Arithmetic. By Charles Pendlebury, assisted by F. E. Robinson. Pp. xvii+468+xliv. (London: George Bell and Sons, 1904.) Price 4*s.* 6*d.*

New School Examples in Arithmetic. By C. Pendlebury, assisted by F. E. Robinson. Pp. xiii+223+xliv. (London: George Bell and Sons, 1904.) Price 3*s.*

A School Geometry. Part vi. By H. S. Hall and F. H. Stevens. Pp. iv+347 to 442+iv. (London: Macmillan and Co., Ltd., 1904.) Price 1*s.* 6*d.*

Theoretical Geometry for Beginners. Part iv. By C. H. Allcock. Pp. 224. (London: Macmillan and Co., Ltd., 1904.) Price 1*s.* 6*d.*

Elementary Plane Geometry. By V. M. Turnbull. Pp. vi+136. (London: Blackie and Son, Ltd., 1904.) Price 2*s.*

Mathematical Problem Papers. By the Rev. E. M. Radford. Pp. vi+203. (Cambridge: University Press, 1904.) Price 4*s.* 6*d.* net.

PART II. of Messrs. Pendlebury and Robinson's "New School Arithmetic" has followed quickly on the publication of part i., and this excellent text-book is now complete. The second part is concerned mainly with the application of arithmetic to the transactions of commerce, dealing with such subjects as interest, discount, commission, stocks and shares, profit and loss, &c. Ratio and proportion find a place, and they are illustrated largely by this class of problem. The authors devote a little space to the training of youths in computations suitable to experimental work in the laboratory. Thus we find that algebraical symbols are freely introduced, and chapters are given on averages, approximations, graphs, elementary mensuration, and logarithms. This portion of the book might well have been extended even at the expense, if necessary, of some of the chapters relating to purely business matters. But the subjects treated are very numerous, affording considerable ground for selection, and many teachers will no doubt, and with advantage, omit some of the technical commercial chapters. At every stage examples are introduced in great abundance, the answers to which extend to nearly fifty pages. The book concludes with a collection of test papers, and a large number of miscellaneous problems. Parts i. and ii. are published separately, and also in one volume. The examples and answers may also be obtained without the other text. Altogether the book is one that deserves, and will no doubt obtain, an extended circulation.

With the issue of part vi. of Messrs. Hall and Stevens's "School Geometry," this popular text-book must now be nearing its completion. The present section corresponds, substantially, with Euclid, Book xi., 1–21, and it further deals with the mensuration of the simpler geometrical solids. In establishing the theorems of pure solid geometry, the authors follow Euclid rather closely, but there are some useful additions. Thus it is shown how a point in space is located by means of rectangular coordinates; but it is not shown how position and form may be exhibited graphically by means of projections. In dealing with areas and volumes, elementary trigonometry is used. The prismoidal formula is also introduced, but its value is scarcely made sufficiently manifest, and it is not shown how to deal approximately with irregularly shaped figures, by means of Simpson's or other rules. The book is printed in very distinct type, and the figures and diagrams are beautifully designed and executed. The subject-matter is presented and developed in the clear and attractive style which is always found in the authors' text-books, and is illustrated by well chosen examples.

Part iv. of Mr. Allcock's "Theoretical Geometry for Beginners" treats, in the first instance, of ratio and proportion, with geometrical applications. The propositions correspond roughly with Euclid, Book vi., but the style of proof is different. The reader is first introduced to the conception of ratio and proportion by means of numerical and algebraical examples, and his knowledge of arithmetic and algebra is drawn upon in establishing some preliminary theorems, which are subsequently used in demonstrating the various theorems. The latter half of the book is devoted to modern geometry, including chapters on harmonic pencils, the complete quadrilateral, poles and polars, centres of similitude, inversion, maxima and minima, and envelopes. Some numerical examples are given at intervals, but, as the title implies, the propositions and the exercises thereon are almost entirely confined to deductive geometry, and from this point of view the treatment is eminently satisfactory. The book is got up and printed in a way that leaves nothing to be desired.

The "Elementary Plane Geometry" by Mr. Turn-

bull is intended for youths who have already had a course of experimental geometry, and is almost entirely devoted to demonstrative geometry. It is divided into four sections, dealing respectively with triangles and quadrilaterals, circles, areas, and with ratio, proportion, and similar figures. Most of the propositions contained in the volume belong to Euclid, but the author has allowed himself that freedom of treatment that is now happily prevalent. The book shows no conspicuous merits such as would render its general use either likely or desirable.

In the volume by the Rev. E. M. Radford, the author has compiled and arranged a hundred test or examination papers, each containing twelve problems; a large number of the latter are stated to be original, and many are taken by permission from published examination papers. The collection is "intended primarily for the use of candidates for mathematical entrance scholarships at Oxford and Cambridge," and the subjects on which problems are set comprise "pure geometry, algebra, trigonometry, analytical conics, and elementary mechanics," with the addition in the last fifty papers of elementary theory of equations and elementary differential calculus. The book will no doubt prove useful to the class of student for whom it is intended, but the problems show no sign whatever of having been influenced by the reform in the teaching of mathematics which is now in progress. The author hopes shortly to publish a volume of solutions, and this will be very acceptable to teachers who may use the work.

OUR BOOK SHELF.

Handbuch der Laubholzkunde. Charakteristik der in Mitteleuropa heimischen und im Freien angepflanzten angiospermen Gehölz-Arten und Formen mit Ausschluss der Bambuseen und Kakteen. By Camillo Karl Schneider. Erste Lieferung, pp. 160; Zweite Lieferung, pp. 161–304. (Jena: Gustav Fischer, 1904.) Price 4 marks for each Lieferung.

THESE two parts form the commencement of a work intended to render possible the identification of the hardy species of angiospermous trees and shrubs indigenous to, or cultivated in, Central Europe. Such a work invites comparison with Koehne's well known book on the same subject rather than with the more comprehensive descriptive works by Koch and Dippel. From the first named it differs in the vastly greater number of illustrations, and in the fuller details given regarding the characters of buds and twigs. These additional details contained in Schneider's book go far towards removing the uncertainty of diagnosis involved in the provisional identification by means of the dichotomous keys employed throughout the work. The present Lieferungen, dealing with the Salicaceæ, Myricaceæ, Betulaceæ, Fagaceæ, Ulmaceæ, Moraceæ, Urticaceæ, Santalaceæ, Loranthaceæ, Aristolochiaceæ, Polygonaceæ, Chenopodiaceæ, Phytolaccaceæ, Caryophyllaceæ, Trochodendraceæ, Ranunculaceæ, Lardizabalaceæ, and some species of Berberis, nominally include 197 illustrations, but in reality contain quite 2000 figures of buds, twigs, leaves, inflorescences, flowers, fruits, and their parts. In addition, the free use of abbreviations and of small print has rendered possible the condensation into small compass of much information concerning not only diagnostic characters of species, varieties, and forms, but also concerning their nomenclature, distribution, and phenology. To illustrate the method of treatment adopted by the author, *Populus alba* may be selected from the twenty-three species of Populus considered in this work. Three varieties of this tree are sufficiently described as regards their distinctive features; figures are given of resting-buds, twigs and their transverse sections, four forms of leaves, flowers, seed, embryo, and seedling; information is tendered as to the times of flowering, of flushing of the vegetative buds, and of fruiting, also as to the germination, distribution, and age attained by this species; and finally hybrids including this species are noted. In so thorough a work it is exceedingly difficult to avoid making statements not universally applicable, but the solitary one that the reviewer has observed is to the effect that *Carpinus Betulus* has a trunk with a light grey coating of cork. The work may be strongly recommended to all engaged in the study of dicotyledonous woody plants growing in the open in this country. PERCY GROOM.

The Cancer Problem in a Nutshell. By Robert Bell, M.D. Pp. 39. (London: Baillière, Tindall and Cox, 1904.) Price 1s. net.

DR. BELL in this pamphlet ascribes the development of malignant disease to a withdrawal of some controlling influence exerted by the thyroid gland upon the cells of the body, caused by some toxic state of the blood. He therefore advocates the administration of thyroid gland or of its active principle in the treatment of the disease, and claims to have obtained successful results. Little or no evidence is given in support of these views, and since malignant disease occasionally, though unfortunately rarely, undergoes spontaneous cure, the apparent success of any form of medical treatment has to be carefully controlled before such a result can be admitted. Dr. Bell's suggestions for the prevention of malignant disease may be of some value.
R. T. H.

Photography on Tour. Pp. 132. (London: Published for the *Photogram*, Ltd., by Dawbarn and Ward, Ltd., n.d.) Price 1s. net.

IN these pages, the sizes of which are only $3\frac{3}{4}$ inches by $4\frac{3}{4}$ inches, we have a number of useful hints and instructions which are well worth an amateur's time to read. When the photographer is away from his base, and has to invent all sorts of makeshifts, he may find many a useful wrinkle given here for which he may later be very thankful. The author seems to have brought into a very small compass a great deal of information covering a wide field, and this pocket book for the touring photographer should serve a useful purpose.

The Story without an End. From the German of Carové. By Sarah Austin. Illustrated by Paul Henry. Pp. vii + 77. (London: Duckworth and Co.) Price 1s. 6d. net.

IN this allegory a child is introduced to the beauties of plants, birds, insects, and other forms and aspects of nature. It pleases children to imagine themselves in close communion with inanimate nature, and they have no difficulty in endowing all the objects around them with human attributes. Poetic feelings, and sympathetic interest in plant and animal life, are appealed to by this daintily bound and gracefully illustrated contribution to literature.

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.*]

On the Origin of Flagellate Monads and of Fungus-germs from Minute Masses of Zooglœa.

BACTERIAL scums are exceedingly common in ditches and ponds, nature's laboratories, and it is a matter of much importance to know what goes on therein. Some light may be thrown upon this subject by making infusions or macerations from cut fragments of various plants, and then examining, at different periods, the scum or pellicle that forms on such fluids. What I have now to say will refer almost exclusively to infusions made from hay. The hay employed may be either fresh or old, but it does not do to substitute for hay mere unripe grasses. I have elsewhere shown how remarkably different are the products derivable from living unripe grasses and from ordinary hay.[1]

In making such an infusion I have been accustomed to cut the hay into short pieces, to place these in a little beaker, and then to add water so as well to cover the fragments. After maceration for three or four hours at a temperature of about 86° F. (30° C.), the infusion has been filtered through two or three layers of the finest Swedish filtering paper into another small beaker. In this way all but the smallest particles, 1/12,000 of an inch or thereabout, will be excluded. For observation of the changes now to be described it is best that the bacterial scum, which soon forms on the surface of the fluid, should be very thin, therefore the depth of the fluid ought not to be more than about one and a half inches—though if one is seeking to make out the origin of ciliated Infusoria infusions of greater depth should be employed in order that a fairly thick pellicle may form.

When such an infusion is kept under a bell-jar (to exclude dust) at a temperature of about 65° F. (18° C.), the pale sherry-coloured fluid in less than twenty-four hours becomes lighter in colour and very turbid. Soon a scum, almost invisible, begins to form on the surface, composed of several different kinds of bacteria, and in about thirty-six hours small Zooglœa masses of the most varied sizes and shapes begin to appear therein. In Fig. 1, A, a portion of such a scum is shown as it appeared at the end of the third day on a hay infusion in which the masses of Zooglœa were exceptionally numerous. The portion of this scum here represented had been transferred on the tip of a sterilised scalpel to a drop of a dilute solution of eosin, which stained the surrounding bacteria a pale red tint, but left the Zooglœa masses unstained, so that they were rendered very distinct. Had logwood been used the results would have been reversed—that is, the Zooglœa areas would have been more or less deeply stained, while the surrounding bacteria would have remained unstained.

Examination of one of these masses with a high power will show its constitution, and reveal the fact that we have to do with an aggregation of separate bacteria imbedded in a jelly-like material. This may be seen from Fig. 1, B, which shows a highly magnified portion of one of the Zooglœa masses from the same pellicle after it had been immersed in a drop of a weak solution of Ehrlich's eosinophyle fluid, which stained the surrounding bacteria a yellow tint, while it left the Zooglœa mass unstained. The slightly altered bacteria within the Zooglœa mass are at this early stage plainly to be seen, though later on they become more or less obscured by reason of progressive molecular changes taking place in the mass during its subsequent transformation.

Some of these Zooglœa masses are destined ultimately to be converted into numbers of flagellate Monads or of Amœbæ, while others become resolved into heaps of Fungus-germs. I have found it impossible to tell from the mere microscopical appearance of the Zooglœa masses whether they are destined ultimately to yield Monads or Fungus-germs. The latter transformation is undoubtedly by far the commoner of the two, and when I was working for many months at this subject during 1899 I was unable to find any good specimens, capable of being photographed, showing the conversion of Zooglœa masses into Monads, although I many times saw and photographed Monads originating from the pellicle as discrete motionless corpuscles—especially when the infusions were kept at a temperature of about 72° F. (22° C.).[1] But one day last month, on October 19, desiring to make certain observations, I made a weak infusion from a portion of a small handful of hay gathered in Norway more than two months previously, which had since been kept in a small cardboard box. The infusion was prepared and filtered in the manner already indicated, and divided into two portions: one, which we may name A, being placed in a small open beaker and left beneath a bell-jar at the end of the mantelpiece in my study; while the other (a very small portion), which we may name B, was put into a small half-ounce earthenware pot, over which the cover was placed. The two specimens of the infusion, covered and uncovered, were then left side by side beneath the bell-jar, so that the temperature to which they were exposed might be as nearly as possible similar. Some of the changes in the scums that formed on the surface of these fluids are now to be described.

Origin of Flagellate Monads from Minute Masses of Zoogloea.

A. When examined fifty-one hours after the time of filtration the scum on this infusion was found to be very thickly crowded with small masses of Zooglœa varying much in shape and actual size, as shown in Fig. 1, A.

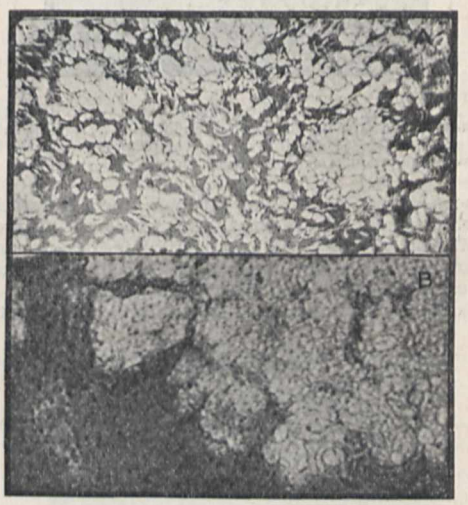

FIG. 1.—A, Zooglœa masses in the scum on a hay infusion (×100); B A portion of one of these masses showing the contained bacteria (×500).

In the course of the fourth day very many of the smallest masses were seen to be undergoing segmentation into small motionless spherical bodies, while multitudes of active flagellate Monads of the same size were for the first time seen in the fluid and in the midst of the portion of the scum under examination. When a similar examination had been made twelve hours previously not a single Monad was seen; now there were swarms of them, and all were of about the same size.

In Fig. 2, A (×500), some of these small masses are shown together with their contained bacteria; B (×375) shows a number of the small masses undergoing segmentation; while C (×700) shows one of these bodies more highly magnified, in which the segmentation into embryo Monads, still in a motionless condition, is almost complete.

In the course of the next day the Monads were found in prodigious numbers. They were spherical or ovoidal in shape, and provided with a single flagellum about twice the length of the body. Under a high power a nucleus could be distinctly seen, generally surrounded by a circle of very minute granules. In addition, two or three larger granules were to be seen—one of them, larger and more highly refractive than the others, being often present in the

[1] "Studies in Heterogenesis," p. 87 (1904).

[1] "Studies in Heterogenesis," pp. 69–73, Figs. 53–55.

posterior half of the body of the organism, and there showing faint oscillations. Numbers of the Monads that were aggregated between three small contiguous air bubbles are shown in Fig. 2, D (×125), as they appeared under a low power of the microscope. Many of them were in active

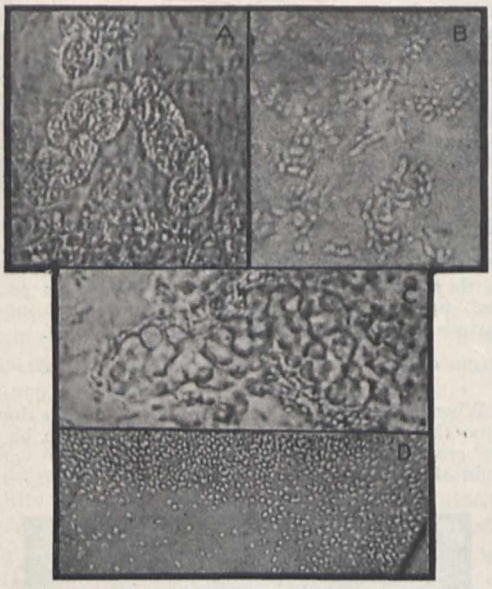

FIG. 2.—A, Small Zooglœa masses from the hay infusion (×500); B, Other of these masses undergoing segmentation (×575); C, One such mass the segmentation of which is nearly complete (×700); D, Monads derived from products of segmentation (×125).

movement and are not shown, but those that were stationary were photographed by a very brief exposure. I found it impossible to photograph these particular Monads under a high power because they were mixed up with active bacteria, and were themselves very delicate in texture. The movements of these bacteria could not be arrested except by a

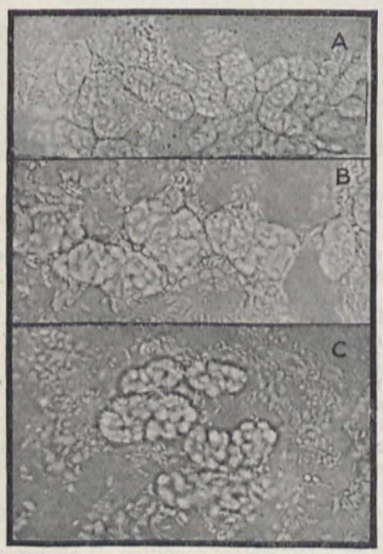

FIG. 3.—A, Portion of pellicle taken from the pot (×500); B, Small Zooglœa masses about to segment (×500); C, Small Zooglœa masses which have undergone complete segmentation (×500).

comparatively strong osmic acid solution, or by exposure to the vapour of a 1 per cent. solution for more than half a minute, and in either case the result was to make the Monads almost invisible, if it did not cause their complete diffluence.

B. The closed pot was not opened until the end of the fifth day, and I then found the surface of the infusion covered with a very thin, scarcely perceptible film of bacteria, which on microscopical examination was seen to be densely crowded with very minute Zooglœa masses such as are shown in Fig. 3, A (×500). Not a single Monad was to be seen, but many of the masses were found to be about to segment as in B, or actually segmenting as in C, into a number of motionless spherical corpuscles.

During six subsequent days I uncovered the pot for a moment to take up on the tip of a sterilised scalpel a portion of the scum for examination, and on each occasion found the minute Zooglœa masses presenting similar characters, except that day by day a rather larger number of them showed evidences of segmentation, though not a single active Monad was to be seen.

The Zooglœa masses formed in the dark, and in a comparatively airless pot, were not only different in character from those formed in the open vessel, but it would seem that their process of change was slower and was in part arrested by the opening of the pot, since after eleven days there was still not a single active Monad to be seen, though in the open vessel swarms of them were found during the fourth day.[1] This arrest of the process of change recalls the similar arrest which was always found to occur when the pot was opened in which Hydatina eggs were being transformed into ciliated Infusoria of the genus Otostoma.[2]

It so happened that on the very day that I first observed the segmentation of the small Zooglœa masses in A I had

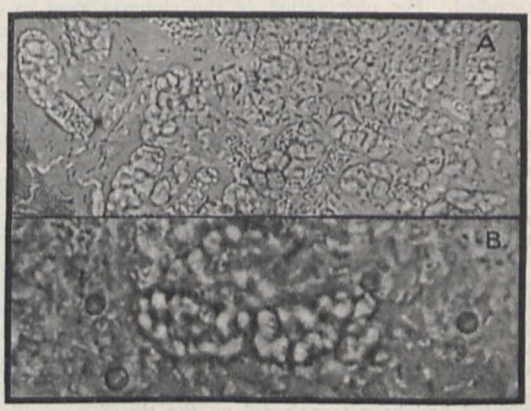

FIG. 4.—A, Minute Zooglœa masses in various stages of change (×500); B One of these masses in which segmentation has been nearly completed (×700).

on my work-table under a bell-jar a small petri dish in which a tuft of dead lichen had been soaking for a few days in distilled water. There was a very thin scum here and there on the surface of this water, and on examining a portion of it I was surprised to find that it also was crowded with small Zooglœa masses, many of which were apparently in different stages of segmentation into Monads, though the majority of them showed no signs of segmentation. Being busy with what seemed at the time to be the more important A infusion, I did not examine this new scum again until after the expiration of two days, and then I found crowds of active Monads, and all the Zooglœa masses now in different stages of segmentation such as are shown in Fig. 4, A (×500). The only portion of an unaltered mass that I could find is seen on the left hand side of this figure, contiguous to the black speck. In the two days all the small Zooglœa masses had either

[1] Examinations of the scum taken from the pot have since been made at intervals during another week and still, up to the eighteenth day, not a single Monad has been met with, though very many of the small Zooglœa masses have been found segmenting into pale brown Fungus-germs. But nine days ago (in order to test the question whether the *premature* opening of the pot had caused an arrest of the formation of Monads) I made another similar infusion from the same hay, and placed some of it in another small half-ounce pot, which was opened for the first time to-day. In the first portion of the scum obtained from this second pot I found swarms of active Monads, and also heaps of the small brown Fungus-germs resulting from the segmentation of other of the Zooglœa masses.—*November* 14.

[2] "Studies in Heterogenesis," pp. 49-51, and xiv.

become converted into Monads or altered in a more or less irregular manner. I attempted to stain some of the masses with a dilute solution of gentian violet. One of these, in which segmentation is pretty complete, is shown in B (×700), while the scattered products of another mass are

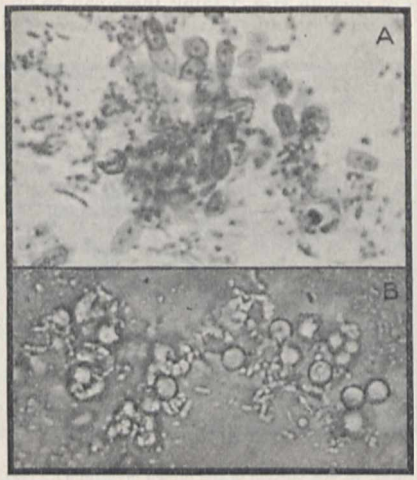

FIG. 5.—A, Products of segmentation stained, and appearing as minute spherical nucleated cells (×900); B, Monads in a resting stage (×700).

shown in Fig. 5, A (×900), after they had been lightly stained with Westphall's mastzellen fluid. In this embryonic condition the future Monads are seen as spherical nucleated cells, either single or in pairs. Some of the

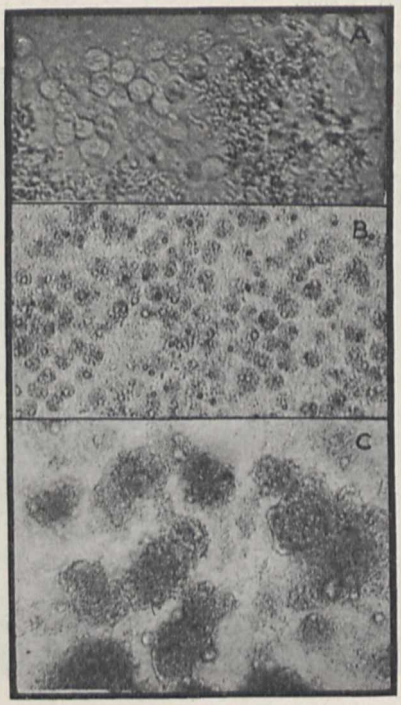

FIG. 6.—A, Monads developed from Zooglœa masses in a hay infusion (×500); B, Amœbæ stained with logwood, from an egg and water emulsion (×200); C, Amœbæ originating in the scum from an egg and water emulsion (×125).

Monads which were found a few days later in a motionless, resting condition, are shown in B (×700).

On other occasions I had been a little more successful in photographing Monads produced from Zooglœa areas in a hay infusion. Thus Fig. 6, A (× 500), shows some such Monads, found on the third day, which had been developed from discrete corpuscles, and which were rendered motionless by a very weak osmic acid solution. These discrete corpuscles, as well as the motionless corpuscles derived from the segmentation of Zooglœa masses, sometimes become converted into Amœbæ rather than into Monads. What the conditions are that favour this particular change I have

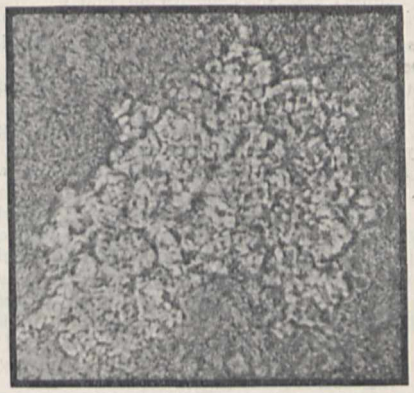

FIG. 7.—A Zooglœa mass undergoing change (×375).

been unable to ascertain, though I know that in rare cases swarms of minute Amœbæ rather than Monads appear in this way in hay infusions. The production of swarms of minute Amœbæ is, however, the rule in the pellicle that forms on an emulsion made by pouring about eight ounces of water on a teaspoonful of mixed white and yolk of egg. Such Amœbæ, slightly stained with logwood, are shown in Fig. 6, B (×200), taken from a pellicle on the seventeenth day, while in C (×125) they are seen, as I believe, originating in another egg and water emulsion on the eighteenth day, in the midst of irregular clumps of bacteria. These aggregates of bacteria had been noticed for several days, but when first observed not a single Amœba had, up to this time, been seen either in them or in the surrounding

FIG. 8.—Portion of a Zooglœa mass about to segment (×500).

fluid. Then there were appearances as though changes were taking place within the aggregates, followed in two or three days by the presence of swarms of minute sluggish Amœbæ around, and issuing from, the bacterial aggregates, as shown in the figure under a low magnification.

In reference to the occurrence of these swarms of minute Amœbæ, I may say that I have never seen one of them multiply by fission, and certainly their vast numbers are not to be accounted for in this way. I make these remarks concerning Amœbæ without pretending that what I have here said in regard to them is quite conclusive, or in any

way comparable to the convincing evidence above adduced concerning the heterogenetic origin of Monads from the transformation of Zoogloea masses—a transformation in which we have vegetal organisms giving rise to animal organisms of a totally different kind, though between these two forms of life no relation of kinship has ever been admitted, or even suspected, by the great majority of biologists.

Origin of Fungus-germs from Masses of Zoogloea.

It has seemed to me, as I have said, impossible to say from the mere microscopical characters of the masses of Zoogloea whether they are likely to yield Monads or Fungus-germs. It will be observed, however, that in the three cases to which I have just referred the masses giving rise to embryo Monads have all been small, and that they have tended to go through their metamorphoses with some rapidity.

It is certain, however, that the great majority of the larger Zoogloea masses tend rather to produce Fungus-germs of one or other kind, and to go through their changes at a slower rate. These statements may be illustrated by a record of the changes taking place in the larger Zoogloea masses that were found in great abundance in the pellicle forming on infusion A. These larger masses of Zoogloea, and also all the later changes which I am now about to

FIG. 9.—Development of small brown Fungus-germs from a mass of Zoogloea (×500).

describe, were, however, wholly absent from the pellicle on infusion B, up to the eleventh day.[1]

Where the changes occur to which I would now direct attention the Zoogloea masses gradually become larger and much more refractive, while they also stain much more deeply with logwood, gentian violet, or other of the aniline dyes. At the same time the constituent bacteria, which are so very distinct in the early stages, seem to become enlarged and gradually more or less hidden as the molecular changes taking place in the mass increase. One of these aggregates in this refractive, glistening stage, which was found and photographed on the fifth day, is shown in Fig. 7 (×375).

The next stage of change is revealed by distinct indications of segmentation beginning to show themselves through the mass, such as may be seen in Fig. 8 (×500), which represents a portion of a large Zoogloea mass that was found on the sixth day. This condition may persist for several days, but occasionally further changes occur rapidly, as may be seen by Fig. 9 (×500), showing a portion of another large Zoogloea mass found on the seventh day, in which minute ovoid germs of different sizes are separating from the mass, and at the same time assuming a brown colour. This change was proceeding more rapidly at the edge of the mass; but further in, as may be seen in the upper portion of the figure, the mass shows more of the appearance to be seen in Fig. 8. Although the germs seem to separate from the metamorphosed Zoogloea mass as bodies of varying size, I think there can be no doubt that some of the separate units subsequently increase distinctly in

FIG. 10.—A portion of the brown mycelium (×125).

size—though whether they undergo segmentation is not so clear. On the following day numerous heaps of brown Fungus-germs were found derived from these Zoogloea masses, forming clusters so thick and dense that their constituents could only be shown by pressing upon the cover glass firmly and thus breaking up the masses of germs. Portions of such a broken up mass are represented in Fig. 11, A (×500).

As a rule, these bodies show little tendency to germinate,

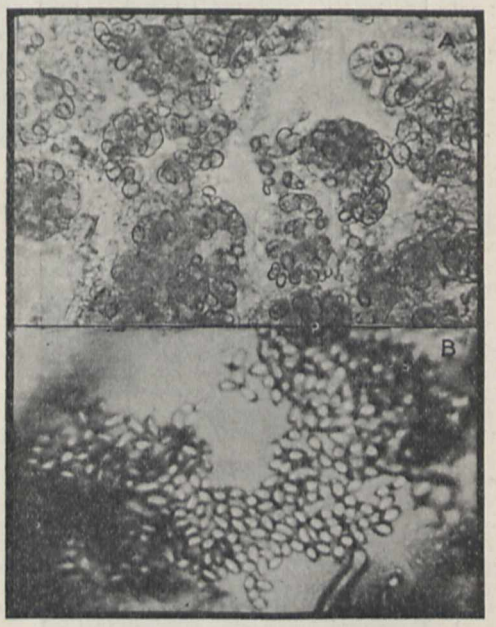

FIG. 11.—A, Heterogenetic Fungus-germs (×500); B, Acrospores produced from the mycelium (×500).

but occasionally they do so, and two or three masses of mycelium to which they had given rise (also of a brown colour) were found on the eighth day. One of them had sent a hypha above the surface, and there produced a great number of ovoid acrospores having a bluish-black appearance. Some of the mycelium is shown in Fig. 10 (×125), while the acrospores are represented in Fig. 11, B (×500).

[1] See note on p. 78.

It will be noted that the acrospores are comparatively uniform in size, and are wholly different from the extremely variable brown Fungus-germs produced from the Zooglœa masses.

What has just been illustrated is only one of the ways in which Fungus-germs are produced in the pellicle from Zooglœa masses. Anyone working at this subject will have no difficulty in recognising many other modes in which they originate. Sometimes the germs separate from the Zooglœa masses as colourless units, and then take on an almost black colour before they begin to germinate, as in the specimen shown in Fig. 12, which was taken on the twelfth day from another pellicle on a hay infusion.

I have frequently found that these heterogenetic Fungus-germs are small ovoid bodies with one, or sometimes two, nuclear particles such as may be seen in this case, and also in some of the small brown units shown in Fig. 9. It is interesting, moreover, to find that the immediate products of segmentation which are about to develop into flagellate Monads present, except for their spherical shape, very similar characters, as may be seen by reference to Fig. 5, A.

It seems to me impossible to doubt that we have in the processes which I have just described definite instances of heterogenesis. The fact of the individualisation and the segmentation of these Zooglœa masses cannot be denied. It is plain, indeed, that from such aggregates of bacteria, by common consent regarded as belonging to the vegetal kingdom, we have the production of typical animal organisms, and that, as I have said, no kinship between

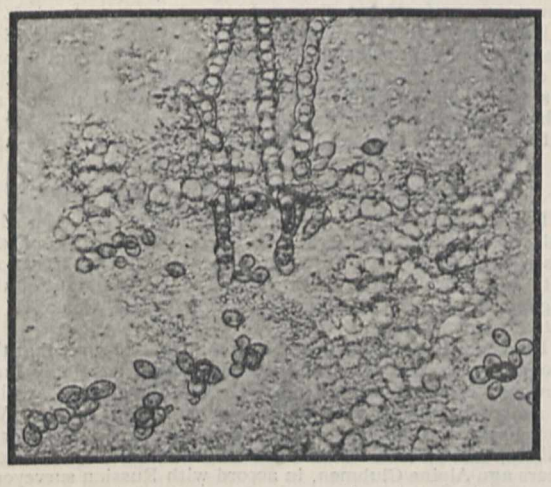

FIG. 12.—Heterogenetic Fungus germs becoming black and germinating (×500).

bacteria and flagellate Monads has ever been recognised, or even suspected, by the great majority of biologists; and, though it cannot be said that there is the same lack of kinship between bacteria and Moulds, it can certainly be said that the majority of biologists have never suspected any such relation between these two forms of life as that which has now been made known.

I care little what names may be given to the bacteria, though I am certain that many different varieties are prone to form zoogloeal aggregates, and to go through one or other variety of such changes as have just been described. Being much interested with these processes that go on in nature, and under more or less natural conditions, I have been familiar with such phenomena for more than a generation[1]; but although they were made known so long ago I am not aware that any bacteriologist in Europe, America or elsewhere has ever repeated my observations. Bacteriologists to whom I have personally mentioned the subject have, with only one exception, shown not the least desire to examine specimens or to follow up the inquiry. They seem wedded to their strict laboratory methods, and seemingly prefer to have dealings with nothing but pure cultures and sterilised media. I do not deny for a moment the enormous increase of knowledge, and the benefit which has accrued to the human race, from their studies, but should like to see a little more toleration displayed for those who prefer to work in a different way, and strive to find out what goes on under more natural conditions—undeterred by the much talked of but much over-rated risk of "infection." Assuredly, in the future, much of what is now ascribed to "infection" will be differently regarded as the "origin of species" by heterogenesis becomes more and more known.

If such processes as have just been described are continually going on in nature, but are not to be met with in the laboratories of bacteriologists, it should make us hesitate to repudiate a natural origin of living matter at the present day simply because undoubted proof of its occurrence cannot be produced by laboratory experiments. If it occurred in the past the law of Continuity would lead us to expect that it has been continually occurring ever since, and, as I said in my letter of November 10, "if the origin of living matter takes place by the generation in suitable fluids of the minutest particles gradually appearing from the region of the invisible, such a process may be occurring everywhere in nature's laboratories, though altogether beyond the ken of man." H. CHARLTON BASTIAN.

[1] See *Proceedings* of the Royal Society, 1872, vol. xx. p. 239.

The Temperature of Meteorites.

DURING the early part of the year 1901, when I was on the staff of the Elswick Works, it occurred to me that it would be useful and interesting if a connection could be made between the conditions of the flight of artillery shells and of meteorites. Later in the same year I made a preliminary mathematical investigation into the matter, and as a result a paper on the temperature of meteorites was sent in as an essay to compete for the Smith prizes at Cambridge. It was distinguished from other essays sent up in not receiving a prize.

It has since remained a strong wish on my part some day to work up the subject into a form fit for presentation to a scientific society, but the pressure of other matters has prevented this. In order, therefore, to preserve at least its outlines, I give here a brief exposition of the premises, the procedure, and the conclusions of the essay.

Ordinary ballistic tables contain a wealth of information as to the retardation experienced by projectiles of all sizes and of one general shape. The shape of the shell is well known. If the same rules can be made to fit the motion of meteorites it is clear that the velocity at any time can be obtained, and thence the loss of energy due to the obstruction caused by the air. This energy reappears as heat, sound, electrical energy, chemical energy, &c. Of these by far the most important is heat. Thus the conditions under which a meteorite "heats up" can be ascertained, and if it be assumed that all the energy is so spent, it is obvious that a superior limit to the resulting temperature may be obtained. One further point should, however, be mentioned—a meteor which reaches the earth is called a "meteorite," and the velocity necessary for this is such that the time of passage through the material part of the earth's atmosphere is so short, say five seconds, that chemical burning will not, in general, introduce any sensible error. Such error as might be introduced would be of the opposite sense to radiation losses, themselves small for much the same reason.

Meteorites may be of almost any shape. I have only considered the shell shape, as it is the only one the flight of which has been thoroughly investigated by exhaustive experiment.

According to Ingall's "Exterior Ballistics," the law of the resistance of the air is a function of the velocity which, for velocities above 1380 feet per second, is the velocity squared. For meteoric problems, velocities less than this are unimportant. Whether this simple law would hold good for velocities of, say, 20 miles a second, or even the 7 miles a second which the earth can impose, is not known, but for lack of a better it has been necessary to employ it.

The next difficulty, and of difficulties there is no small number, lies in the varying density of the air. A few thousand feet is the upward limit of ordinary projectiles. Even for howitzer shell the correction for rarefaction is so slight that the simplest kind of correction is enough. For

meteorites, however, more extended treatment is required. I have taken the resistance to be in direct proportion to the density of the air. To do even this requires a knowledge of the density at all altitudes, and for this I have assumed an isothermal distribution of temperature. The theory of adiabatic distribution makes the atmosphere cease at distances well within twilight and meteor phenomena, and is therefore of no use. Probably something between these two would be most accurate, but its precise form is not of great importance in this investigation owing to the very slight influence of the uppermost reaches of the air on the motion of meteorites.

I now come to the meteorites themselves. Many sizes have been considered, but chiefly diameters of 0·10 inch and 12·0 inches. I refer to these as the "small" and the "large" meteorites. When other sizes are mentioned their diameters are given. I have further taken two materials, viz. iron and stone (trap rock), representing holosiderites and asiderites. The thermal constants for the materials are those found by Forbes.

I stated above the circumstances in which a knowledge of the heat energy given to the meteorite might be taken to be known. To find the temperature distribution in the *interior* of the iron or stone I have adopted the approximation of considering the meteorite to be cylindrical, and then utilising ordinary cylindrical coordinates. During the investigation a good many results were obtained which indicated methods by which the simple labour of the work could be lightened. Some of the more cumbersome expressions could be simplified by dividing the distance between the earth's surface and infinity into two regions, that within the sensible effect of the atmosphere and that without.

Many results were obtained during the investigation. In the large meteorite it was found that for all velocities of approach the temperature at the centre was a most minute fraction of that at the surface. For the small meteorite it was found that the final velocity was always very small and the time of flight correspondingly great, with the result that the whole of the material would be consumed before reaching the earth's surface—this would then properly be termed a meteor, not a meteorite. In its turn this consideration gives the altitude at which incandescence would occur. The small iron meteor would burst into brilliance at 45 miles up, and the stone one at 68 miles. To obtain a superior limit to the point of incandescence I assumed a meteor the diameter of which was only a millionth of an inch. For iron, brilliancy is obtained at 106 miles, and for stone at 129 miles. These figures are obtained by assuming the meteors to have the maximum velocity which the earth could impose. If, however, an initial velocity of 250 miles per second be assumed, surely a superior limit, incandescence would occur some 35 or 40 miles further off, so that the greatest height for visibility would lie well within some 170 miles.

An iron meteorite 3 inches in diameter falling to the earth from an infinite distance would begin to get warm about nine seconds before reaching the earth, and continue to increase in temperature for about seven seconds, after which its velocity would be practically "killed," and two seconds later it would reach the earth at about two-thirds of a mile per second. This represents a typical case for what might be termed the "twelve pound shell" size.

In the "twelve pound shell" size the internal temperature falls off very rapidly towards the interior. Thus, taking the mean temperature in the severest case as 1·00, the surface temperature was 2·2, and at a depth equal to a fifth of the radius (0·30 inch) the temperature was about 0·3 only, whilst at the centre it was 0·0016. So that for the most excessive surface temperatures the central temperature would be well below the temperature of liquid air, assuming, of course, that the initial temperature of the meteorite is at the absolute zero.

The steepness of the heat gradient at or near the surface is the probable cause of the nodular appearance of meteorites. Great resistance to the inward flow of heat would be offered by any internal veining, and as a result such surfaces of separation would tend to become the limiting surfaces for any burning which might occur.

The various formulæ used to obtain the above results were suited to a subsidiary investigation, viz. that of the problems connected with the ejection of rock from terrestrial volcanoes. The results of such an investigation may be briefly summarised as follows:—Had the earth no atmosphere all masses shot off vertically at 7 miles a second and over would fail to return. With the existing atmosphere the large meteorite would require a velocity of 13 miles per second, and the "twelve pound shell" would want a velocity of 78 miles per second. These velocities are not without interest in view of the theory that meteorites originated from terrestrial volcanoes. Smaller velocities would suffice were the masses discharged from high altitudes. Thus, from a height of 5 miles, the velocity for the large iron meteorite would be only $8\frac{3}{4}$ miles per second, and for the "twelve pound shell" only 18 miles a second. Further calculation shows that with an initial velocity of 7 miles a second the large meteorite would rise to only some 120 miles, and the "twelve pound shell" to between 40 and 50 miles, and both would then fall back to the earth.

In conclusion, the result of the investigation may be said to have created a strong presumption in favour of the following general deductions:—

(*a*) That the velocities of meteorites are materially changed by the resistance of the atmosphere, and, in general, by a fractional part of the velocity which is independent of the velocity of approach.

(*b*) That the superior limit for incandescence is probably about 150 miles above the earth's surface.

(*c*) That no iron meteor the original weight of which was less than 10 to 20 lb. reaches the earth's surface, and that when a meteor does do so the temperature of its centre is not in general above that of liquid air (assuming the temperature of space to be zero).

I am aware that the whole structure of the investigation rests on the evil principle of extrapolation, but until man is capable of experimenting with velocities of 10 or 20 miles a second, and surviving thereafter to record his results, no other manner of investigation seems possible.

London, November 13. H. E. WIMPERIS.

Mount Everest: the Story of a Controversy.

I HAVE read with interest in your columns under this title a carefully compiled and instructive account of the discussions that have from time to time during the past fifty years broken out with regard to the naming of the highest measured point on the earth's surface, Peak XV of the Indian Survey.

I have long maintained it to be a matter for regret that the monarch of mountains should be called after any individual, however eminent, and I am still of this opinion, which is shared by most mountaineers and mountain lovers. We should prefer that Peak XV should bear a Nepalese or a Tibetan name, even had one to be invented for it, as twenty years ago Alpine Clubmen, in accord with Russian surveyors, found or invented native names for many of the great peaks of the Caucasus.

But, since your correspondent appeals to me not to prolong the controversy further, I must remind him that the opinion I have expressed is an individual and not an official opinion. For ten years I have had no official connection with the Royal Geographical Society.

Should the council of that body resolve that, considering the length of time the title "Mount Everest" has been more or less in use in this country for Peak XV, the absence of any evidence that that individual peak is designated as, or included in the designation of, Gaurisankar by the Nepalese, and the practical inconvenience (whether the name be authentic or not) of introducing a new Tibetan name such as Chomo- or Jamokangkar, it is expedient that the title Mount Everest should be generally accepted, I shall acquiesce. For I attach greater importance to the general principle than to the particular case, and I believe the protracted discussion and many protests summarised in your columns have served their purpose in helping to discourage the practice of giving personal names to mountains.

I should add that foreign geographers are not, as your correspondent suggests, mainly dependent on the *Geographical Journal* for information in this matter. Captain Wood's report has been noticed in that well known periodical *Petermann's Mitteilungen*.

DOUGLAS W. FRESHFIELD.

Observations of the Leonid Meteors, 1904.

OBSERVATIONS by the writer this year go to show that the intensity was much below that of last. Briefly, the nights of November 12 and 13 were heavily overcast, but the night of November 14 and early morning of November 15 were fortunately clear. The display lasted about an hour, say from 12.30 until 1.30 a.m., maximum 1 o'clock a.m. (local times), hourly rate, low, 20 to 25. Bright meteors, however, continued to appear at intervals up to 3 a.m., when clouds coming on stopped further observation. A couple of hours' watch before and after midnight of November 15 gave only two Leonids, while another two hours' watch on the night of November 16 showed the radiant, which was sharply defined the previous nights, at 150°+23°, near Zeta, to be quite quiescent. Other radiants active were :—

	R.A.	Dec.	
	°	°	
(1) Leonids (No. 2) ...	165	+25	... Strong, bright.
(2) Ursids	155	+47	... ,, ,,
(3) Præsepids	125	+20	... Slow, small, wiry.
(4) Cancrids	130	+5	... Short, bright.
(5) Geminids	108	+28	... (One) short, bright.

It would be interesting to hear of observations made during the hour or so before daybreak on the morning of November 15, as it is just possible the increased intensity noticed in previous years may not be real, but due rather to the fact of the radiant being near the meridian, and the smaller meteors coming down more direct at that time are the better able to penetrate to the lower layers of the atmosphere. W. H. MILLIGAN.

Holywood, co. Down, November 18.

The Discovery of Argon.

IN your translation of Prof. Mendeléeff's interesting paper on the chemical elements (November 17, p. 94) I see that he attributes the discovery of argon and its congeners to Ramsay. Am I not right in believing that it was Lord Rayleigh who discovered argon, and that it was he who gave that impulse to chemistry which Sir William Ramsay has carried forward to such remarkable results?

November 20. G. H. DARWIN.

Blue-stained Flints.

SOME years ago there were many blue-stained flints on a road near Cambridge. Lime from gas-works was about to be mixed with the flints used as road-metal, and the two different materials had lain for some time in heaps by the roadside. The blue colour, in some instances very intense, was developed wherever a heap of flints and one of lime touched each other; from which I surmised that the calcium sulphide of the gas-lime had reacted with an aluminium compound present in the flints, producing a substance akin to ultramarine. F. J. ALLEN.

Cambridge, November 19.

Inheritance of Acquired Characteristics.

IT may be worth noting that since my letter to you of some months back, in which I gave an instance of fox-terrier pups being born with short tails, I have heard of two similar cases. In one of these cases the dog was owned by one of the managers of the Rhodes' Fruit Farms, near Cape Town. The other case occurred in the Transvaal at Sabi, one out of a litter of four being born with a short tail. D. E. HUTCHINS.

Forest Office, Cape Town, October 18.

DR. KOENIG'S METHOD OF COLOUR PHOTOGRAPHY.

IN the methods of three-colour photography hitherto practised the colours are used as inks, stains, or pigments already prepared, and their distribution is effected indirectly by the action of light. In the imbibition process three thin gelatin reliefs are prepared (using potassium bichromate to sensitise the gelatin), and after each relief is stained with its appropriate colour the three films are superposed. The method recently described by Dr. Koenig is of the multiple film kind, but the colours are produced by direct exposure to light.

Many organic colouring matters yield by reduction colourless bodies that are more or less easily re-oxidised with the production of the original colours. The oxidation of these leuco colouring matters is generally if not always quickened by light. If, therefore, the leuco-compound produced from a dye of a suitable red colour is caused to impregnate a film, and this is exposed beneath the negative made to give the red image in three-colour work, the red image may be produced by direct exposure to light. A similar procedure will of course give the yellow and blue images, and so the complete colour print may be obtained. Such are the general principles upon which Dr. Koenig's process depends, but to elaborate the details of a successful process on these lines it was necessary to overcome many practical difficulties.

It was necessary, in the first case, to select only those dyes (of suitable colours, of course) that yield leuco-derivatives of sufficient stability to stand the necessary manipulations. Then it was found that the leuco-bases selected as otherwise suitable gave but a feeble image even after long exposure; but it was observed that when collodion was used as the medium the sensitiveness was greatly enhanced, and the vigour of the image very much improved. This improvement was traced to the action of the nitrocellulose, and other nitric acid esters were found to have a still greater effect. Nitromannite especially is useful for sensitising purposes. Dr. Koenig emphasises the fact that the leuco-bases in an inert film are useless, as the action of aërial oxygen, when it has reached its maximum, gives only a flat and feeble image.

The fixing of the image was the next difficulty, for obviously it is necessary to remove the excess of the leuco-body without interfering with its coloured oxidation product. It is well known that many dyes show a great tendency to remain attached to a fabric or film in spite of the application of solvents, but the leuco-bases employed also have a similar tendency. Dilute mineral acids, though they dissolve the greater number of the leuco-bases, would not remove them from collodion films. A 10 per cent. solution of monochloracetic acid was found to be the best fixing agent.

The various solutions required are supplied ready for use, and the following summary of the instructions issued with them will give a general idea of the manipulation required. A piece of baryta coated paper rather larger than the negative has its edges turned up, and is coated with a 1½ per cent. collodion to which has been added the leuco-derivative of the blue dye and a solution containing the necessary additions. When dry it is exposed under the appropriate negative (for, say, twenty to forty seconds in bright sunshine), soaked in the fixing bath for a few minutes, washed for a few minutes, dipped into a gelatin solution that contains a little chrome alum, and hung up to dry. The print is then turned so that its lower edge shall be uppermost, again dipped into the gelatin solution, and again allowed to dry. The gelatin coating is applied to isolate the collodion film so that it may not be interfered with by the application of the second collodion. The print is then coated with collodion to which the materials for the blue image have been added, exposed under the proper negative, fixed, and coated twice with gelatin as before. A similar procedure follows for the yellow image, and after the final gelatin coating it is well to varnish the print. It is claimed for the dyes employed that the blue, which is the one most liable to change, is more permanent than Prussian blue.

THE NEW WHALE FISHERIES.[1]

IN the story of the rise and fall of the whale fisheries history has many times repeated herself. The Basque fishery, the oldest of all, the fragmentary records of which go back beyond the middle ages, which extended centuries ago to the other side of the Atlantic, which long furnished harpooners to our own fleet, and which has left us the harpoon and its name, finally passed away during last century with a practical extinction of the object of its pursuit. Our own Greenland, or right whale, fishery, in which for one hundred years some 250 vessels were employed, hailing from almost every east coast port, has been now for nearly another century on the decline, and some half dozen whalers from Dundee are all that is left of the once great argosy. A few fine old American ships, with dark-skinned harpooneers from the Cape Verdes, still chase the sperm whale throughout its world-wide habitat, in place of the 700 sail that followed the business sixty years ago. Zorgdräger, Scoresby, Scammon, and a host of lesser men have left us records of these old fisheries, of the methods employed, and of the marvellous success achieved; but, nevertheless, the naturalist has much to regret in the passing away of these great industries, in the near approach to extermination of the most valuable and most interesting species, and in the scantiness of the material that has as yet been saved. Our chief museum contains, I believe, neither skeleton nor even skull of the Greenland whale, and the difficulties in the way of procuring one now-a-days seem to be very great indeed. We have to go to Stockholm or St. Petersburg to see the entire skeleton of such a whale, with the huge fringes of whale-bone still in place in the jaws. Nor, by the way, would our knowledge seem to be more adequate than our anatomical material, for a writer in a standard text-book told us only the other day that a single whale may yield us "several tons" of whale-bone!

While the fisheries before mentioned, and others like to them, are passing or have passed away, a new fishery has sprung up that has for the object of its pursuit a class of whales that formerly had been left in peace. This is the fishery for the great rorquals, or finner whales, first instituted by Captain Svend Foyn at Vadsö in 1864. The fishery is carried on by means of small steamers, carrying at their bows a harpoon gun which discharges a line and explosive bullet. The steamer tows the fish home, to be flensed and worked up in the factory ashore. Twenty years after Svend Foyn's small beginning there were more than thirty such factories on the coasts of Finmark, but all of these have very recently been disestablished by the Norwegian Government, which, in deference to temporary and local prejudice, is robbing its country of a profitable and ill-spared industry. The great success and profit of this fishery has led to its extension to Iceland, Færöe, Newfoundland, and lastly, to Shetland and the Hebrides; but it is still almost wholly in Norwegian hands, and a factory at Tonsberg enjoys a practical monopoly of the machinery employed.

One consequence of the growth of this new industry has been to impress upon us, or to remind us of, the fact that at least certain species of whales exist in their native seas in prodigious numbers, seldom though the occasional traveller has the luck to see them. Once, in the North Pacific, on a calm summer's day, I saw for an hour the ship surrounded on every side by great whales to the number of many hundreds, and a somewhat similar display is said to have been witnessed to the north of Shetland during the past summer. Dr. Hjort calculates that from the beginning until 1901 the finner whale fishery resulted in the capture of some 27,000 fish, a vast number in itself, though not great in comparison to the yield of the Arctic fishery in its palmy days, for the Dutch alone are reckoned to have taken no less than about 575,900 Greenland whales and "Nordkapers" or Biscayan whales, between 1669 and 1778. Probably long lived, but certainly slow breeding, the whale must in the end give way before a wholesale persecution; but meanwhile several species are still immensely numerous, and the naturalist has at least the consolation that pursuit tends to cease as scarcity becomes manifest, and long before actual extermination is achieved.

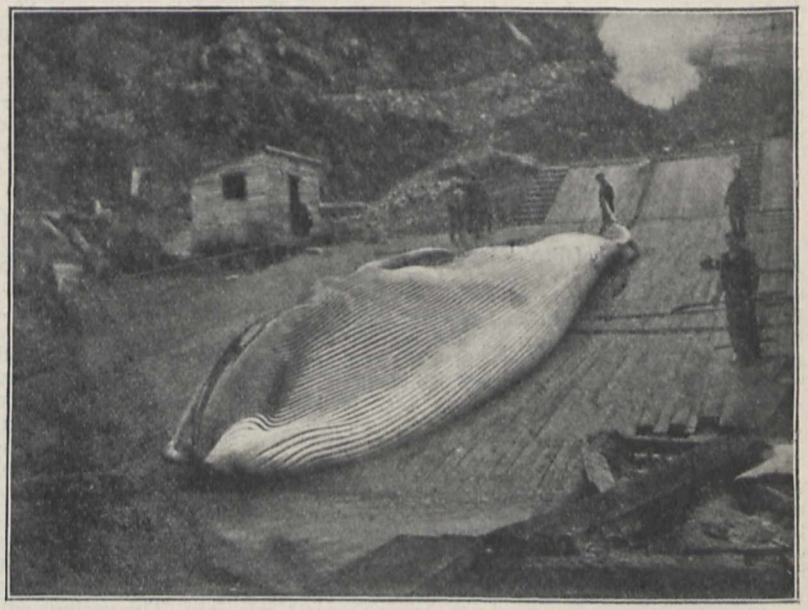

FIG. 1.—The Common Rorqual, Snook's Arm, Newfoundland.

The new industry has many attractions and opportunities for the naturalist. The stations are in many cases within reach of easy travel, and the manner in which the carcases are drawn up for flensing on the shore affords a perfect spectacle of the entire creature. The volume which has suggested the present article, by Dr. F. W. True, of the U.S. National Museum, is the outcome of a careful use of the opportunities afforded by the Newfoundland whaling stations, supplemented by abundant use of literature and study in American museums. Dr. True, who is already well known as a student of the Cetacea, seems to have made it his first object to investigate the specific characters of the larger whales, with the exception of the Greenland whale, and to determine, once for all, whether specimens of the various forms from the two sides of the Atlantic be specifically identical.

[1] "The Whalebone Whales of the Western North Atlantic." By Frederick W. True. (Smithsonian Contributions to Knowledge.) Pp. iv+332, and plates. (Washington: Smithsonian Institution, 1904.)

This question is answered, in general, in the affirmative, with some reservation as to the possible existence of varietal or subspecific differences in the case of the humpback, Megaptera, and the lesser piked whale, *Balaenoptera rostrata*, or *acutorostrata*, as our author, following Lacépède, prefers to call it. Furthermore, additional evidence is adduced in support of the identity of the North Pacific species with those of the North Atlantic. This conclusion is entirely confirmatory of the views of European naturalists, and Dr. True's remarks on the distribution of the various forms deserve to be read in connection with Dr. Guldberg's recent very interesting papers on the probable course of the annual migrations of several species around the circuit of the North Atlantic.

But Dr. True has given us other things besides a careful account of specific characters. He has given us, in the first place, a singularly interesting epitome of the early history of whaling in America, downwards from the mythical days of the Saga of Thorfinn. It will be news to the citizens of New York that, in the seventeenth and eighteenth centuries, there was a not unimportant whale fishery on Long Island and in Delaware Bay, and that so late as 1823 (?) there was a family on Long Beach, N.J., who every winter sought for and "sometimes captured" whales, in which business they had been engaged, father and sons, ever since the Revolution. In the next place, and of still more popular interest, Dr. True has enriched his book with fifty large plates, for the most part taken directly from photographs, of whales as they lay on the beach at the Newfoundland factories. A few similar photographs have recently appeared from Norwegian and Scottish sources, but no such excellent and comprehensive series as Dr. True's has yet been made, though, by the way, one series of *B. musculus*, published about twenty years ago by M. Yves Delage, could scarcely be surpassed.

Five or six species of whales are obtained, more or less abundantly, at the various whaling stations. These are the great "sulphur-bottom," or Sibbald's rorqual, the blue whale of the Norwegians, which, rare on our own coasts, is the chief source of profit to the Icelandic and Newfoundland whalers; secondly, the common rorqual; thirdly, Rudolphi's rorqual, the Seihval of the Norwegians, which seems to be rare on the other side of the Atlantic, but which in certain years has bulked very largely in the Finmark catch; lastly, the humpback, Megaptera. Besides these a sperm whale is caught every now and then, and the Icelanders still take an occasional Nordkaper, or Biscayan whale. Thus the "finner" industry furnishes not only a large number of individuals, but a great variety of species to the observation of the naturalist. Several curious points crop up in regard to the relative commercial value of the several forms. Thus, for instance, Rudolphi's whale, a species very similar to the common rorqual, long overlooked and afterwards considered very rare by naturalists, is now a most valuable element in the fishery, its whale-bone, though no bigger and longer than that of the common species, being worth, from its intrinsic quality, just about ten times as much.

Dr. True's photographs show us, with a wealth of illustration, Sibbald's whale, the common rorqual, the humpback, and the Nordkaper as they lie upon the beach. Many interesting points are excellently well shown—the distribution of colour, the curious pleatings of the ventral skin, the contrast in form between the long, slender, lanky Sibbald's whale and the shorter, stouter body of the common species, the tubercles on the head of Megaptera, the huge flippers with their garniture of barnacles in the same species.

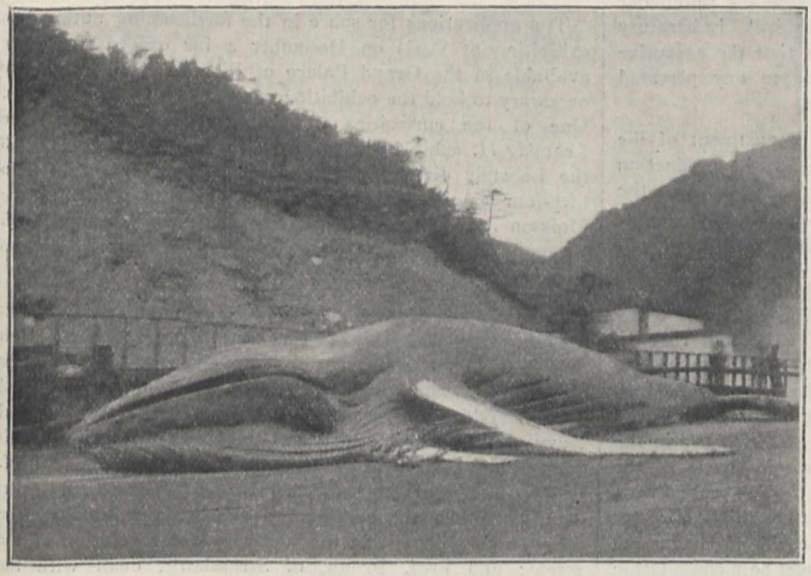

FIG. 2.—The Humpback, Balena Station, Newfoundland.

It is a common practice of American naturalists, and Dr. True is no exception, to deal somewhat harshly with received nomenclature in the quest after "priority." Rightly or wrongly, the common rorqual is invariably known to us as *B. musculus*, but that name is here transferred to what we call *B. sibbaldii*; the former is here designated *B. physalus*, L., and *B. biscayensis* figures as *B. glacialis*, Bonnaterre. The work as a whole does not lend itself to epitomisation, and the foregoing brief account does not do justice to its scientific interest.

D. W. T.

NOTES.

THE directors of the Ben Nevis Observatories, which were closed on October 1, have just issued a circular describing the circumstances in which these observatories have at last been discontinued. The maintenance of the two stations at Fort William and on the summit of Ben Nevis has involved an average yearly expenditure of 1000*l*. Of this sum, 350*l*. has been supplied by the Meteorological Council, and the remainder has been obtained from various private sources. It was hoped that the Treasury Committee which was appointed to consider the question of the annual grant to the Meteorological Council would deal adequately with the position of the Ben Nevis Observatories in its report, but in their circular the directors express disappointment that this was not done. The directors remark:—"Some of their number, including the two secretaries, were examined, and fully stated their case, besides handing in detailed memoranda regarding the history, work, and cost of maintenance of the observatories. Yet, with all this information before them, the committee state in their report that 'it appears that only 350*l*. per annum is required

to ensure the continued maintenance of the observatories.' The directors lost no time in calling the attention of the First Lord of the Treasury to this 'inexplicably erroneous' statement, and in appealing to him that means should be found to prevent the abandonment of the observatories. The Treasury, however, could not see its way to any further increase of the contribution from the Parliamentary Grant, but offered to continue the allowance of 350*l.* a year hitherto received from the Meteorological Council. As this arrangement would have left the directors exactly where they were before, face to face with the impossibility of continuing to raise 650*l.* every year, and with the obvious hopelessness of obtaining adequate pecuniary support from the Government, there was no alternative but to close the observatories."

It is announced in the *Times* that a donor, who desires to remain anonymous, has placed a sum of 1000*l.* in the hands of the treasurer of the Royal Society, to be devoted to the advancement of science. By his wish 500*l.* of this gift is to be placed to the credit of the "Catalogue of Scientific Papers Account" of the Royal Society, and the remainder to the credit of the "National Physical Laboratory Account" of that body, with the request that the executive committee of the laboratory will accede to any personal wish of the director as to its expenditure.

A strong, detailed indictment of the department of the War Office which should be responsible for the production of necessary maps appeared in Saturday's *Times* from the military correspondent of that journal. The war in the Far East has lasted now for nearly nine months, and not a single map of the seat of war has been issued by the Government department which is the chief recipient of the results of our geographical research. The vexatious thing is that the information, even the maps, exist, but that no endeavour has been made to utilise them for the public benefit. The Russian and Japanese Staff maps of Manchuria exist in London, but neither map can be purchased by the public through the trade, though, as both are in the hands of individuals in London, and whole sheets of the Japanese map have been reproduced by the Japanese Press, the presumption is that the mapping section of the director of military operations also stands possessed of them. A map intended to be of use to the public must be a compilation of these and other materials; but no such map has been issued officially at all. The only excuse for this deplorable want of sense is the lack of staff and of time to produce the map for which there is a public demand. In this case nothing could be simpler than to provide some house in the trade with the information available, and allow suitable maps to be produced by private enterprise. Our official maps are, the article affirms, nothing less than a national disgrace. Not only all the Great Powers, but even those of the second and third rank, are infinitely superior in cartography. These facts are then employed to direct attention to the whole question of the teaching of geography, and to warn us of a serious defect in our system of national education. We have suffered in the conduct of military operations because the teaching of geography has not assumed its proper place in the education of our army officers.

The death is announced of Dr. Karl H. Huppert, emeritus professor of physiological chemistry in the University of Prague, at seventy-two years of age.

The scientific committee of the Royal Horticultural Society met recently and received with regret the resignation of Prof. Henslow, who for more than a quarter of a century has acted as its secretary. Mr. F. J. Chittenden, who has been for some time a member of the scientific committee of the society, has undertaken to discharge the duties of secretary until the end of the current session.

It is stated by the *Pioneer Mail* that the Burma Government has decided to discontinue the experiments for the improvement of the indigenous silk industry in the more important silk centres of the Province by the importation of silkworm eggs from France. Owing to climatic and other causes, rearing has failed with foreign imported eggs, and it is not considered worth while pursuing the experiments without the aid of an expert.

Mr. J. N. Halbert has been appointed assistant in the Dublin Museum in succession to Mr. G. H. Carpenter, who held the post for many years. Mr. Halbert is known as the author, in collaboration with the Rev. W. F. Johnson, of a list of the beetles of Ireland (*Proc.* R. I. Acad.). He has also published some papers in the *Zoologischer Anzeiger* and the *Annals and Magazine of Natural History*, on freshwater mites.

The applications for space in the forthcoming automobile exhibition at Paris on December 4 far exceed the space available in the Grand Palace of Fine Arts, so it may be necessary to hold the exhibition at the Galerie des Machines. One of the curiosities of the exhibition will be the *Lebaudy II.* exhibited in a reduced model. To November 18 the Lebaudy dirigible balloon had executed not less than fifty-four ascents, and on the fifty-first the return to the Moisson Aërodrome, the starting point, was accomplished. From the last day of October to November 18 ten ascents were successfully executed.

The first meeting of the annual session of the German Society of Naval Architects was held at the Technical High School at Charlottenburg on November 17. The Emperor William, the honorary president of the society, the Grand Duke of Oldenburg, the Secretary of State for the Imperial Navy, Admiral von Tirpitz, and the secretary of the British Institution of Naval Architects were present. Prof. Ahlborn, of Hamburg, read a paper on the spiral formation of water under the action of a ship's screw, and on the movements produced in the water by the revolution of the screw; and Prof. Braun, of Strassburg, dealt with the methods and aims of wireless telegraphy.

The *Journal* of the Society of Arts states that among the congresses arranged in connection with the Liège International Exhibition of next year, and with which the co-operation of the Belgian Government is ensured, one on chemistry and pharmacy, convoked by the Belgian Chemical Society and the Liège Pharmaceutical Association, will be held at the end of July. The congress is to be divided into the following sections:—(1) general chemistry, physico-chemistry; (2) analytical chemistry, apparatus and instruments; (3) industrial mineral chemistry, including metallurgy; (4) industrial organic chemistry (sugar-boiling, fermentation, tanning, dyeing, &c.); (5) pharmaceutical chemistry; (6) the chemistry of food substances; (7) agricultural chemistry, manures; (8) biological and physiological chemistry (application to hygiene and bacteriology); (9) toxicology; (10) practical pharmacy; and (11) legislation and professional interests, deonthology. The president of the organising committee is Prof. A. Gilkinet, of Liège.

A conference on physical education was held on November 16 at the Education Offices of the London County Council, the Bishop of Bristol presiding. Miss Johnson, of the Swedish Institute, Clifton, advocated the organ-

isation of physical education on the lines of the Royal Central Institute of Sweden, which she described. Sir W. Church, president of the Royal College of Physicians, moved a resolution to the effect that it is desirable that a national system of physical education should be established in the United Kingdom. This was seconded by Sir Lauder Brunton, and supported by other speakers, including Lord Londonderry and Sir W. Broadbent. The *Times* of November 17, in a leading article on the subject of the conference, while acknowledging our supineness in this respect in the past, rightly deprecates any hasty action in the matter, and remarks that while Swedish and other systems have their merits, what we want here is not a system borrowed from Sweden, Denmark, or Japan, but a British system growing out of the British character, and suited, as no borrowed system can ever be, to British needs, and considers that we must begin with the children in our elementary schools.

IN the *Times* of November 17 appeared a letter stating that skulls and limb-bones of horses of known pedigree, no matter what their breed, are required by the natural history branch of the British Museum, and the cooperation of horse-owners is invited in the endeavour to bring together a large series of such specimens. No mention is made in the letter of the special purpose for which a collection of this nature is required. Those who have kept abreast of zoological literature for the last year or two will, however, have scarcely failed to notice how much attention has been directed by naturalists to the problem of the origin of the various breeds of domesticated horses, and especially to the idea that thoroughbreds and Arabs have a different parentage from the "cold-blooded" horses of western Europe. The circumstance that some horses of eastern origin show a vestige of the cavity for the "tear-gland" of the hipparions has been recently brought to notice as an important factor in the problem. To ascertain the frequency of this feature is probably one of the objects of making the collection, while a second may be to ascertain the constancy of certain proportionate relations between the limb-bones of racers and cart-horses. The museum already possesses the skeleton of "Stockwell," from whom are descended most of our best thoroughbreds, and likewise the skull of "Bend Or," presented by the Duke of Westminster, and Mr. W. S. Blunt has promised a skull of one of his famous Arabs.

WE have received from Messrs. Friedlander, Berlin, a catalogue of books on comparative anatomy, which is divided into three sections, the first dealing with vertebrates and the second with invertebrates, while the third is devoted to comparative embryology and morphology.

No. 9 of vol. xxxi. of the *Proceedings* of the Boston Natural History Society is devoted to the North American parasitic funguses of the group Ustilagineæ. These organisms, which have been hitherto very imperfectly known, infest various parts of herbaceous flowering plants, and are represented by twenty-four genera included in two families. Much still remains to be done in determining their distribution, and some of the hosts of certain species are given on the authority of observers other than the author of this paper, Mr. G. P. Clinton.

AN account of the method of preparing *clayed* cocoa appears in the *Bulletin* of the Trinidad Botanical Department for July. The cocoa-beans, after being fermented and dried, are collected in heaps, upon which men are set to dance, while others replace the beans as they scatter. Meantime the heaps are dusted over with powdered clay which adheres to the gummy surface of the beans and acts as a polish, so that finally the beans assume the appearance and colour of polished mahogany; careful drying completes the process, which results in the beans carrying and keeping better on account of the protective covering formed.

THE Cosmo Melvill herbarium, now the property of Owens College, Manchester, is estimated by the donor to contain five thousand genera, or two-thirds of the total number recorded in the "Genera Plantarum," exclusive of others since instituted, and the phanerogams alone amount to 36,000 different species. From a geographical point of view nearly every country appears to have furnished a quota. Amongst the more important collections mention should be made of Sir Joseph Hooker and Dr. Thomson's Indian plants, Dr. Henry's Chinese collections, Mr. C. G. Pringle's Mexican plants, and the specimens collected by Dr. Nuttall in North America.

THE Deutsche Seewarte has added another to its many useful publications, *Tabellarische Reiseberichte*, a collection of tabular reports of the meteorological logs received during the year 1903 from observers on ships. It has several times been suggested that observations made at sea should be published in a tabular form, similarly to those made at land stations; the late Admiral Makaroff was the last to urge the importance of doing so, but the question of expense has always stood in the way. The work in question does not attempt such a regular tabulation of observations, but gives a useful summary of some of the principal phenomena recorded on each voyage, *e.g.* the limits of the trade winds and monsoons, the force of wind, the storms experienced and the behaviour of the barometer during their occurrence, noteworthy currents, sudden changes of sea temperature, &c. Each report also gives the length and nature of the voyage, so that any person interested in the meteorology of any particular part of the ocean can determine approximately the amount of materials available. It is proposed to issue a similar volume for each year.

DR. H. HERGESELL, president of the International Aëronautical Committee, has contributed to *Beiträge zur Physik der freien Atmosphäre* an interesting account of his kite observations on the Lake of Constance. The ascents were first made in the year 1900, and subsequently in the years 1902 and 1903, on both occasions with the assistance of Count Zeppelin, who lent his motor-boat for the purpose. It is understood that such observations are somewhat difficult at an inland station, as the wind velocity necessary for raising the kite (about 8 metres per second, or 18 miles per hour) is not always available without the artificial wind produced by the motion of a boat. Dr. Hergesell's experiments clearly show that, frequently, inversions of temperature and humidity occur at certain levels, which are not exhibited by observations made on mountain peaks, and the opinion is expressed both by Prof. Mascart (president of the International Meteorological Committee) and by himself that however useful in various ways, observations on mountain stations have not led to the results that were expected from them. He is of opinion that if any improvement is to be made in what he terms the present stagnant condition of meteorological science, it will be by the investigation of the upper strata of free air rather than by piling up observations made at ordinary meteorological stations—in other words, by making meteorology a study of the physics of the atmosphere.

IN a communication to the Institution of Mechanical Engineers Mr. R. M. Neilson discusses the possibilities of gas turbines from a scientific standpoint, a region of

study to which up to the present little systematic attention has been given. The author considers that there are four different cycles which could be applied with advantage to a gas turbine, giving efficiencies of from 0·25 to 0·84, and two of them admitting of several different cases. The necessity of keeping the temperature of the blades of the turbine down to about 700° C. to a certain extent limits the efficiency, but, as the author points out, a decrease in the temperature of the source in a Carnot's cycle affects the efficiency less than an increase in the temperature of the refrigerator of the same amount.

We have received from the Stanley Electric Manufacturing Co., of Pittsfield, Mass., an interesting wall map showing the long distance power transmission lines in California. There are six power houses situated on the western slopes of Sierra Nevada from which power is transmitted electrically to San Francisco and the surrounding district. The longest transmission is from the De Sabla power house to Sansaulito, which is to the north of San Francisco, on the opposite side of the Golden Gate; the length of this line is 232 miles. More than 10,000 h.p. is being supplied to San Francisco itself from the electric power house which is 147 miles away. An additional power house is proposed, and also several additional lines.

At a recent meeting of the Faraday Society, among other papers was one by Miss B. Pool on a suggested new source of aluminium. This consists of the vast deposits of laterite which occur in several parts of India; these laterites are closely analogous to bauxite, from which aluminium is at present manufactured. The paper gives analyses of several of the laterites in different districts, and the author concludes that this raw material, on account of its purity, ready accessibility, and association with flowing water should be almost an ideal source of aluminium. Mr. W. M. Morrison, in the discussion, questioned whether it was probable that the Indian laterites would be used in this country, as the supply of bauxite near at hand was plentiful, though it was not unlikely that at some future date they might be worked *in situ*.

We have received from Messrs. Christy and Co., of Old Swan Lane, Lower Thames Street, E.C., a few samples of the several varieties of Dr. Schleussner's dry plates, and have found them to vindicate, practically, the commendations bestowed upon them by many Continental men of science, including several well known astronomers. The "ordinary" plates are characterised by their great sensitiveness and the evenness of their emulsion. The "special rapid" plates, intended chiefly for stellar photography and general scientific work, were found excellent, especially in stellar work, even faint stars giving fairly dense trails when the plates were exposed in a stationary camera. The results in this direction especially are enhanced by the very smooth grain of the finished negative. On testing the "orthochromatic" plates in terrestrial and stellar spectroscopic work they were found to be extremely sensitive, and, with relatively short exposures, gave spectra extending well up into the orange with only a short break on the less refrangible side of the "F" line. The "Viridin" are especially sensitive in the green, with reduced sensitiveness in the blue and violet, and should be found very useful in landscape work where the use of a screen is inconvenient or likely to lengthen the exposure unduly. All the plates were easy to develop with normal pyro-soda, and gave excellent, fine-grained negatives free from any trace of fog. Messrs. Christy are the sole agents for these plates in Great Britain.

No. 9 of vol. cvi. of the *Bulletin de la Société d'Encouragement* contains several papers of metallurgical interest. M. H. Le Chatelier describes a photographic method of recording the temperature of pieces of steel at every instant during the rapid cooling which accompanies hardening, and investigates the law of this cooling in the case of the commoner baths, such as water, oil and mercury, which are employed in industry. Contrary to the usually accepted view, the rate of cooling by means of mercury is much smaller than that due to water; the specific heat of the quenching material, and not its thermal conductivity, is obviously the principal factor to be considered in such cases. The cooling by oil is relatively very slow, owing to its low specific heat and to its viscosity, which prevents loss of heat by convection. M. L. Guillet describes in the same part the properties of tin and titanium steels, and M. P. Mahler discusses the reversible actions occurring in the blast-furnace.

We have received a copy of the "British Standard Specification and Sections for Bull Headed Railway Rails," issued by the Engineering Standards Committee. It has been resolved that the steel used in these rails shall be of the best quality, the constituents conforming to the following limits:—carbon from 0·35 to 0·5 per cent., manganese from 0·7 to 1·0 per cent., silicon not to exceed 0·1 per cent., phosphorus 0·075 per cent., and sulphur 0·08 per cent. The manufacturer shall make and furnish to the purchaser a carbon determination of each cast, and a complete chemical analysis representing the average of the other elements present shall be given for each rolling. A table of the general dimensions of the "B. S." rails is given, with illustrative sections. For straight lines, the committee recommends the adoption of the following as the normal lengths of the rails, namely, 30 feet, 36 feet, 45 feet, and 60 feet. The tensile strength must not be less than 38 tons per square inch nor more than 45 tons per square inch, and a 5-feet length of rail shall respond satisfactorily to the blows of a falling weight of 2240 lb. The inspection and testing of the rails by the purchaser during the course of their manufacture are suitably provided for.

An interesting paper by Mr. L. Gilchrist on the electrolysis of acid solutions of aniline appears in the November number of the *Journal of Physical Chemistry*. On electrolysing a hydrochloric acid solution, aniline black is formed, the depolarising effect amounting to about 0·3 volt. Substituted chloranilines are not formed to any appreciable extent. Electrolysis of a hydrobromic acid solution, which has a considerably smaller decomposition voltage, leads on the other hand to bromanilines, and no aniline black is produced.

The *Proceedings* of the Royal Dublin Society (vol. x., No. 23) contain a report by Dr. E. J. McWeeney on the cases of carbon monoxide asphyxiation which have occurred in Dublin since the addition of carburetted water gas to the ordinary coal gas. It appears that from 1880 to 1900, before the addition of carburetted water gas was practised, there was no recorded case of death from coal gas poisoning, whilst during the four years that have elapsed since the addition was made, there have been ten cases with seven deaths due to that cause.

In a paper published in the *Manchester Memoirs* (vol. xlix., 1904) Mr. W. Thomson describes experiments which show that arsenic is rapidly eliminated from the system by kidney secretion. After the administration of one-fiftieth of a gram of arsenious oxide, about 16 per cent. was found

to be eliminated in this way within twenty-four hours. The amount of arsenic in the secretions of people in towns where large metallurgical operations are carried on is found in some cases to be as high as one-thirtieth of a grain per gallon.

A SECOND edition of Prof. Hantzsch's "Grundriss der Stereochemie" has just been published by J. A. Barth in Leipzig. The rapid advances which have taken place in this branch of chemistry during the last ten years have rendered considerable additions necessary. Sections are now included dealing with the stereochemistry of diazo-compounds and complex inorganic bodies, and with the molecular asymmetry of nitrogen, sulphur, selenium, and tin compounds. The connection between configuration and biological activity, the reciprocal transformation of optical antipodes, and the phenomenon of steric hindrance are also treated in the new edition, which should be welcomed by all classes of chemists.

A THIRD edition of the "Elements of the Mathematical Theory of Electricity and Magnetism," by Prof. J. J. Thomson, F.R.S., has been published by the Cambridge University Press. A new chapter on the properties of moving electrified bodies has been added, and other minor changes have been made.

MESSRS. BELL AND SONS have published separately, under the title "Examples in Algebra," a selection of the examples in the recently published "Elementary Algebra," by Messrs. W. M. Baker and A. A. Bourne. The price is 3s., and the new volume may also be had in two parts at 2s. each.

THE yearly volume for 1904 of the *Reliquary and Illustrated Archaeologist* has now been published. The four separate issues, which have been referred to from time to time in these columns, together form a handsome volume. Some articles in the volume will appeal to students of science who are not archæologists. Among these may be mentioned a well illustrated article by Mr. W. H. Legge "About Almanacs," and Mr. F. W. Galpin's "Notes on a Roman Hydraulus."

IN order to meet the requirements of the new syllabus in chemistry of the matriculation examination of the University of London, Dr. G. H. Bailey has taken advantage of the demand for a second edition of his book on chemistry to rewrite and enlarge it. In its present form "The New Matriculation Chemistry" contains everything that a candidate at the matriculation examination is likely to require. An introductory course of experimental work has been inserted in addition to other new matter. The volume is published by Mr. W. B. Clive, and edited by Dr. William Briggs.

OUR ASTRONOMICAL COLUMN.

ENCKE'S COMET (1904 *b*).—On a photograph obtained on October 28 with two hours' exposure, using the Bruce telescope, Prof. Max Wolf discovered a faint image of Encke's comet, the apparent position of which at 28d. 7h. 13m. 48s. (Konigstuhl M.T.) was

$$\alpha = 23\text{h. } 37\text{m. } 51{\cdot}41\text{s.}, \quad \delta = +26^\circ\ 0'\ 38''{\cdot}0.$$

A faint tail, extending in a northerly direction, was suspected.

On the same night Prof. Millosevich at Rome was able to find the comet with the 39 cm. equatorial of the Roman College Observatory. The object was extremely faint, and had the following position at 6h. 30m. (October 28, Rome M.T.), $\alpha = 23\text{h. } 37\text{m. } 58\text{s.}$, $\delta = +26^\circ\ 1'{\cdot}4$.

Prof. E. Hartwig also observed the comet visually, using the large refractor of the Bamberg Observatory, at 9h. 18m. 11s. (Bamberg M.T.) on October 30, and determined the following as its position :—

α (app.) $= 23\text{h. } 28\text{m. } 1{\cdot}01\text{s.}$, δ (app.) $= +25^\circ\ 23'\ 25''{\cdot}1$.

The comet was very diffuse with a faint central condensation, and a diameter of more than 10′ (*Astronomische Nachrichten*, No. 3977).

OBSERVATIONS OF PERSEIDS.—The results of a large number of independent observations of the Perseid shower of last August, together with a detailed exposition by M. Chrétien of the process by which the positions of meteor radiants may be determined from the observed data by the method of least squares, are published in the November number of the *Bulletin de la Société astronomique de France*.

Among other results, those obtained by M. Perrotin at Nice and by M. G. A. Quignon at Mons are given. The former have already been summarised in these columns; the latter are as follows :—

During a total watch of 7h. 15m. between August 7 and 12, M. Quignon observed 110 meteors, chiefly Perseids, and determined the position R.A. = 44°, dec. = +59°, as the mean radiant point of the shower. The maximum display took place between 22h. 40m. and 23h. 10m. on August 11, when 21 meteors, or 42 per hour, were seen.

HEIGHTS OF METEORS.—In a letter to the November number of the *Observatory* Mr. Denning publishes some data regarding the observed heights of the appearances and disappearances of several different classes of meteors.

He states that, generally speaking, the swift meteors become visible at a greater height than the slower ones, and do not approach so near to the earth's surface before disappearing. Thus for the Leonids and Perseids, both of which are characterised by their comparative swiftness, it has been determined that the former are generally more lofty than the latter, the average heights being as follows :—

	Height at beginning	Height at ending	No. of meteors
Leonids ...	84 miles ...	56 miles ...	25
Perseids ...	80 ,, ...	54 ,, ...	40

On the other hand, the mean heights of the very slow meteors appear to average about 65 miles at the beginning to 38 miles at the end of their appearance. These, however, appear to form two distinct classes :—(1) those having very low radiants, extending from 64 miles to 48 miles; and (2) those having fairly high radiants, extending from 66 miles to 28 miles.

The swiftest meteors apparently become visible when nearly 20 miles higher than the very slow meteors, whilst those of the latter which have high radiants come 20 miles nearer the earth than those having very low radiants.

Seven Quadrantids and four Lyrids gave mean heights of 67 miles to 52 miles and 84 miles to 50 miles respectively.

THE PHOTOGRAPHIC SPECTRUM OF JUPITER.—Using the large refractor of the Meudon Observatory in conjunction with a spectrograph containing one 60° prism and having a focal length of 292 mm., M. G. Millochau obtained a number of photographs of the spectrum of Jupiter during December and January.

A study of the resulting spectra, which were obtained on Lumière panchromatic plates and extend from F to C, showed a number of bands at λλ 618, 607, 600, 578, and 515, which are apparently the same as those observed by Keeler in the spectrum of Uranus. It further disclosed the facts that the water vapour and α bands were greatly strengthened in the planetary spectrum, and that all the bands were relatively more intense in that part which was produced by the light from the south equatorial band of the planet's apparent disc.

The appearance of the band at λ 618, which has been previously observed in the spectra of the superior planets, and of several new faint bands in the Jovian spectrum, indicates the existence of a gas in the atmospheres of the outer planets which does not exist at all, or only in much feebler proportions, in the atmospheres of the inferior planets.

M. Millochau intends to prosecute this research further at the Mont Blanc Observatory, where the clearer atmosphere should permit of better results being obtained (*Bulletin de la Société astronomique de France*, November).

SCIENCE AND THE STATE.[1]

I HAVE long held that there is a certain class of work performed by institutions which should undoubtedly be carried on by some department of the State, specially devoted to such work.

The work to which I refer is such as is not suitable, or to be expected from societies or individuals. It is work which is continuous and must expand in the flux of time, which is recognised by the public as useful, which is not and cannot be remunerative, which requires a staff larger than is required by the ordinary demands of a society, and cannot be dropped without serious detriment to the public.

When there is some pressing need Government does administer branches of a department which has to carry out scientific investigation. Thus the medical branch of the Local Government Board has been laboriously and gradually built up. It is far otherwise, however, with that scientific work which has no department specially interested in or needing it, though it is for the public weal; as the State departments only exist for ministering to that weal, it appears that some department should be created or enlarged to take charge of such work. This view, which I have long held, has been more than confirmed by the evidence given before a recent committee, which the Treasury practically appointed, to consider the present position of the Meteorological Office, but limiting the recommendation to be made so far as the grant made to it is concerned.

Meteorological science has been greatly retarded in Great Britain by want of funds. Perhaps the latest example occurred in 1902, when there was a proposal to obtain further information about atmospheric currents and conditions by the use of balloon and kite observations, an international scheme of work being contemplated. The small sum of 500*l*. a year would have been necessary to carry out this research, but the Royal Society was obliged, on behalf of the Meteorological Office, to reply that they had no funds, a reply which it would have been difficult to make had the Meteorological Office been part of a Government department. Let us look across the water at our American cousins and see how they regard the science of meteorology, and whether or not it is important enough to attach it to the State. According to evidence given to the committee, the Weather Bureau in America, corresponding to our Meteorological Office and forming part of the Department of Agriculture, was spending 230,000*l*. a year on the same work as that of the Meteorological Committee, whose funds at the maximum were confined to 15,300*l*. In Germany, where very large sums are spent on the oceanic part of meteorology, it is a part of the Navy Department. We, with our splendid navy and mercantile marine, surely ought to see that this part of meteorology is as well cared for as it is in Germany, and that there is no lack of funds. The evidence given before the committee showed that without the help of the hydrographic branch of the Navy the work could not have been carried on with anything like success. I am not intending to enter into a discussion of meteorological science, but it has been pointed out that if forecasts are any good (and we have it on record that from 68 per cent. to 75 per cent. of them are successful) they ought to be made as good as possible. There is no doubt that kite and balloon observations, and the use of wireless telegraphy in mid-ocean, would give a still higher percentage of successful forecasts. But the additions must remain in abeyance owing to the money limit which has been fixed at the same standard for so many years.

Again, we find that a very large item of expenditure by the Meteorological Office is the cost of telegrams. It has to pay the same price for the use of the Post Office telegraphs as any private individual, whereas every Government office has the free use of the wires, and has not to consider whether a telegram runs to 12 or 120 words, or whether it sends 1 or 100. The main object of the Meteorological Office is to assist the public, and this is the same as that of Government departments, yet the one is hampered by the cost of publishing information (which to be of the greatest use must be transmitted at once), whilst the other is not. The view of the committee which sat was strongly that this disability ought to be removed, so that wide publicity to weather reports, especially in harvest time, should be given. Finally, the committee almost unanimously reported in favour of the office being attached to some Government department, and proposed that this should be the Board of Agriculture, a department which at present is not overweighted.

I must remind you that our great Indian dependency has been more alive to the question of meteorology than we have at home; but I trust that, backward as we are, we may, before long, attain that excellence of administration which the Indian Meteorological Department has exhibited under its present and past able administrators.

What the Government intends to do with the committee's report I do not know. Judging from previous history, there seems to be a dread at the Treasury of any of the present departments having more to do with science than is absolutely forced upon them. Perhaps this is natural. The lay official mind has, with some few exceptions, never fully grasped the importance of orderly and continued scientific investigation in order to increase national prosperity. It recognises this in a way, for the need is continually brought into prominence by the Press, but to it the easiest plan is to leave all such investigation to societies. In Great Britain it has never been realised that to foster such work is a duty of the nation. We have ignored the very patent fact that in free America and in other countries the necessity of annexing to the State all utilitarian research (when such research is carried out with the definite object of public usefulness) is fully recognised. I am not proposing for an instant that the work which is carried out by individuals or societies should be curtailed, but there are questions which are too large, too expansive, and bearing too much on the public weal which should be dealt with in Great Britain as they are in (say) America.

I have only so far referred to the Meteorological Committee, but, at all events, there is another institution, the National Physical Laboratory, which should come into the same category of quasi-public departments.

The Government has given the National Physical Laboratory buildings, and a sum of 19,000*l*. to make the additions to them, which were absolutely necessary to commence with. It granted 4000*l*. a year for four years, and afforded assistance to it through the Office of Works. The term of years for which the grant was made runs out in March next, and its financial position has to be reviewed by the State through the Treasury. Its existence and development has become a necessity through the excellent work that it has already done. But there is work of first-class importance to the public which the laboratory has been forced to refuse owing to lack of funds. Standardising is not a luxury in the present day, and England has suffered much in its trade owing to the want of it.

The table on p. 91 will show the amounts granted by the different States in regard to these laboratories.

Here we have a direct comparison of grants and turn-out of work. Great Britain, I think I may say, has no reason to be ashamed of the work, though it has of the grants. In connection with the results given in the table, I may point out that France and the United States started their institutions after the inauguration of our own laboratory.

The idea of making any such institution a State institution, it may be supposed, was never entertained by the Government, such a notion being foreign to existing precedent. The precedent—bad precedent too—had to govern the situation. We have only to look across the Atlantic to see how our Anglo-Saxon cousins treat such matters. There, institutions such as I have here described are part and parcel of a State department, and have a handsome annual grant allotted to them. The Government of the United States recognised the public need, and so did Congress, with the result that the public need is catered for by a public department, as it should be.

In regard to the National Physical Laboratory, it is no secret that at the present moment it is hampered by want of funds for equipment and staff. Its refusal of work has only proceeded from this cause. The report which it issued showed that its expenditure had been larger than its income

[1] Abridged from the inaugural address delivered at the Society of Arts on November 16 by Sir William Abney, K.C.B., F.R.S., vice-president and chairman of the council of the Society.

of 9000*l.*, an income which is derived from a variety of sources:—Treasury grant, 4000*l.*; Gassiot Fund, 40*l.* (about); from Meteorological Committee, 400*l.*; fees, &c., 4200*l.* (about). In addition to this there has been 1200*l.* in donations.

Whether the laboratory can become self-supporting is a matter of doubt to my mind. Even if it should be so, that is no reason for taking it away from State control, which always gives an impress to decisions, and it is a pledge that gain is not its only object. Certainly it would never arrive at the proportions that the huge, more than self-supporting department, the Post Office, has arrived at. The example of Germany, where the State takes the fees, and supports the institution, is worth following.

Country	Name	Cost		Annual Grant	Receipts from annual work	No. of tests made	Staff
		Building	Equipment				
Germany	Reichsanstalt	£200,000		£16,000	£3,000[2]	22,469	112
	Aichungs-kommission ...	48,000		8,500	—	—	—
	Versuchsanstalt	137,000		15,000	8,000[2]	5,000	140
		£385,000		£39,500	£11,000	27,469	252
France	Laboratoire de l'état ...	£27,000 and some buildings.	£20,000	5,500	—	—	12
U.S.A.	Bureau of Standards ...	£70,000	45,000	19,000	114[3]	1,666[3]	22
Great Britain..	National Physical Laboratory	£19,000 including some buildings.	[1]	4,000	4,042[4]	30,807[4]	50

[1] The annual grant was made before the work was started, and any balance left after paying salaries I believe was available for apparatus.
[2] In these cases the State takes the fees. [3] For the first year. [4] Includes the Observatory Department.

I might refer to researches in solar physics also, which are carried out in the iron shanties at South Kensington, under the control of the Board of Education. The sum of 700*l.* is allotted as a grant in aid for the work that is carried out there, and some of the staff are borne on the estimates; but if, as is to be believed, some of the tremendous problems of the causes of famine and plenty are dependent on the solar phenomena, then this work should be enlarged and encouraged. The expenditure of ten times the sum in one year may enable millions of pounds and lives to be saved which may be lost from the scant supply of needful means. It is true that the Solar Physics Observatory is under the Board of Education, but if its history were written, I doubt not that it would be found that from its very first inception (due to the repeated recommendation of a host of scientific men who foresaw something of what might be expected from it) the State wanted none of it. It may be said that if the Meteorological Office and the National Physical Laboratory were attached to a Government department, they might be starved in the same way. I do not believe it possible that such would be the case, for these two are of ostensible use to the ordinary public, and appeal to that most sagacious and popular person the man in the street, in a way that solar physics does not. The last deals with problems which are for future use, but it is intimately, most intimately, connected with meteorology. If the Meteorological Office becomes attached, as it eventually must be, to a Government department, the Solar Physics Observatory and staff should be attached to the same department.

If the Government will recognise the two institutions as doing essentially public service, and ask for the necessary funds, I believe Parliament would vote the supplies in the same ungrudging manner that Congress has done, as they would look upon them as a paying investment. Parliament realises most frequently before Government does the importance of any public work. The most happy solution of the problem would be (1) to have some department of State to which these and other kindred scientific institutions should be attached; (2) to have a scientific advisory board; (3) to distinguish clearly between grants for research, equipment, and material, and those for staff.

THE BEN BULBEN DISTRICT.

THE region lying north of Sligo, which was visited by a large party of naturalists last July on the occasion of the fourth triennial conference of the Naturalists' Field Clubs of Ireland, is one of much beauty and interest. In its general aspect it recalls the best features of the Yorkshire Carboniferous Limestone area. Its setting, with the great limestone plain of Ireland stretching away on one hand, and the Atlantic Ocean on another, adds a dignity and impressiveness to this group of cliff-rimmed, flat-topped hills which might not be bestowed by their height alone, though they are of no mean elevation (Truskmore, the highest point, rises to 2113 feet). The Ben Bulben range, which derives its name from that of one of its spurs which projects boldly towards the Atlantic, represents the wreck of the Upper Limestone of this district. The fertile undulating low grounds all around are occupied by a lower and more argillaceous series, through which one of the old Caledonian folds of Ireland projects as a knobby ridge, its rugged outlines forming a charming contrast with the green and grey tabular forms of the limestone. The Upper Limestone, 700 feet or 800 feet thick, massive and strongly jointed vertically, rests on the lower series as a cliff-bound plateau, intersected by several grand glens, which are cut through the limestone deep into the less resisting rocks underneath. The mural precipices are the result of the characteristic weathering of the massive limestones. Below them, where not obscured by talus, the Middle Limestones and shales fall away in steep concave slopes into the plain. The exquisite valleys of Glencar and Glenade cut right through the plateau, the first in an east and west direction, the other north and south. Each is from one to two miles wide from cliff-top to cliff-top, and about a thousand feet deep (Fig. 1). The floors of these valleys are undulating, and the scenery is much enhanced by the fact that each embosoms a lake at the point where the cliff scenery reaches its best.

On some parts of the plateau-edge denudation has been more severe, as in the beautiful wedge of Ben Whiskin (1666 feet), the western side of which displays a characteristic precipitous front, while the eastern side has been worn down to a uniform steep slope which drops into Gleniff.

The uniformity of the post-Carboniferous uplift is shown by the almost absolute horizontality of the beds of limestone throughout the region. The surface of the plateau, while retaining in a general way this horizontality, is seen on a nearer approach to be undulating, a feature chiefly due to the fact that patches of the Yoredale sandstone still remain here and there isolated on the surface of the limestone. The whole plateau, limestone as well as sandstone, has in general a thick covering of peat.

To the botanist the Ben Bulben range is well known as the only British habitat of *Arenaria ciliata*, a species with a high northern and alpine distribution, which is locally

abundant on these hills. This plant strikes the key-note of the flora of the district, which is essentially northern and alpine in its characters. Adjoining on the south, in Mayo, the Lusitanian heaths, *Erica mediterranea* and *Dabeocia polifolia*, and other plants fully represent the remarkable southern flora which characterises the western sea-board of Ireland, and a few miles on the northern side the same features are repeated in Donegal in the occurrence of *Saxifraga umbrosa*, *Euphorbia hiberna*, and *Trichomanes radicans*. But in the Sligo flora the southern element is absent, saving the occurrence of *Adiantum Capillus-Veneris*, which may be found growing at sea-level in company with *Draba incana* and *Saxifraga aizoides*.

As it is with the plants, so with the animals. The characteristic southern forms of western Ireland are scarcely represented, while northern animals are conspicuous. The Field Club entomologists found *Pelophila borealis* literally to swarm on the shores of Lough Gill, which is only a few feet above sea-level; *Xenylla brevicauda*, an Apteron new to the British Isles, which accompanied it here, is likewise northern; and other instances might be quoted. Among other results of the Field Club visit (which are fully described in the September number of the *Irish Naturalist*) may be mentioned the discovery of three water-mites, one of which, *Eylais bicornuta*, is new to science, and the two others new to Britain.

FIG. 1.—Entrance of Glencar. Showing the southern cliff-wall of Carboniferous Limestone, which rises a thousand feet above the valley.

COAST EROSION AND PROTECTION.

TWO papers on this subject were recently read at the Institution of Civil Engineers, one by Mr. A. E. Carey on coast erosion, and the other by Mr. E. R. Matthews, the borough engineer of Bridlington, on the erosion of the Holderness coast of Yorkshire.

The first paper deals generally with the whole coast of England, and briefly enumerates the salient geological features of the coast line and points out their connection with the relative rates of erosion. The second paper is confined to the erosion taking place on the Yorkshire coast between Bridlington and Spurn, and the works that have been carried out in constructing promenades, sea walls, and groynes at Bridlington.

There is no novelty in the descriptive parts of these papers. It is a well known and recognised fact that on certain parts of the coast of this country considerable loss of land is taking place by the erosion of the sea. The subject occupied the attention of the geological section of the British Association in 1885, when a committee was appointed to investigate the subject of coast erosion, and reports of experts having local knowledge were obtained from all parts of the coast and printed in the reports issued from time to time, the last, which was confined to recent evidence obtained from the coast guards, being published in the report of the meeting held at Southport in 1903. We have ourselves dealt with the subject in articles in NATURE in our number for June, 1899, and on sea coast and destruction in August 23, 1900. The destruction of the Holderness coast and the protective works put up to stop the erosion at Hornsea, Withernsea, and Spurn were dealt with in a paper by Mr. Pickwell on the encroachments of the sea from Spurn Point to Flamborough Head printed in the *Minutes of Proceedings* of the Institution of Civil Engineers, vol. li., 1878.

The whole subject, both as descriptive of the coast of England, the losses that have taken place, and the works that have been carried out to prevent erosion, is also very fully dealt with in the work on "The Sea Coast" published by Messrs. Longmans in 1902.

Mr. Matthews in his paper makes a statement that has frequently been made before, but for which there does not appear to be any warrant, to the effect that the material eroded from the Holderness coast is carried into the estuary of the Humber. This subject was very fully dealt with in a paper read at the British Association at Glasgow in 1901 on the source of warp in the Humber, in which it was conclusively shown that it is physically impossible for this material to be carried into the Humber, and that, as a

matter of fact, no warp is carried into the river from the sea, but that the warp in suspension is derived entirely from the solid matter brought down by the various tributaries of the river. The paper describes this matter as oscillating backwards and forwards with the tides in a zone confined to the lower reaches of the Ouse and the Trent, except that when heavy freshets are running it extends into the Humber and is then partly carried out to sea. This peculiar action is made use of to improve the value of the land adjacent to the rivers by the process of "warping." Any solid matter brought into the Humber on the flood tide consists entirely of clean sand, and has no relation to the waste of the Holderness coast.

The only novel features, therefore, in these papers is the suggestion of Mr. Carey that the matter should be taken up by Parliament, and that a body of commissioners should be created with the special function of dealing with the foreshores of England and Wales. He proposes that the coast should be divided into districts placed under commissioners, each having an engineer to act as coast warden, with power to deal with the material on the beach, and the general control and management of all foreshore lands, the costs incurred by this commission to be divided between the Treasury, the local authorities, and the landowners.

Mr. Matthews confines his ideas of Government interference to the coast of Yorkshire, and suggests that this ought to be protected against the inroads of the sea by the Government, quoting as a precedent for this that the Board of Trade protects the Spurn Peninsula. He loses sight, however, of the fact that this is done for the protection of the lighthouses which stand on the peninsula, and for the preservation of the entrance to the Humber. Mr. Matthews gives an estimate for protecting this reach of coast by sea walls and groynes, and shows, as has been done by others on previous occasions, that the value of the land swallowed up by the sea within a reasonable period would not amount to one-third of the first cost of the protective works, apart from their maintenance.

It will be remembered that recently, owing to the great destruction of sea protective works that occurred at Lowestoft and Southwold, the representatives of the sea coast towns on the east of England held a conference at Norwich and appointed delegates to interview the Prime Minister and the officials of the Government departments more particularly concerned in this matter, urging that the preservation of the coast and the sea defence works ought to be a national charge. So far, however, they do not appear to have justified their claims for such aid. It has been pointed out that most of these towns have gradually emerged from mere fishing villages into sea-side resorts, and have erected promenades and other similar works for the purpose of making their places popular, and have by this means increased the value of the land in the neighbourhood from a mere agricultural price to that of building land, very greatly to the profit of the owners of such land. It appears therefore manifestly unfair to ask the owners of the agricultural land at the back, whose rents have already been greatly depleted by the fall in value of agricultural produce during the last few years, to contribute towards works for the improvement of their neighbours' land on the coast, which they would have to do if these works were made a charge on the national revenue, and it would be equally unjust to levy contributions on inland towns which have borne the costs of large improvements for sanitary and health purposes out of their own rates.

Mr. Carey describes in his paper the evolution of a sea-side village, subject to intermittent inundation, into a watering place, in front of which the local authority charged with the works not only encloses within the sea wall nearly the whole of the shingle beach which afforded a natural protection to the shore, but also by groynes traps the whole of the travelling shingle, with disastrous results to the owner of the land to leeward. It may also be pointed out, as stated in the British Association report for 1895, that many of the disasters that occur to the sea walls and promenades of these sea-side towns are due to defective engineering and a complete disregard of the laws of nature.

It is obvious that it would be very desirable to set up some better control over the works now carried on along the sea shore either by increasing the powers of the Board of Trade or by the appointment of a special commission, as suggested by the author of the paper. The great difficulty will be in dealing with the rights of the persons claiming the ownership of the beach material, which in many cases is sold and removed in very large quantities for concrete making, road repairs, or other purposes. The Board of Trade occasionally, on being applied to, intervenes and issues notices prohibiting the removal of sand and shingle, but its power to do so is not so well defined as it ought to be, and the whole subject requires investigation, and legislative action for regulating and controlling works carried out on the sea shore and the removal of beach material; but the preservation of the property of landowners and urban authorities out of funds provided from the national exchequer would be entirely contrary to the methods of administration hitherto pursued in this country.

THE NOVEMBER METEORS OF 1904.

THOUGH there was no prospect of a brilliant display this year, there seemed the probability of a pretty conspicuous shower. In 1838—five years after the great meteor-storm of 1833—Mr. Woods, of London, reported in the *Times* that on the night of November 12, between 15h. 25m. and 15h. 55m., "nothing could exceed the grandeur of the heavens. Meteors fell like a shower of bombshells in a bombardment and in such rapid succession as to defy every attempt to watch their particular directions or to ascertain their numbers." Mr. Woods estimated that he saw 400 or 500 meteors during the half-hour mentioned.

In 1872 also, about five years after the brilliant displays in 1866, 1867, and 1868, the Leonids returned pretty abundantly, for on November 13, 12h. to 18h., several observers at Matera, Italy, counted 638 meteors, and the display was regarded as having been much brighter than usual.

In these circumstances it was expected that the return of 1904 would be deserving of careful observation, and so it has proved, though the shower was perhaps not quite so rich as expected. The earth, however, probably passed through the denser part of the stream at about Greenwich noon on November 15, and thus it must have escaped observation in England. Reports from American stations are awaited with interest. In this country fogs were very prevalent at the important time, and at some places appear to have obliterated the phenomenon.

At Bristol during the night of November 13 there were very few meteors visible, with only occasional Leonids, but the stars were dim in the fog.

On November 14 the conditions were more favourable. Between 13h. 30m. and 15h. 45m. about 55 meteors were seen (including 33 Leonids) by the writer during a watch extending over 1½h. of the period named. It was considered that Leonids were appearing at the horary rate of 25 for one observer. After 16h. increasing fog interfered with observation. The Rev. S. J. Johnson at Bridport had, however, a very clear sky after 16h., and noted a fairly numerous display of Leonids, including one as brilliant as Venus and several equal to Jupiter. He does not mention the exact number seen.

Mr. C. L. Brook at Meltham, near Huddersfield, watched on November 14 between 16h. and 18h., and counted 69 Leonids, of which number 17 were observed in the first quarter of an hour. Other results have come to hand which corroborate Mr. Brook's figures, and show that the maximum was attained between 15h. 50m. and 16h. 20m., when the rate of apparition was 1 Leonid per minute in the sphere of vision commanded by one observer.

There appear to have been very few Leonids seen either on the nights of November 13 or 15.

As observed at Bristol, the radiant seemed to be an area 4 or 5 degrees in diameter, with its centre slightly west of γ and ζ Leonis, or at 151°+23°. There were several minor showers visible, and two of these were well pronounced at 43°+21° and 144°+37°.

W. F. DENNING.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Rhodes trustees have decided to add 200*l.* a year for the next five years to the stipend of the reader in pathology. Mr. Alfred Beit and Mr. Wernher have supplied sufficient money to endow a professorship of colonial history, and to appoint an assistant professor in the same subject. They have also made a gift to the Bodleian Library.

Magdalen College has made a grant to the delegates of the university museum of 250*l.* a year for the next two years for the purpose of the payment of scientific assistants.

The following examiners have been appointed:—in chemistry, W. H. Perkin, jun.; in preliminary physics, E. S. Craig; in preliminary chemistry, J. E. Marsh; in preliminary animal physiology, W. Ramsden; in preliminary zoology, E. S. Goodrich; in medicine, organic chemistry, N. V. Sidgwick; in human anatomy, A. Thomson; in materia medica, R. Stockman; in midwifery, J. S. Fairbairn; in pathology, G. Sims-Woodhead; in forensic medicine and public health, J. D. Mann and A. L. Ormerod; and in human physiology, L. E. Hill.

THE Treasury, at the instance of the Colonial Office, has made a grant of 500*l.* a year to the Liverpool School of Tropical Medicine.

THE prizes and certificates gained by students at the Sir John Cass Technical Institute during the past session will be distributed by Sir William H. White, K.C.B., F.R.S., on Thursday, December 1. The laboratories and workshops of the institute will be on view, and there will be exhibitions of students' work.

AT Bedford College for Women two occasional lectures, open to the public without fee, will be delivered on November 25 and December 8. The first lecture will be by Prof. Karl Pearson, F.R.S., on "Recent Work and some Unsolved Problems in Heredity," and the second by Miss C. A. Raisin on "London, its Early Foundation and Later Growth, a Geological Study."

THE alumni of the Massachusetts Institute of Technology are collecting, says *Science*, a fund for current expenses, which now amounts to more than 20,000*l.*, to be used in the course of the next five years. We learn from the same source that Harvard University has received from Miss Whitney a gift of 1000*l.*, the income of which is to be applied as a scholarship to aid meritorious students in the study of field geology or geography in the summer months, preferably in the mountain region of the western United States.

APPLICATION will be made to Parliament in the ensuing session for an Act to transfer University College, London, exclusive of the North London or University College Hospital, the medical school, and the boys' school, to the University of London, and to dissolve or provide for the dissolution of the college itself. The Bill will contain a clause authorising and providing for the making by the Senate of the university, or by such other body or persons as the Act may prescribe, of statutes and regulations for the management of the college; and provision will also be made for carrying on the work of the hospital, the medical school, and the boys' school.

THE new buildings of the Borough Polytechnic Institute were opened by Mr. Benn, chairman of the London County Council, on November 16. The buildings, which were urgently needed for the large number of students, have cost with equipment more than 24,000*l.* Toward this amount the central governing body of the City of London Parochial Charities contributed 3000*l.*, the London County Council 16,000*l.*, with a promise of a further sum. The council also meets the cost of installation of the electric light and equipment, amounting to 295*l.* The total cost of the land, about 1¼ acres, buildings and equipment, by the end of the year will be not less than 96,000*l.*

WITH the object of giving to the school children of the United Kingdom better knowledge of the colonies, and of giving to the school children of each colony better knowledge of the United Kingdom and of other parts of the Empire, a syllabus of seven lectures on the United Kingdom, each to be illustrated by about forty lantern slides, has been drawn up by a committee connected with the Colonial Office. The subjects of the lectures are:—(1) the journey from the East to London; (2) London the Imperial city; (3) scenery of the United Kingdom; (4) historic centres and their influence on national life; (5) country life and the smaller towns; (6) great towns, the industries, and commerce; (7) defences of the Empire. Mr. H. J. Mackinder will give an account of the scheme, and exhibit some of the slides which have been prepared to illustrate it, at the Whitehall Rooms, Hôtel Métropole, on Wednesday, December 7, at 5 p.m. The Colonial Secretary has consented to preside.

AT the inaugural meeting of the new session of the Royal Statistical Society on November 15, the new president, Sir Francis Sharp Powell, Bart., M.P., delivered an address on education in which he presented specially impressive figures to illustrate prominent educational features of various countries. The activity in educational matters of to-day was commended, and attention directed to the growing conviction that a more liberal education than that provided by purely technical instruction is necessary in this country. Among other interesting comparisons instituted in the address was one dealing with the average expenditure on education per child in Prussia and in England. Exclusive of central and local administration, it appears that the average expenditure per child on the register is in Prussia 1*l.* 15*s.* 6*d.* if buildings are included, and 1*l.* 10*s.* 8*d.* exclusive of buildings. The corresponding figures in England are 2*l.* 12*s.* 9*d.* and 1*l.* 17*s.* Further, the number of scholars per teacher is 66 in Prussia and 57 in England, excluding pupil teachers. It seems clear from these figures that Germany, with a smaller expenditure per child than our own, succeeds in securing better results, and it is to be hoped that English education soon may be conducted more scientifically, so that the value of our education may be more in accordance with our expenditure. The address also pointed out that in secondary education German activity is shown in the provision of technical schools for special branches of metal industries, for wood-working, engineering, and textile industries, and for agriculture.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 16.—"Hydrolysis of Cane Sugar by *d*- and *l*-Camphor-β-Sulphonic Acids." By R. J. **Caldwell**, B.Sc.

The rates of inversion of cane sugar by two stereoisomeric acids were determined in order to compare the results with the case of inversion by enzymes, which are apparently all asymmetric substances. Wilhelmj's law holds accurately for half normal solutions of both dextro- and lævo-camphor-β-sulphonic acids. The velocity constant κ (equal to $10^4/t \log_{10} a/a-x$, where a is the initial cane sugar concentration, and x the concentration of the inverted sugar at the end of t minutes) was found to be 10·07 and 10·13 in two experiments with the dextro-acid, and 10·05 and 10·08 for the lævo-acid. The author concludes that there is no difference in the inverting power of the two acids attributable to their asymmetric structure. This result is in accord with the conclusion arrived at by Emil Fischer regarding the *d*- and *l*-camphoric acids (*Zeits. Physiol. Chem.*, 1898, vol. xxvi. p. 83). The relative activities of hydrochloric acid and camphor-β-sulphonic acid towards cane sugar are 100 : 90, whereas for milk sugar the ratio is 100 : 70.

November 17.—"Enhanced Lines of Titanium, Iron, and Chromium in the Fraunhoferic Spectrum." By Sir J. Norman **Lockyer**, K.C.B., LL.D., F.R.S., and F. E. **Baxandall**, A.R.C.S.

In this paper the authors give the results of a detailed study of the enhanced lines of Ti, Fe, and Cr in relation to the lines of the Fraunhoferic spectrum. In previous Kensington publications it had been shown that the enhanced lines of some of the metals are prominent in the spectra of α Cygni and the sun's chromosphere, whilst it has been generally recognised that the lines in the Fraunhoferic spectrum are mainly the equivalents of lines in the arc spectra

of metals. In connection with the work on enhanced lines, it has been noted that some of them, at least, appear to correspond with comparatively weak solar lines to which Rowland has attached no origin. With the object of possibly tracing some of the unorigined solar lines to their source, a careful comparison has been made between the enhanced lines shown in the photographic spark spectra of Ti, Fe, and Cr and the solar lines. The photographs used for this purpose were all taken with a Rowland grating, and on such a scale that the length of spectrum between K and F is about 14 inches (35 cm.). The chemical elements named were first selected for investigation because they furnish by far the greater number of enhanced lines which have been shown to occur in the spectrum of α Cygni.

It was found that many of the enhanced lines fell exactly on isolated lines of the solar spectrum, and in these cases the solar wave-lengths were adopted and the identification considered established. If, however, for any of these solar lines Rowland had given alternative origins, special comparisons were made of the enhanced line photograph with those of the metals given by Rowland. Notes (given at the end of the tables) were made as to the agreement or non-agreement of the metallic lines involved, and also of the relative intensities in their individual spectra, so that due weights could be given to the respective metallic lines which were thought conjointly to produce compound solar lines.

Where there was any doubt as to the exact coincidence of a metallic and solar line, or where by the close grouping of several solar lines it was not possible to say by direct comparison to which solar line the metallic line corresponded, careful measures were made of the metallic line, and its wave-length found by interpolation between closely adjacent lines of known wave-length. The resulting wave-lengths were then compared with Rowland's solar wave-lengths, and in cases of close agreement with solar lines it was deemed probable that the two lines were really identical.

A final table is given of the enhanced lines of the three elements which are considered, as a result of the analysis, to be identical with lines in the Fraunhoferic spectrum. Forty-two of these agree with solar lines unorigined by Rowland, and as the majority of them are conspicuous lines in stellar spectra of certain types, it has been thought that these results will be of importance in standardising the wave-lengths of many stellar lines.

Physical Society, November 11.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Investigation of the variations of magnetic hysteresis with frequency: Prof. T. R. **Lyle.** The experiments were made on two rings of laminated annealed iron, in one of which the radial breadth of the iron was considerable relative to its mean radius. These rings were magnetised by alternating currents of different strengths and periods; both the magnetising-current wave and the magnetic-flux wave were quantitatively determined by a wave-tracer (described by the author in the *Phil. Mag.*, November, 1903), and the wave-forms so obtained subjected to harmonic analysis. The experiments were divided into series, in which the period and wave-form of the magnetising current were kept as nearly constant as possible throughout any one series, while its strength was varied. The analytic expressions for the associated current and flux waves for a few series are given in tabular form. From the analytic expressions for each pair of associated waves it was found that when the magnetising current was approximately sinusoidal the total iron loss (I) was, within certain limits of the induction, given by a formula $I=(a+bn)\mathfrak{B}^{1\cdot67}$ where n is the number of periods per sec., $\mathfrak{B}$ the "effective induction," and a and b are constants. When from the total iron loss per c.c. per cycle the sum of the statical hysteresis and the value that theory assigns to eddy-current loss was subtracted, a considerable quantity remained, which increased both when the frequency and the flux-density increased. This quantity, called by Fleming the kinetic hysteresis, has been obtained for each experiment.—On the practical determination of the mean spherical candle-power of incandescent and arc lamps: G. B. **Dyke.** Mr. Dyke points out the need of an improved method of expressing the efficiency of glow-lamps, and adopts the suggestion of Dr. Fleming of expressing the whole flux of light in lumens per watt. The expression of the efficiency in this manner involves the determination of the mean spherical candle-power (M.S.C.P.), and the paper describes a method of doing this. The objects of the paper are:—(1) to obtain curves showing the variations of candle-power of glow-lamps in a horizontal plane; (2) to obtain reduction factors by which the mean horizontal candle-power (M.H.C.P.) may be calculated from the maximum horizontal candle-power (C.P.); and (3) to obtain reduction factors for deducing the M.S.C.P. from the M.H.C.P. and from the C.P.—Exhibition of apparatus: R. W. **Paul.** The construction of highly sensitive pivoted electrical instruments has been rendered difficult by the fact that delicate pivots will not admit of transporting without injury. A number of galvanometers were shown in which the design was based upon the use of a moving coil, supported on one pivot in a powerful and uniform magnetic field, and controlled by a spring. A simple non-reflecting, suspended-coil galvanometer for the student's use, with a sensibility of 1 division per micro-ampere, was also exhibited. A new design of lantern, adapted for science lectures, and for use with three Nernst filaments arranged closely together, was shown in action. It is capable of being instantly changed from horizontal to vertical projection, can be fitted with a reversing prism, and has a wide adjustment for focusing. Another exhibit was an Ayrton Mather reflecting electrostatic voltmeter with a magnetic damping device. The instrument shown had a sensibility of 500 mm. at 1 m. for 30 volts, but similar instruments are made to give this deflection with pressures as low as 8 volts.

PARIS.

Academy of Sciences, November 14.—M. Mascart in the chair.—Researches on the desiccation of plants: the period of vitality. Moistening by liquid water: imperfect reversibility: M. **Berthelot.**—New researches on the Cañon Diablo meteorite: Henri **Moissan.** A very careful and complete examination was made of a block of this meteorite weighing 183 kilograms. It was found to be distinctly heterogeneous in structure, containing iron, nickel, sulphur, phosphorus, silicon, and carbon. The latter element was present in several forms: amorphous carbon, graphite, and diamonds, both the black and transparent variety of the diamond being separated. Characteristic green hexagonal crystals of silicon carbide were also isolated, the author remarking that this is the first time that this compound has been met with in nature.—The measurements of the velocity of propagation of earthquakes: G. **Lippmann.** An instrument is described capable of determining to 1/5 of a second the exact time of the commencement of a seismic shock at any given point. The author also discusses the following problem: to find the direction of the seismic wave front at the surface of the earth, in a given region, and to measure the velocity of its horizontal propagation.—On the inscription of seismic movements: G. **Lippmann.** In the photographic self-recording apparatus in common use for earthquake phenomena, owing to the considerable expense of the strip of sensitised paper, its velocity through the apparatus is very slow, about 12 cm. per hour. In the modification now proposed, the slit through which the ray of light falls on the paper is closed by a shutter, and this is operated electrically by the seismic shock. By this means the speed may be greatly increased, since the paper is only used up during the period of the earthquake shocks.—On the seeds of the Neuropterideæ: M. **Grand'Eury.** As the result of the examination of more than 1000 specimens of fossil seeds, usually attributed to ferns, the author distinguishes 15 genera or subgenera of Neuropterideæ, and 25 specific types.—Remarks on Hugoniot's adiabatic law: M. **Jouguet.**—On the use of helium as a thermometric substance and on its diffusion through silica: Adrien **Jaquerod** and F. Louis **Perrot.** An attempt to determine the melting point of gold with a thermometer of fused silica, and containing helium, failed owing to the rapid diffusion of the gas through the silica at the high temperature. The velocity of diffusion appears to be proportional to the pressure of the gas, and is very considerable, since after six hours' heating at 1100° C. the pressure of the helium had fallen to about one-seventh of the initial pressure. Below a red heat, at about 510° C., the diffusion is still fairly rapid, and a very slow effect could even be traced at 220° C. For practical purposes, therefore, the nitrogen

thermometer remains the best instrument for high temperatures.—Researches on dielectric solids: V. **Crémieu** and L. **Malcles.** In the course of his researches on electric convection, Crémieu observed some anomalies of electrical influence through solid dielectrics. The authors have commenced a systematic study of these phenomena, and give an account in the present paper of the apparatus used, reserving the results for a future communication.—On the conductivity of gases from a flame: Paul **Langevin** and Eugène **Bloch.** The coefficient of re-combination of the ions from a flame has been measured, and found to be equal to about 0·7. This value is less than one, as the theory requires, and is much greater than in the case of the Röntgen rays.—On the absorption of hydrogen by rhodium: L. **Quennessen.** Contrary to the statement given in the text-books, the absorptive power of rhodium for hydrogen is nil. Rhodium is not analogous with palladium in this respect.—The action of boric acid on the alkaline peroxides and the formation of perborates: George F. **Jaubert.** By the action of boric acid upon sodium peroxide a perborate of sodium is formed, the analysis of which leads to the composition $Na_2B_4O_8,10H_2O$. On re-crystallising this a substance possessing more oxygen, $NaBO_3,4H_2O$, is formed, and this is very stable at the ordinary temperature, although decomposed rapidly at 100° C. The latter substance, treated with 50 per cent. sulphuric acid, gives after filtration through guncotton a solution of hydrogen peroxide of a strength of 150 to 200 volumes.—On thioformic acid: V. **Auger.** The author has shown in a previous paper that the substance regarded by Wöhler and Limpricht as thioformic acid is in reality trithioformaldehyde. The method which was found to give the best yield of sodium thioformate was the interaction of sodium hydrogen sulphide with phenyl formate. The latter substance was incidentally obtained in the pure state for the first time, and details of its preparation are given.—The synthesis of ββ-dimethyladipic acid: G. **Blanc.**—On a new sugar from the berries of the mountain ash: Gabriel **Bertrand.** The sugar is isomeric with, but distinct from, sorbite and mannite, and is provisionally named sorbierite. Its physical properties are given, and its composition as a hexahydric alcohol determined by the production of a hexacetate.—The development of the organic material in seeds during their ripening: G. **André.**—On the detection of cotton seed oil in olive oil: E. **Milliau.** The test proposed is a modification of the reduction test with silver nitrate.—Anhydrobiosis and tropisms: Georges **Bohn.**—On the growth of man and of living beings in general: Charles **Henry** and Louis **Bastien.**—The evolution of the weight and organic material of the leaf during necrobiosis in white light: L. **Beulaygue.**—On heterogeneity in the Stichodactyline group: Armand **Krempf.**—The comparative influence of some organic compounds of phosphorus on the nutrition and development of animals: A. **Desgrez** and A. **Zaki.**—On the inoculation of cancer: M. **Mayet.**—On the bleaching of flour by electricity: M. **Balland.** The treatment of flour by electrified air has a bleaching action, and produces chemical changes corresponding to the effect of age.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 24.

ROYAL SOCIETY, at 4.30.—On the Refractive Indices of the Elements: C. Cuthbertson.—The Flow of Water through Pipes. Experiments on Stream-line Motion and the Measurement of Critical Velocity: Drs. H. T. Barnes and E. G. Coker.—On Galvanic Cells produced by the Action of Light. Preliminary Communication: Dr. M. Wilderman.—Some Physical Characters of the Sodium Borates, with a New and Rapid Method for the Determination of Melting Points: C. H. Burgess and A. Holt, jun.—On the Convergence of Infinite Series of Analytic Functions: H. A. Webb.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Hydrodynamical and Electromagnetic Investigations regarding the Magnetic-Flux Distribution in Toothed-Core Armatures: Prof. H. S. Hele-Shaw, F.R.S., Dr. Alfred Hay, and P. H. Powell.

FRIDAY, NOVEMBER 25.

PHYSICAL SOCIETY, at 5.—The Measurement of Small Differences of Phase: Dr. W. E. Sumpner.—On the Curvature-method of Teaching Geometrical Optics: Dr. C. V. Drysdale.—(1) Exhibition of Specimens of Crystals showing the Phenomenon of Luminous Rings; (2) On a Rapid Method of Approximate Harmonic Analysis: Prof. Silvanus P. Thompson.—Exhibition of Apparatus by Prof. Dalby, Mr. Darling, Dr. Drysdale, and Prof. Thompson.

SATURDAY, NOVEMBER 26.

ESSEX FIELD CLUB (at Essex Museum, Stratford), at 6.30.—Delegate's Report British Association: F. W. Rudler.—Notes on Supposed Lake Settlement at Skitt's Hill, Braintree: F. W. Reader.—Coast Erosion in East Anglia: John Spiller.

MONDAY, NOVEMBER 28.

SOCIETY OF ARTS, at 8.—Musical Wind Instruments: David J. Blaikley. (Cantor Lecture I.)

INSTITUTE OF ACTUARIES, at 5.—Inaugural Address by the President, Mr. Henry Cockburn.

TUESDAY, NOVEMBER 29.

ZOOLOGICAL SOCIETY, at 8.30.—Some Observations on the Field Natural History of the Lion: Capt. Richard Crawshay.—On some Nudibranchs from East Africa and Zanzibar. Part VI.: Sir Charles Eliot, K.C.M.G.—The Altai Lynx: R. Lydekker, F.R.S.—On Old Pictures of Giraffes and Zebras: R. Lydekker, F.R.S.—On the Morphology and Classification of the Asellota Group of Crustaceans, with Descriptions of the Genus Stenetrium and its Species: Dr. H. J. Hansen.—On the *Lacerta depressa* of Camerano: G. A. Boulenger, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Discussion*: Distribution of Electrical Energy: J. F. C. Snell.

WEDNESDAY, NOVEMBER 30.

SOCIETY OF ARTS, at 8.—The British Canals Problem: Arthur Lee.

THURSDAY, DECEMBER 1.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—The Ascent of Water in Trees: Dr. A. J. Ewart.—On the Presence of Tyrosinases in the Skins of some Pigmented Vertebrates. Preliminary Note: Miss F. M. Durham.—On Chemical Combination and Toxic Action as Exemplified in Hæmolytic Sera: Prof. R. Muir and C. H. Browning.—Histological Studies on Cerebral Localisation. Part II.: Dr. A. W. Campbell.

CHEMICAL SOCIETY, at 8.—The Nitrites of the Alkali Metals and Metals of the Alkaline Earths, and their Decomposition by Heat: P. C. Rây.

RÖNTGEN SOCIETY, at 8.15.

LINNEAN SOCIETY, at 8.—Proteid Digestion in Animals and Plants: Prof. Sidney H. Vines, F.R.S.

FRIDAY, DECEMBER 2.

AËRONAUTICAL SOCIETY, at 8.—The Aëronautical Exhibits at the St. Louis Exhibition: the President, Major B. Baden-Powell.—Kites, Kite-flying and Aëroplanes: W. H. Dines.—The Work of the International Aëronautical Commission: Dr. M. H. Hergesell.—Captive Balloon Photography: Griffith Brewer.

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