THURSDAY, MARCH 26, 1903.

ANCIENT ASTRONOMY.

Sphaera; neue griechische Texte und Untersuchungen zur Geschichte der Sternbilder. Von Franz Boll. Pp. xii + 564; with illustrations and 6 plates. (Leipzig: Teubner, 1903.) Price 24 marks.

THIS is undoubtedly one of the most important works on the history of astronomy that has appeared for many years. The author here publishes and annotates the text of several newly discovered manuscripts of astronomical-astrological authors of the Classical and Byzantine periods. The names of Teukros the Babylonian, Antiochos, Valens, and the poet Johannes Kamateros were known to us before, but Herr Boll has considerably increased our knowledge of them and their work, and he has, indeed, almost added a new chapter to the history of astronomy.

The first part of Herr Boll's work deals with the critical discussion of the new texts, the second with the description of the constellations mentioned in them, the third with the history of the "Sphaera Barbarica" in reference to the work of Nigidius and others. The third part closes with a sketch of the history of mediæval and modern astronomy. To the appendix Herr Karl Dyroff has contributed a most useful edition and translation of part of the "Book of the Great Introduction" (*Kitâb al-mudḫal al-kabîr*) of the Arab astronomer of Irak, Abu Ma'sar Ja'far ibn Muḥammad al-Balḫî.

Naturally the greater part of the book is taken up with a description of the constellations of the Greek and Egyptian Heavens as given by Teukros and the rest. This leads Herr Boll to deal with many extremely interesting questions in the course of his annotations on the words of his authorities. The section on the Egyptian "Sphaera" is extremely good, and we must congratulate a "nichtägyptolog" upon the general accuracy of his critiques of Egyptological and other theories of Egyptian astronomy. Nevertheless, a few references ought to have been made by the author to other authorities besides those who have written in German and French. He seems unacquainted, as far as we can see, with works in English which deal with the subject. Yet there are several of weight and authority, notably Sir Norman Lockyer's "Dawn of Astronomy."

New light is thrown by this author on the question of the origin of the representations on the Græco-Egyptian zodiacs at Dendera and Esna. He shows that the Egyptian element in them is really greater than has often been supposed, and at the same time notes the probable origin of the non-Egyptian constellation-figures, &c., of which the majority are, as in the case with the Greek "Sphæra," of Babylonian origin, such as the Goat-Fish, the Scorpion, the Centaur, &c. The signs of the zodiac are all of Babylonian origin, as Jensen showed several years ago in his useful book, "Die Kosmologie der Babylonier."

Herr Boll further shows that the purely Egyptian figures in these zodiacs and in more ancient astronomical representations in the tombs of the Bibân al-Mulûk and elsewhere are really intended to represent constellations, and not single stars, as Letronne and Ideler thought. He gives interesting parallel plates of the Zodiac of Dendera from a photograph of a cast and from the old picture in the "Expédition de l'Égypte," which is by no means incorrect, as may be seen on comparison with the photograph. Further, on p. 201, he gives an illustration of a circular zodiac or planisphere from a Babylonian boundary-stone of about 1100 B.C.; an important monument in the history of astronomy.

How the Egyptians regarded the stars is shown by the author with the aid of a quotation from Prof. Maspero's "Revue de l'Histoire des Religions":—

"Die ägyptische Anschauung sah überhaupt in den Sternen Leuchten. 'Les astres ne sont pas pour les Égyptiens des corps célestes; ce sont des lampes (khabisou) allumés au firmament. Les Égyptiens conçevaient les dieux-étoiles comme certains pères de l'Église considéraient les anges chargés d'entretenir les astres: c'étaient des dieux lampadophores. Au Tombeau de Séti Ier Isis-Sothis porte sa lampe sous forme d'étoile à cinq branches au-dessus de sa coiffure et Osiris-Orion la sienne au-dessus de son sceptre.' Ganz besonders aber war nach Brugsch der Name Lampe oder Leuchten (χebs, lucerna) den Dekansternen eigen. Auf den beiden Tierkreisen von Esne sind tierisch-menschliche Gestalten mit Sperber- oder Hunds- oder Widder-köpfen zu sehen, die auf vorgestreckten Händen kleine Lampen tragen: 'dieux lampadophores' oder δεκανοὶ μετὰ λαμπάδων, ganz wie sie Teukros beschreibt."

In dealing with the text of the newly discovered authorities and collating them with one another, Herr Boll has often been led to make interesting comparisons and connections. In describing the Ram and the Bull, Antiochos speaks of a constellation called "The Syrian Horse," ὁ Σύριος ἵππος. Valens, in describing the Bull, puts in place of this "the heavenly Osiris," Ὄσιρις ὕπτιος. It is evident, as Herr Boll points out, that ὁ Σύριος ἵππος is a corruption of Ὄσιρις ὕπτιος, the real name of the constellation. As a corruption it is rather a curiosity.

Herr Boll has omitted to note, in speaking of the constellation Typhon (the Great Bear), that this name is purely Greek, and would have been unintelligible to an Egyptian; he uses it as if he thought it were the Egyptian name. The Egyptologists are to blame for this, and we wish they would banish this "Typhon,' identifications of Hathor with "Venus," and talk about "Jupiter" Ammon from their works. The Egyptian name for the Great Bear or Plough is the "Thigh of Set," the Ahriman of Egyptian religion, who was identified by the Greeks with their giant Typhaon or Typhon, son of Typhoeus and grandson of Tartaros. Ordinarily the constellation was called "the Thigh," and a very good name it is too, almost as good as our "Plough," and much better than "Charles's Wain" or the "Great Bear." The form is just that of the thigh of an animal.

Altogether this book will be found very interesting by all astronomers who are interested in the past history of their science, and very useful to the Hellenist, the Egyptologist and cuneiform scholar, who will find (with the English exceptions already noted) the latest results of both astronomical and archæological researches bearing upon the subject of the astronomy of the ancients.

A FRENCH WORK ON SYLVICULTURE.

Traité de Sylviculture. Principales Essences Forestières. By Prof. P. Mouillefert. Pp. xii+544. (Paris: Félix Alcan, 1903.) Price 7 francs.

PROF. MOUILLEFERT, who has taught forestry at the French National Agricultural College of Grignon (Drôme) since 1875, is publishing his lecture notes in the form of an elementary manual of forestry. This he considers necessary for agriculturists and others in spite of the fact that there are already works by Boppe and Jolyet, Broillard and other eminent foresters on the subject. The work is to be in four volumes, of which the present is the first, and deals with the chief French forest species, including exotic trees that thrive in France. The second volume will deal with the management of woodlands, the third with their valuation, and the fourth with artificial plantations, the afforestment of waste land and the restoration of inferior woodland.

The objects set forth as the basis of French forestry are: *first*, to obtain from a forest the greatest annual revenue in the most advantageous manner; *secondly*, to secure the natural regeneration of woods by growing species best adapted to the soil and climate; *thirdly*, to improve the soil as much as possible by rational sylviculture.

The first volume begins with some interesting statistics. The area of French woodlands is about 37,000 square miles, 18 per cent. of the total area of the country, while there are about 24,000 square miles of heath, mountain land, swamps and peat-moor, most of which might be planted. Of the actual woodlands, 68 per cent. are in private hands, 11·8 per cent. belong to the State and 20·2 per cent. to départements, communes and public establishments (hospitals, &c.). Private people can clear their woodlands for agriculture on application to Government, except when their maintenance is necessary to prevent landslips in mountainous country, erosion by water-courses, for the protection of sand-dunes, for military defence, or sanitation. About one-third of the woodlands is in plains (0-200 metres above sea-level), one-third in hills (200-500 metres), and the rest in mountains. France is subdivided into three climatic districts—the warm district, with Quercus Ilex and maritime pine; the temperate district, with beech, oaks and artificial plantations of *Pinus sylvestris*; and the cold mountainous district, with silver-fir, spruce, larch, mountain and Cembran pines. Although the author omits *Pinus sylvestris* in this district, the tree grows naturally in Savoy, Dauphiny and Provence, as well as in the Cevennes and the Pyrenees.

As regards the management of the forests, nearly half the area is simple coppice, producing little besides firewood and tanning bark, while one-fourth of the area is under coppice-with-standards, yielding oak, ash and other standards, besides the underwood. Only about 9000 square miles are high forest. There is an error in the areas given by the author for the different systems or I would have quoted them. The total production of wood in 1892 was about 21 millions of tons, of which 5½ million tons were timber, the rest firewood. This gives 40 cubic feet per acre as the annual yield; only one-fourth of this is timber, though in the State forests one-third of the average annual yield (41 cubic feet) is timber. In three départements (Aisne, Nièvre, Doubs) the average annual yield of forests exceeds 70 cubic feet per acre, while in the mountain regions (Pyrenées, Hautes Alpes, Basses Alpes) it falls to less than 14 cubic feet.

The total average annual sales of wood, bark and resin amount to 9,470,000*l.*, or about eight shillings per acre, but the value of the hunting, shooting, quarries, pasture and other minor produce is not therein included, the author estimating their value at 6*d.* per acre in State forests and 1*s.* per acre in private forests.

He does not estimate the cost of management, but as natural regeneration is chiefly practised and the wood is sold standing to purchasers, who are frequently debited with the cost of repairs to roads and with cultural operations, which they pay for out of the value of the timber, these charges not being debited in the accounts, the expenditure is chiefly that of supervision only, which Broillard estimates at about 8*d.* per acre. If, therefore, we wish to estimate the net revenue from French forests, we may allow that minor produce pays for maintenance, while the price of the wood is net profit. With this proviso the following statement shows their average capital value and yield.

Nature of woodlands.	Average capital value per acre.	Net revenue per acre.	Rate per cent. on capital.
	£ s. d.	s. d.	
State forests	20 10 0	13 0	
Communal forests ...	14 16 0	9 5	3·15
Private forests ...	12 5 0	7 7	

In some départements, as in Aisne (beech and oak), the average revenue per acre is said to be 1*l.* 13*s.* 4*d.* and the capital value 54*l.* 13*s.*, while some of the silver-fir forests in the Vosges are at least as valuable, though this is not stated by the author.

As regards prices of wood, although the use of coal, and of coal-gas for cooking, is steadily replacing that of firewood in Paris and other large towns, yet the price of firewood (about 1½*d.* per cubic foot in the forest) has remained steady throughout the last century, while that of timber has more than trebled, good standing oak trees being now about 1*s.* 9*d.* per cubic foot without top and lop.

There is a good chapter on the influence of forests on water-supply and climate, and it is shown that forests drain the soil, but keep the upper layer (15-20 centimetres) moist. The great transpiration of forests maintains a prism of cool, moist air above them, 1000 to 1500 metres thick, and this is readily perceived when the forests are passed by balloons, the latter descending in such cases unless ballast is thrown out. As regards the subsoil, it is found that the water-level is 4 or 5 metres deeper in forests than in the open country, although the rainfall is sensibly greater in the former (100 : 77 in the Fôret de Haye, near Nancy). Climate

and soil are discussed in another chapter, but more detail is required regarding the latter.

The chief part of the book (pp. 38-532) describes the forest species, and is done much in the same way as by Mathieu in "La Flore Forestière," with the addition of some sylvicultural details. It differs, however, from the latter by the addition of ninety-two excellent botanical plates, showing the structure of the branches, foliage, flowers, fruit and wood of the principal species.

The exotic species described are few in number, and most of them are without sylvicultural importance, except in Algiers and Corsica, where species of Eucalyptus, *Grevillea robusta* and *Casuarina tennissima* thrive. Of the few exotic broad-leaved trees which thrive in temperate districts, *Liriodendron tulipifera*, the wood of which from America, combining the qualities of lime, alder and poplar, is largely used in France, *Juglans nigra* and *Carya alba* deserve notice. Among conifers, the Douglas fir, Menzies spruce and *Thuya gigantea* may be mentioned, Weymouth pine having been long naturalised, and figuring among the indigenous species.

This is a valuable book, but its value would have been enhanced had there been more sylvicultural detail. The remaining three volumes will be awaited with interest. W. R. FISHER.

THE ART OF ILLUMINATION.

The Art of Illumination. By Louis Bell, Ph.D. Pp. ix + 345; with 127 illustrations. (New York: McGraw Publishing Co., 1902.) Price 2.50 dollars.

WHEN the importance of artificial light and its effect upon our comfort and eyes is considered, it seems impossible that the technique of healthy and satisfactory lighting should have been neglected in the way it has. The fact, however, remains that although there are books in plenty on the various available illuminants and the generation of light from them, yet the true art of illumination has received but scant attention.

Dr. Louis Bell, in attacking this important problem, has done well in devoting the first three chapters of his book to the effect of light and colour on the eye, and the works of Chevreul, Helmholtz and Abney are effectively laid under contribution to provide a firm foundation for the latter part of the work. The effect of faulty and flickering illumination upon the eye, and the damage to the eyesight brought about by excessive and unshaded lights, is dealt with, but it cannot be too strongly insisted upon that we are living in an age of intemperance with regard to artificial light that is likely, after a few generations, to produce serious racial eye trouble. Already we cannot work with comfort by the light that served our fathers, and although a certain advance in quantity of light was an advantage as saving strain upon the eyes, yet there is no doubt that the present tendency to high-power incandescent and arc lights is not only inartistic, but harmful, as the small area from which the light is emitted and the high intensity throw a serious strain upon the eye, and yet the light given has but little diffusive power.

Chapters iv. and v., which deal with combustible illuminants and incandescent mantles, are the least satisfactory in the book, this being partly due to the fact that the conditions of cost here and in America are so different, and largely also to the evident fact that Dr. Bell is more at home with electric than with combustible illuminants.

When one finds it freely stated that "incandescent electric lamps are about equivalent to ordinary gas in cost, with a tremendous hygienic advantage in their favour," it must be remembered that the cost of the gas is 1 to 1.50 dollars per 1000 cubic feet, and that an electrician always overlooks the fact that the hot products of combustion from a gas flame are among the most powerful factors in ordinary ventilation. In Fig. 21, a Siemens regenerative burner is figured as a Wenham, whilst the Wenham is shown at Fig. 22 as a Siemens. Full justice is done to acetylene, but the author shows but little knowledge of the incandescent mantle when he speaks of it in one place as being composed of various blends of the more accessible of the rare earths and in another says it is "well known to consist essentially of the oxides of the so-called metals of the rare earths, chiefly thorium and yttrium." The data given as to the candle-power and life of the mantle also suggest that this part of the subject has not been quite brought up to date.

In the chapter on incandescent mantle lighting for open spaces, no mention is made of such high-candle-power units as are now given by the high-pressure gas systems and the Kitson (oil) burners; indeed, a mantle giving 100 candle-power is spoken of as somewhat exceptional, whilst in Berlin at the present time there are plenty of mantles giving 1500 candle-power with gas at a water pressure of 4½ feet.

Passing on to the chapters on electric lighting, one has nothing but praise; the author knows his work thoroughly, and a better popular treatise on the subject would be hard to find, whilst undoubtedly the best portion of the whole book is that dealing with the title matter—the art of illumination.

At the present time everything is being done that can be done to increase the intensity of local centres of light, a condition of things brought about by the advent of the electric arc for outdoor illumination, and the feeling that if gas or other illuminants are to hold their own for this purpose, they must be able to complete in this respect.

This, however, is an advance on totally wrong lines, and the author has done good service to the art of illumination by pointing out that its progress must always be in more and more complete subdivision of the illuminating radiants, and the subordination of great brilliancy to perfect distribution.

The concluding chapter deals with standards of light, and gives full credit to Mr. Vernon Harcourt's 10-candle pentane lamp as a trustworthy and reproducible standard.

Everyone interested in the present phases of street illumination will read with pleasure the remarks made by the author on the nominal rating of the candle-power of electric arc lamps, which "have long since

been relegated to the category of merely commercial designations, the rating bearing no more precise relation to the real thing than does the term 'best' as applied to flour or other commodities," a description fully realised when one sees a nominal 1000 candle-power arc blinking with a feeble 200 candle-power duty.

The book is so good, and deals with such a little studied subject, that it is to be hoped that the author will add to the value of the work in its next edition by either giving full references to the original papers or adding a short bibliography. It is undoubtedly a book which should take its place as a work of reference in the library of everyone interested in artificial illumination.

PHYSIOLOGICAL HISTOLOGY.

Methods and Theory of Physiological Histology. By Gustav Mann, M.D., C.M., D.Sc. Pp. xv + 488. (Oxford: Clarendon Press, 1902.) Price 15*s.* net.

A FIRST attempt at scientific research in a new field should always command our respect, and this book, professing to expound the methods of physiological histology with their underlying reasons, is no exception to the rule. The author has with incredible labour collected all the current information on physical chemistry colloids, histology and the chemistry of dye-stuffs, and has endeavoured to combine these into one harmonious and coherent whole, and to deduce from them reasonable answers to all the questions that have arisen on the subjects of the fixation and staining of animal tissues. That the explanations of the observed facts in histology have so far been fragmentary, incomplete and unsatisfactory, no one will deny, and if this work has hardly as yet brought us to a final and definite conclusion, the fault must be laid to the door of our collective ignorance of the matters involved rather than to the writer of the present volume.

A considerable space has been allotted to subjects which bear more or less directly on the theories afterwards propounded, and, as a rule, these are admirable summaries of the work already done. The chapter on colloids is especially worthy of praise. The chapters containing the accounts of the author's own carefully performed experiments are also very interesting, though whether all his readers will or will not agree with his conclusions is quite another matter. However, there is no question as to the success of the fixing fluids which have been proposed as a result of these researches, and the practical directions accompanying them will be of value to everyone who is not familiar with the processes employed. This comment applies also to all the methods recommended for staining, which give the result of a long and thorough experience in the various processes, and, speaking generally, we know of no better practical guide than is to be found here.

Then follow pages—very many pages—devoted to microchemical reactions, the theory of staining, and, as an appendix one-third as large as the book, on the chemistry of the coal-tar colours and similar matters, which space will not permit us to refer to at length. They will well merit careful study, but the question obtrudes itself as to whether the author has not gone a little too far afield, and whether it is really necessary to cover so many pages with chemical details already well known to experts and unintelligible to the ordinary reader without their context.

We regret that the author's modesty has not permitted him to add some account of *intra-vitam* staining and the examination of fresh tissues; we trust that in the future he may see his way to do so.

There are singularly few details to which exception can be taken, and small errors and misprints are conspicuously absent. The paper and general appearance of the book are, however, surely too meagre for the importance of the contents, and drawings of the author's preparations would be vastly more interesting than the illustrations of obsolete microtomes with which we are favoured. One page—460—must have been composed during a nightmare; we cannot imagine it represents the author's real views. It purports to treat of electrical measures. The *ampere* is defined as "a current which passes in every second at the rate of one coulomb through a conductor"! Ohm's law has a whole line to itself, and is thus printed:—"Ohm's law =

$$\text{current} \frac{\text{electromotive force}}{\text{resistance}} = \text{ampere} \frac{\text{volt}}{\text{ohm}}"!!!$$

It is very kind to tell us what a "macrocallory" is; we might otherwise have supposed it to be a kind of eel; in neither case is it a unit of electricity. Also——but we decently conceal the rest.

There is a very good index, and as a whole the book is one that is a most valuable contribution to our knowledge of physiological histology.

OUR BOOK SHELF.

The Figures, Facts, and Formulae of Photography. Edited by H. Snowden Ward. Pp. 166. (London: Dawbarn and Ward, Ltd., 1903.) Price 1*s.* net.

THERE is probably no other art that is so encumbered with formulæ as photography. Every maker of sensitive material seems to consider it his duty to supply his own particular formulæ for its use, and no doubt this has something to recommend it, but even conveniences may be multiplied until they result in confusion. Many formulæ for developers, for example, differ only in the methods of expressing them, except to an inappreciably small extent due to the use of different weights and measures. And when it is borne in mind that by far the greater number of formulæ are not based on a systematic trial of the effects of varying each of its constituents, as all ought to be, the value of even notable differences disappears.

But to eliminate useless formulæ is practically impossible, as it would introduce differences of opinion as well as of fact. We think, therefore, that the compiler of this volume has done quite right in including the "instructions" of the various manufacturers, and we should have preferred that he had gone even further than he has, and given the formulæ recommended by foreign as well as English houses. Of other formulæ for developers, we find those adopted by Messrs. Burroughs Wellcome and Co. for their "tabloid" preparations described as "standard" formulæ, though

why they should be so singled out is not stated. There is a considerable collection of development formulæ in addition to the above, but only one here and there has the name of its author attached. It would have been better if the author's name had been given in every case, with a reference to the source whence the formula was obtained. Various fixing solutions are given, neutral and acid, one including "acetone-sulphite," but alkaline fixing baths are not represented. Among "stain removers," too, weak alkaline solutions do not appear to be mentioned, though they are the best solvents of the coloured oxidation products of developing reagents.

In a few cases the compiler has ventured to state that one or the other formula is "the best," without quoting any authority or giving any reason for the preference. Among "hypo. eliminators," for example, "the best is plain water," but potassium percarbonate "is the best chemical destroyer of hypo." A soluble hypochlorite was the first "hypo. eliminator" suggested, now many years ago, and it remains unsurpassed, if equalled. It is, however, not mentioned here, and its omission is not due to the ease with which, if carelessly used, it attacks the silver image itself, because sodium hypochlorite is given as a stain remover.

Each of the thirty-three chapters is on a different subject, ranging from "The Studio" and "The Workroom," and the various operations that are generally understood as practical photography, to the "Facts of Copyright" and "Toilet and Hygiene." This last section treats of stained finger-nails; eyes affected by the coloured light of the dark room; skin irritation caused by developers, potassium bichromate, &c.; and similar subjects. The volume is full of information, and cannot fail to prove useful to the photographer who keeps it at hand.

U. S. Department of Agriculture. Field Operations of the Bureau of Soils, 1901. Third Report. Pp. 647+case containing thirty-one maps. (Washington: Government Printing Office, 1902.)

THE book under notice constitutes the third of the series of reports on the work of the Division of Soils, which is engaged in mapping the distribution and describing the agricultural characteristics of the various soil types met with in selected areas of the United States. The general scope of this remarkable undertaking has already been discussed in these columns when reviewing the Report of 1900 (NATURE, November 6, 1902); the present volume shows that the work of the Division has so far been appreciated by Congress that its progress has been assisted by increased appropriations, enabling it to enlarge its working staff and cover a greater area in its annual survey. The reports now presented deal with the most diversified types of land, and speak of the variety in the conditions under which farming is carried out in the United States. On the one hand, we read of intensive systems of agriculture, analogous to our own, as in New Jersey and Pennsylvania, old settled districts in touch with large centres of population, farming high, and either purchasing fertilisers or keeping stock to make manure; then we pass, as a contrast, to parts of Virginia and Georgia, which were ruined by the war and left without capital or energy, where it is still the custom to crop out the soil by continuously growing corn or wheat, and then clear a fresh farm, leaving the old land to fall back to scrub until it accumulates sufficient decayed vegetable matter to be worth breaking up again.

In the western States the contrasts are just as great between the arid regions, which are still "dry farmed," and can only produce a crop of barley or wheat every other season, the land being fallowed in the intervening years to gather two years' rainfall for the needs of one crop, and the rich irrigated land of California, famous for oranges, apricots, and other valuable fruits.

Two of the most interesting crops which come in for notice in this book are tobacco and sugar beet; in both cases the industry is being very rapidly developed in the United States; indeed, the production of beet sugar is an affair of the last two or three years only, and the expansion has been largely brought about by the energy and advice of the Division of Soils. Anyone seeking a striking example of the way a State can utilise scientific research for the fostering of a national industry cannot do better than study the work on tobacco of the United States Department of Agriculture.

Interesting as these volumes are to the agriculturist from the variety of the crops and the farming conditions described, they are equally valuable to many students of pure science; to the botanist they form a treatise on what might be called applied ecology, to the chemist and physicist the "alkali land" problems will appeal; the geographer will find illustrations, often accompanied by excellent photographs, of the most varied types of land surface and the changes to which they are subject; while the economist, as noted above, may obtain abundant material for his special study. An accompanying report sets the whole cost of the Division of Soils as a little under 8000*l.* for the year 1901; of this, the Soil Survey, exclusive of laboratory work, required a little less than half, 3·53 dollars per square mile for the 5596 square miles covered in the year, or almost exactly a farthing per acre, not an excessive charge on the capital value of the land! A. D. H.

Theoretical Organic Chemistry. By J. B. Cohen, Ph.D. Pp. xv + 578. (London: Macmillan and Co., Ltd., 1902.) Price 6*s*.

THE author commences his preface with an apology for bringing out a new book on organic chemistry. We are not, however, prepared to agree with Dr. Cohen that an apology is necessary. There are not very many good and complete text-books on organic chemistry in this country, therefore a new book—provided that it is good—would not be at all out of place. At another place in his preface the author says, "The production and uses of common materials, which come under our daily observation, are frequently relegated in some text-books of organic chemistry to a background of small print; in others entirely omitted." Dr. Cohen particularises such substances as lanoline, linseed oil, gelatine, the tannins, turpentine, &c. Our interest is at once aroused and we turn up turpentine, and this is what we find:

"Turpentine oil is used as a solvent in the preparation of varnishes, for mixing with pigments, as an embrocation, &c. It absorbs oxygen, when heated in presence of water, and the oxygenated water is employed as a disinfectant and deodoriser."

There is very little here about the production of turpentine. We then turn to linseed oil; here we are more fortunate, because there are seventeen lines devoted to telling us that the oil may be used for preparing linoleum, oil-cloth, and that it is employed in making varnishes and paints—but not a word as to its production. Again, the treatment of gelatine, tannin and lanoline can scarcely be called exhaustive. We are not at all sure that it is desirable in a text-book, the size of the one before us, to describe such substances in detail, but when the author lays claim to treat them more fully than they are treated in other text-books, one is rather surprised to find them dismissed with such scanty notices.

Of course, details of this kind do not condemn a book, and, in many respects, the book is very good.

We have read some of the chapters with considerable interest and pleasure, notably those which deal with the phenols and with the carbohydrates, the subjects of which are carefully and fully dealt with. In some parts of the book, however, the explanations are not so clear as we could have wished, the reactions being given with little or no attempt at an explanation. Now the average student requires a considerable amount of explanation in order that he may understand the subject. As an example of want of clearness we think it would have been wise to give some explanation of the probable mechanism of the process involved in the preparation of benzaldehyde by the action of metallic nitrates on benzyl chloride, and some explanation of Reimer's reaction would not have been out of place.

The book is well printed, and the proofs have evidently been very carefully corrected. Taken as a whole, we consider Dr. Cohen's book a very useful compilation; from the preface we had expected to find a book written on new and original lines; in this, however, we were disappointed. F. M. P.

Nature Studies (Plant Life). By G. F. Scott Elliot. Pp. viii + 352. (London: Blackie and Son, Ltd., 1903.) Price 3*s.* 6*d.*

IT is not evident whether the author intends this book as a contribution to the subject of "nature-study," which is now attracting so much attention. Certainly the first and most essential feature of nature-study, namely, personal observation, is not emphasised, nor is the discursive style which the author adopts calculated to induce careful and accurate investigation. A large mass of information has been brought together, compiled from books on bionomics and original papers. The book begins with the flower and fruit, and the vegetative portions follow, an arrangement which has its advantages since morphology is sacrificed to bionomics. The relations between animals and plants are well brought out, but less prominently so the relations between plants *inter se*. The study of plant associations begins with the Cryptogams, and here, as indeed in most of the chapters, the matter is too fragmentary; only occasionally, as, for instance, in the chapters on seaweeds, or when describing the lichens, does Mr. Scott Elliot take the necessary space to do justice to himself and his subject. The concluding chapters dealing with the origin and development of the English flora introduce a subject which is well worth studying.

Das Objectiv im Dienste der Photographie. By Dr. E. Holm. Pp. xvi + 142. (Berlin: Gustav Schmidt, 1902.) Price 2 marks.

THOSE photographers, whether professional or amateur, who are able to read German will find this book full of useful information and valuable hints regarding the properties and use of the photographic objective. So numerous, so varied in construction, and so different in price are lenses of to-day that it is important that the photographer should know something of their nature and capabilities before investing in one or more of them. The present book is intended to give the reader a good all-round idea of not only the properties of lenses, their errors, corrections, the different kinds available, and hints on choosing them, but also how to use them when obtained. Although the text quite fulfils this object, the very excellent set of reproductions illustrating all the kinds of results which accrue from good or bad focusing, setting, choice of position, &c., adds greatly to its value, and demonstrates better than any words could do the points to be observed. The telephotographic lens is also included in these pages, and the book concludes with quite a full index.

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.*]

Permanent Electric Vibrations.

IN his "Electric Waves" (see p. 361) Mr. Macdonald considers that electric waves may be propagated round a ring without being subject to any loss by radiation. The question whether this is possible is of great interest, as such waves might play an important part in atomic phenomena. It seems, however, that such waves cannot exist, except possibly in exceptional cases. For consider a spherical surface to be drawn enclosing the whole of the vibrating system. The electric force cannot vanish at all points of this surface, for the sphere may be as close to the conductors as we please. From the value of the force, and the condition that at infinity any motion that there may be must consist of outwardly progressing waves, we can find by spherical harmonic analysis the field at any point outside the sphere. The result is that in any case the field cannot at all distant points be of an order lower than that of $1/r$; there must be loss of energy by radiation. For a thin circular wire a fundamental mode of vibration is determined, to a first approximation at least, in *Proc. Camb. Phil. Soc.*, vol. ix. p. 326; and the case of a wave progressing round the wire can be deduced by compounding two such vibrations differing in phase. The determination of the resultant disturbance at a great distance involves Bessel's functions in general, but it can be proved without difficulty that for points on or near to the axis of the ring it consists of divergent waves. The consequent rate of loss of energy is of the order of unity, while the energy held is of the order of $\log(a/\epsilon)$, where ϵ is the radius of the wire and a that of the circle. The decrement is hence of the order of $1/\log(a/\epsilon)$, as found in the paper referred to.

On the other hand, it is hard to find a flaw in Mr. Macdonald's general reason for the absence of radiation in this case, and the possibility of non-radiating systems is suggested by the case of a uniformly and superficially charged dielectric sphere of unit specific inductive capacity. If it performs small simply periodic oscillations, each point of its surface may be treated as a Hertzian oscillator. On evaluating the external field, we find that the variable part of it is the same as if the charge were collected at the centre and multiplied by $(\sin \lambda a)/\lambda a$, where a is the radius of the sphere, and $2\pi/\lambda$ is the wave-length in free ether corresponding to the frequency of the oscillation. Hence, if this wave-length is a submultiple of the diameter of the sphere, there is no external oscillating field.

H. C. POCKLINGTON.

The Bearing of Recent Discoveries on the Physics of Taste and Smell.

ONE of the first experimental papers on the nature of the stimulus given to the organs of taste or smell by sapid or odorous substances is, I think, that by the Hon. R. Boyle ("Experiments and Observations about the Mechanical Production of Tasts (*sic*)," London, 1675), in which he puts forward a theory of irritation by particles which penetrate and irritate more or less according to their size and shape. After this a chemical theory of taste seemed to gain ground, and Graham laid down the principle that only soluble substances are sapid, and that further only crystalloid solutes are sapid (see Bain, "Senses and Intellect," 1864). Then in 1882 Sir W. Ramsay very tentatively put forward a dynamical theory from analogy with optics and sound (NATURE, xxvi. 187). He proposed that very light molecules vibrating at a high rate are inodorous, taking as the limit a molecular weight of about 30. On the other hand very heavy molecules would be odourless, because vibrating too slowly, whereas those vibrating at a rate between these limits would find the nerve-cells capable of response. Thus he accounted for the want of odour on the part of H, CH_4, O, N, H_2O, &c. Similar views were later ex-

pressed for taste and smell by Haycraft (*Proc.* Roy. Soc. Edin., 1883–1887).

But we now know gaseous bodies ranging over the whole domain of molecular weights appropriated by odorous and sapid substances, owing to Ramsay's well-known work on He, Ne, A, Kr and X, and to the discovery of SO_2F_2 and SF_6 by Moissan (*Comptes rendus*, cxxx. 1900, 865 and cxxxii. 1901, 374). These last two gases are of special importance because their want of taste and odour cannot be due to the fact that we have become inured to them. The molecular weights of these bodies are respectively 4, 20, 40, 81, 127, 102 and 146, with which may be compared vanillin, with a molecular weight of 152.

It was long ago pointed out by Liebig (see Klimont, "Die Synthetischen und Isolirten Aromatica," 1899) and by Graham (see Bain, *loc. cit.*) that odorous bodies are, as a rule, readily oxidised, and the notion of the chemical origin of the senses in question is much strengthened by the fact that all the new gases above mentioned are very inert. SO_2F_2, although soluble in ten parts of water, can only be decomposed by oxygen by sparking, and SF_6 is extraordinarily stable. It is recorded also by Graham that if an odoriferous principle is sniffed up in a current of CO_2 instead of air, the odour is much weakened.

There is another curious fact which might be accounted for by a chemical hypothesis. It has often been noticed that on purifying odorous or sapid substances, these properties tend to become less marked or to disappear. Thus acetylene, ammonia and acetamide have been described as odourless when pure, and it is said that ordinary sugar becomes less sweet the more it is purified. But it has been found in all carefully studied cases that stability increases very markedly with purity, and therefore on a chemical theory taste and smell would become correspondingly less.

In conclusion must be noted Prof. Ayrton's important contribution to this subject (Presid. Address to Section A. British Association, 1898), in which he definitely proves that the well-known metallic odours are not caused by the metals themselves (which are non-volatile), but by unstable decomposition products, probably unsaturated hydrocarbons.

Such a chemical explanation would not, of course, upset the vibration theory of Ramsay, but would merely mean that instead of these senses being directly stimulated by the ordinary vibrations of the molecules, they are only affected by agitations accompanying chemical change.

F. SOUTHERDEN.

Technical College, Finsbury, London, E.C., March 21.

Electricity and Matter.

IN view of the suggestive close of Sir Oliver Lodge's paper as given in NATURE of March 12, these more than century-old speculations of S. T. Coleridge may be found interesting. E. H.

"But properties are God: the naked mass
(If mass there be, fantastic guess or ghost)
Acts only by its inactivity.
Here we pause humbly. Others boldlier think
That as one body seems the aggregate
Of atoms numberless, each organized;
So by a strange and dim similitude
Infinite myriads of self-conscious minds
Are one all-conscious Spirit, which informs
With absolute ubiquity of thought
(His one eternal self-affirming act!)
All his involved Monads, that yet seem
With various province and apt agency
Each to pursue its own self-centring end."

(From "The Destiny of Nations—A Vision," Juvenile Poems, S. T. Coleridge.)

Papaw-Trees and Mosquitoes.

Re Prof. Percy Groom's letter in NATURE (January 22, p. 271), I may mention that in Ceylon the papaw-tree gives no immunity against mosquitoes. In my garden here we usually take our afternoon tea under the shade of an old and much-branched example of the common papaw (*Carica papaia*), but far from being protected from mosquito bites in that situation, we are always terribly molested by the small striped mosquito (*Stegomyia scutellaris*). The stem of this tree is also haunted by various spiders and flies. I have not sufficiently studied the tree during the sunny part of the day to say whether flies settle on the leaves or not, but I propose to pay attention to this question shortly.

E. ERNEST GREEN.

Royal Botanic Gardens, Peradeniya, Ceylon, February 26.

A Remarkable Meteor.

WITH reference to the meteor a letter of mine concerning which you printed in your last issue (p. 464), I have received some details from Mr. G. S. Russell, of West Norwood, who saw it from the neighbourhood of the Crystal Palace. From the facts that he saw it E.N.E. (as I did) and saw the "wobbling" close to earth, it is seen that the meteor must have been a great distance off, probably falling a considerable distance out in the North Sea. He is convinced that it reached the earth's surface. Its great distance off would account for its apparently very slow movement. Owing to the steadiness of both its brilliancy and velocity it was probably of great size. J. E. C. LIDDLE.

Fairfields, Basingstoke, Hants, March 23.

THE MOVEMENT OF AIR STUDIED BY CHRONOPHOTOGRAPHY.

THE investigation of stream lines has occupied the minds of several powerful workers, and great results have been obtained by the late W. Froude and Prof. O. Reynolds, and recently Prof. Hele Shaw has added some striking illustrations of the paths of the flow of liquids. Borda, in an almost forgotten, but remarkable paper (*Memoires de l'Académie Royal*, 1766), writes thus (when describing the conditions under which water flows by an opposing object):—"On imagine ensuit que les molécules du fluid, en s'approchant du corps, decrivent des lignes courbes, ou plutôt se meuvent dans les *petits canaux courbes.*" Borda goes on to show that theoretically the stream lines should flow round and again join in the rear of the object.

Thus the idea of stream lines and their behaviour was regarded as a matter of interest at an early date.

In a recent paper, in the *Bulletin des Séances de la Société Français de Physique*, 1902, M. Marey has added fresh information respecting the form of stream-lines, and by his new experimental methods he shows how air behaves as it flows by different shaped objects. In the first place he draws attention to his experiments on the movements of liquids in which he employed a stream of water, holding in suspension shining pearls of the same density as water; these were brightly illuminated by sunlight, a dark background being placed behind them; by means of a chronophotographic apparatus, a series of pictures of the illuminated parts was taken, their appearance in the picture being that of dotted lines. The direction and speed of the current which carried them along was by this means found.

When obstacles of different shapes were placed in the current the stream lines of the liquid were seen to bend in different ways and to form eddies. For example, in the case of water impinging against an inclined plane, the streams of liquid divide at a point, which appears to be the centre of pressure. In each case eddies form in the rear of the obstacle. The speed of the fluid, at any moment, could be recognised on the photograms by the degree of separation of the shining pearls, for photographed as they were, at equal times, they covered different distances in these equal intervals of time. A divided scale gave the lengths of these distances covered, while the rate of taking the successive pictures (ten per second) gave the speed of the current in its various positions.

By means of a method similar to this the direction and speed of the streams which form in a current of

air were studied, and the changes which they underwent when they encountered obstacles.

The apparatus for investigating these movements in air was of simple character; it consisted of a chimney of prismatic form (side 0·50 m., height 0·75 m.). The front side was made of clear glass, and the posterior wall was covered with black velvet; the left wall was white and the right one was glazed.

In front of the apparatus a lantern was placed within which a magnesium flash could be fired. A draught was maintained through the chamber by an electric fan. The flow of air was rendered steady by being filtered through silk gauze of fine mesh, placed at the top and at the bottom of the prismatic chamber. By a beautiful method M. Marey rendered the direction of currents of air visible; he introduced minute streams of smoke, which were drawn in with the aspirated air, and remained parallel to each other during their passage through the chamber when not opposed by any obstacle. The smoke was obtained from the combustion of tinder and cotton in a closed furnace; from this furnace the smoke was conducted to a series of narrow tubes parallel to one another.

When an obstacle was placed within the chamber the stream lines were seen to bend against the obstacle and divide into two currents, one of which flowed up the slope of the inclined plane, the other down it (Fig. 1). The division appeared to take place at a point which corresponded with the centre of pressure against the inclined plane. This point of separation was found to be at the middle point of the plane when the plane was horizontal, and to approach its upper end the more the plane was inclined. Behind the obstacle eddies were seen to form.

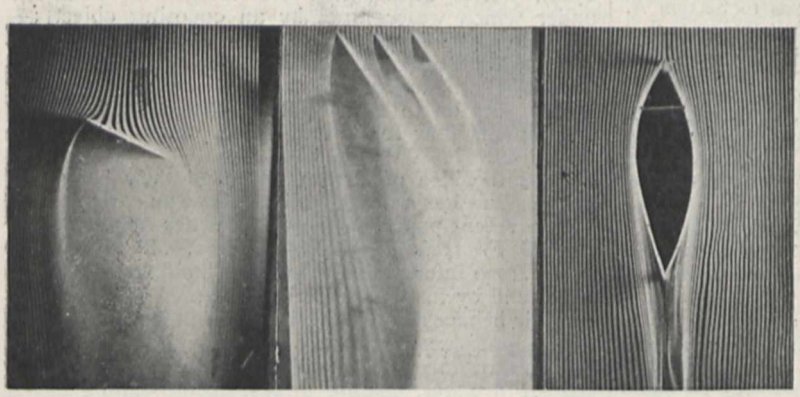

FIG. 1. FIG. 2. FIG. 3.

M. Marey found the velocity of the air streams, thus. By means of an electric vibrator he imparted vibrations to the smoke jet tubes, having a period of ten per second. The smoke streams then became sinusoidal in shape, the inflections being maintained during the whole length traversed by the smoke. The series of lateral inflections was measured by means of a divided scale placed in the same plane as the streams of smoke.

These inflections remained equidistant when the speed of the current remained constant, but when the speed was reduced the inflections were closer together, and farther apart when the speed of the streams was increased. M. Marey employed the magnesium flash to obtain his photograph; probably sharper pictures would have been obtained by using the electric spark from a charged Leyden jar as an illuminant.[1] M. Marey mentions that an important question to be answered in the science of aërial flight is, How do air currents behave when passing through adjacent parallel planes inclined at an angle to the stream? Fig. 2 answers the question clearly. The picture will suggest much to those engaged in the designing of kites of the *box* type, where the air strikes against more than one plane.

The conditions of stream line flow round different aquatic animals have received considerable attention, and we know that a blunt head and a pointed tail is a favourable arrangement. By immersing solid bodies having one end obtuse and the other pointed, it is observable that there is a great advantage in presenting the large end to the direction of motion; this minimises the motion of the air behind the body. The same phenomenon is to be seen in air. Fig. 3 shows that, with the large end facing the stream, the disturbance in the rear of the object is slight, only small eddies being set up. M. Marey's methods are applicable to an almost endless variety of similar experiments on the stream lines of air round differently shaped bodies. M. Marey's paper is short and condensed, but it contains matter of much importance, and is another example of the beautiful results obtained by this master of experimental methods in chronography.

F. J. J.-S.

[1] Spark photography of objects in rapid movement (smoke jets and smoke rings photographed in collision).—Junior Scientific Club, Oxford; NATURE, vol. xlvii. p. 119.

THE VENTILATION OF THE TUBES.

IN October, 1901, the London County Council determined to investigate the condition of the atmosphere in the tube of the Central London Railway, in order to ascertain how far the threatened multiplication of underground tubes might affect the public health. As the result of this, the chemist to the County Council, in conjunction with Dr. Andrewes, made a chemical and bacteriological examination of the condition of the atmosphere in the tunnels, stations, carriages, and lifts of the Central London Railway, as compared with the outside air under ordinary conditions. As might have been expected, it was shown by the experiments that the fluctuations in the amount of carbon dioxide and organic matter present in the tube were very great.

Examination in the early morning showed that the ventilation employed had produced a very fair condition of air, whilst during the hours of traffic the carbon dioxide rose to considerably higher limits than existed in the outer atmosphere. The County Council chemist considers that samples of air taken at any point on the railway should not contain more than double the amount which is found in the air of the streets, inasmuch as the additional carbon dioxide found in the air of the tunnels has been entirely produced by respiration, and is therefore accompanied by organic matter.

This report was submitted to the Council on February 17, but its reception was postponed, as it is clearly one of those cases in which extreme caution should be used in arriving at conclusions, and introducing rules and regulations which might hamper important developments in the relief of our over-congested traffic.

The normal quantity of carbon dioxide present in the air is a little under four volumes in ten thousand, and the sanitary limit, which is universally adopted for the atmosphere in our dwelling-houses, is six parts in ten thousand in rooms which are to be inhabited for any

length of time, this being fixed on the assumption that the organic matter in the air increases at the same ratio as the carbon dioxide, but it is evident that this limit may be exceeded without damage to health when such atmosphere is only to be inhaled for a short period.

On examining the report of the Public Health Committee, it will be noticed that the carbon dioxide was highest in the air of the carriages, and that the air in the lifts also contained a larger quantity of carbon dioxide than the passages leading to them, showing that, as might have been expected, the enclosed areas in which respiration was taking place contained the largest quantity of carbon dioxide.

Before it can be assumed from this that the impurities found are due to want of ventilation in the tube, it should be clearly shown what the comparison is between the carbon dioxide and organic matter present in a carriage on the tube, and a carriage (say) on the North London Railway during the busy hours of traffic, or even in some London theatres towards the close of a performance, and it will probably be found that the difference which exists is very small indeed.

The real hygienic value of the report centres in Dr. Andrewes's summary of his results, in which he concludes that while micro-organisms are present in the tube air in a somewhat greater proportion than in fresh air, *i.e.* 13 to 10, the excess is not so considerable as to cause the tube air to compare unfavourably with the conditions known to exist in inhabited rooms generally. The highest averages of micro-organisms were found in carriages and lifts, *i.e.* in the most crowded places examined, whilst the platforms and passages came out actually better than the fresh air, the tunnels being only a little worse.

If we consider this as well as the fact that the Central London Railway Company is taking steps to improve the ventilation of the tunnels by installing a large rotary fan at the Shepherd's Bush end powerful enough to draw out the whole of the air in the tunnels three times over during the period in which traffic is stopped, and is installing at the Bank station an air compressor for forcing fresh air into the extreme end of the Bank sidings, it seems clear that the facts of the case do not call for any active interference on the part of the authorities, especially after the atmosphere existing in the Metropolitan Railway between (say) King's Cross and Baker Street has been patiently endured for so many years.

THROUGH PERSIA AND BALUCHISTAN.[1]

UNDER a somewhat quaint title, Mr. Landor describes a journey through Persia and Baluchistan to India. He is a keen observer, and, throughout his two large volumes, he writes pleasantly of his experiences on the road, and of much that he saw and heard by the way. He is a little inclined to dwell upon the discomforts rather than upon the pleasures of travelling, and to get excited over "a prominent geographical society," "royal geographo-parasites," and "newspaper penny-a-liners," but he is always amusing. He gives his views with great frankness upon the social condition of Persia, so far as he became acquainted with it, and upon questions of trade, education, and politics. He writes strongly upon the struggle between England and Russia for political and commercial supremacy in the kingdom of the Shah, and gives a clear idea of the smartness with which Russia takes advantage of the slowness and mistakes of her adversary.

Mr. Landor travelled *viâ* Flushing, Warsaw, and Kiev to Baku; crossed the Caspian in a Russian steamer; and, after a sleepless night on a "living" mattress, entered Persian territory at Enzeli. Thence he proceeded to Resht, and drove along the carriage road to Teheran, where he was presented to the Shah, visited several of the Persian Ministers, was present at the birthday festivities, and saw all that is most worth seeing in the capital. An interesting description is given of the Shah's palace and gardens, and, in some remarks on the Persian army, attention is drawn to the great difference between the "Russian-drilled Persian Cossacks" and the infantry soldiers. From Teheran Mr. Landor followed the post road to Isfahan, and thence travelled *viâ* Yezd to Kerman, where he visited the deserted city of Farmidan, and the "Ya Ali" inscription. From Kerman he turned north and crossed the salt desert, Dasht-i-Lut, to Birjand, passing on the way Naiband, of which place and its people many interesting details are given. In the desert he suffered, as others have done in desert countries, from heat and thirst by day, and from cold by night. But he appears to have been more than usually unfortunate in his camels, which do not seem to have been in good condition for a long desert journey, or to have been accustomed to hill work.

FIG. 1.—South-East portion of Zaidan City, showing how it disappears under distant sand accumulations. (From Landor's "Across Coveted Lands.")

From Birjand Mr. Landor followed the well-known route through Sistan and Baluchistan to Quetta. He has much of interest to tell about the ruins of Zaidan, in Sistan, and gives several photographs of one section of them. But surely it is inappropriate to write of the place as "the ancient London of Asia," as if it were of extraordinary size and unusual grandeur. The ruins in themselves are not very imposing, and the view

[1] "Across Coveted Lands." By A. H. Savage Landor. 2 vols. Pp. xv + 927. (London: Macmillan and Co., Ltd., 1902.) Price 30*s.* net.

of Major Sykes that they represent villages built along the line of an irrigation canal seems more reasonable than the opinion of the author that they are the remains of a city eighty-five miles long. The ruins, however, certainly require careful examination, and such excavation as may determine their character and history.

The concluding chapters give a description of the road from Robat through Nushki to Quetta which has recently been completed with good rest houses supplied with water. It is very pleasant to read Mr. Landor's appreciative remarks on the manner in which the British officers connected with the road carry out their multifarious duties, and on the high esteem in which they are held by the natives amongst whom they live and work.

The general impression on reading the book is that Mr. Landor might have conveyed his message from much-travelled Persia and Baluchistan in a less formidable form than two volumes containing more than 900 pages. Still, the work appears at an opportune time; it gives much information in a popular form, and those who are not acquainted with what has been written about Persia will find in it much to instruct and amuse. The illustrations from photographs and sketches by the author are numerous; nearly all of them are good, and some are excellent. C. W. W.

ABANDONMENT OF THE SCHOOL OF MEDICAL RESEARCH AT NETLEY.

THE extinction of the School of Research in Tropical Diseases in connection with Netley Hospital, and the abandonment of prophylactic inoculation against typhoid fever, the adoption of which has already resulted in a marked saving of life, have been noticed with regret by all men of science acquainted with recent advances in scientific pathology.

Mr. Brodrick's action in placing the Army Medical Service under the Advisory Board, constituted, so far as its predominating civilian element is concerned, of members out of touch and sympathy with medical research, has had a disastrous effect on the future prospects of the development of scientific research in connection with the Service.

Though a large sum has already been spent on the plans for, and the foundations of, the research laboratories at the Royal Victoria Hospital, Netley, and in face of the fact that Parliament had voted 45,000*l.* for the purpose, the research laboratories at Netley are to be abandoned. More than this, clinical study in tropical medicine has been eliminated from the programme of instruction for officers entering the Army Medical Service, and the scientific departments associated with the work of Netley Hospital have been hurriedly transferred to cramped and temporary laboratories in London.

The abandonment of the research laboratories at Netley, and their transfer to limited and temporary quarters in London, must be detrimental to the progress of research in tropical medicine. For, whereas the school at Netley was in connection with the Royal Victoria Hospital, which is by far the largest emporium of tropical diseases in the country, in the case of the London school, sick men must be brought from the healthy surroundings of Netley to the unhealthy town atmosphere of London if their diseases are to be made subjects of scientific study.

The retrograde policy which has thus been inaugurated shows a complete disregard for the value of scientific knowledge in medicine. Of bad omen, too, for the future of science is the placing of the professoriate under the orders of a Military Commandant, and above all the limitation of the tenure of the professorships to the ordinary three years limit as fixed for staff officers. We cannot state the case better than it is put in a letter by Sir James Martin to Sir James Clark when this question was raised and quashed in connection with the Army Medical School in 1863—quashed only to be reopened again, after forty years, in 1903. "There is no comparison, I think, between the nomination of military officers to staff offices and that of scientific men as teachers. The duties of the first-named are ordinary and every-day. The duties of medical officers as teachers of the most difficult of all sciences, including that of climate, are altogether another affair, and to change such teachers at short terms—men of peculiar and acquired excellences and experiences—would go to destroy any scientific institution whatever."

The downward course entered upon has been further signalised by the dismissal of Prof. A. E. Wright, professor of pathology at Netley, on the ground of his acceptance of a post in connection with a metropolitan hospital, a post which competent judges allege would have in no way interfered with his official duties, but might have proved valuable in providing further material for the complete instruction of his classes. But in face of the terrible lessons of the recent war in South Africa, perhaps the most serious result of Mr. Brodrick's action is the proposal to abandon antityphoid inoculation in the Army, and this, too, upon the recommendation of a subcommittee of the advisory board which considered it unnecessary either to give Prof. Wright an opportunity of appearing before it or to make for itself any statistical inquiry.

There is, unfortunately, nothing new in this country in a policy such as that we have outlined. An equally flagrant case of brain starvation is the educational vote included in the Army Estimates, where, as the *Times* points out, in a total military Budget of 34,000,000*l.* only 134,000*l.*, or about 0·4 per cent., are devoted to education. The lessons which have been learnt in other countries, where men of science are systematically consulted upon all questions the solution of which demands scientific knowledge, have led to a marked increase in their national prosperity. The rulers of our Empire will some day understand what immense loss the neglect of science entails, and until this is fully appreciated it is the duty of all who know to explain on every occasion.

As an indication of the value attached by our foremost pathologists to the work upon which Prof. Wright was engaged at Netley, we print below a letter from Dr. E. Klein, which he has given us permission to publish.

In common with many other physiologists and pathologists in this country, I have noticed with extreme regret the omission of Prof. Wright from the teaching staff of the Army Medical Service.

Prof. Wright, by his numerous researches and valuable discoveries of new methods in the study of the physiology and pathology of the blood, by his systematic work on antityphoid inoculations, has won for himself the reputation of an original investigator of the foremost rank. Moreover, by the eminently practical work of his pupils in the Army Medical Service, he has demonstrated the great value of a research laboratory for the Army Medical Service.

Everyone interested in the advancement of medical science in general, and of the teaching of scientific pathology to our Army medical officers in particular, will gladly admit the great services which Prof. Wright has rendered while at Netley. E. KLEIN.

EARTHQUAKE IN THE MIDLANDS.

EARTHQUAKE shocks were felt at many places in the midland counties about 1.30 p.m. on Tuesday. The reports which have been received up to the time of going to press show that the counties of Derby, York, Stafford, Cheshire, Notts and Leicester were affected by the disturbance. Two shocks were felt at most places, one a few minutes after the other. Though no very serious damage was done, the rumbling noise and the vibrations due to the earthquake caused much alarm, and people ran from their houses into the streets. We give below a summary of the reports which have appeared in the daily papers, and the report of an interview with Prof. Milne, published in Wednesday's *Daily Mail*.

DERBYSHIRE.—*Derby*. Shocks felt at 1.10 p.m. Duration, 5–10 seconds. Houses shaken, windows rattled, and crockery overturned. Rumbling noises heard. Second shock at 1.29 less severe.—*Matlock Bath*. Two shocks at about the same time as Derby. Duration, about 45 seconds. Slight rumbling sound.—*Alfreton*. Three shocks. Many buildings shaken and cracked. Chimney overthrown.—*Ashbourne*. Chimney overthrown.—*Buxton and Bakewell*. Pictures and ornaments displaced by vibration of walls of houses, and crockery overthrown.

NOTTINGHAMSHIRE.—*Nottingham*. Time about 1.30 p.m. Duration, 5–6 seconds. Large buildings in centre of city seen to sway.

YORKSHIRE.—*Sheffield*. Slight shocks felt.—*Dore*. Time, 1.30 p.m.–1.40 p.m. Houses shaken, bells rang, windows and crockery rattled.—*Baslow*. Rumblings heard and houses and objects shaken.

STAFFORDSHIRE.—*Burton-on-Trent*. Two shocks felt at 1.30 p.m. Windows violently shaken, and crockery and furniture rocked by prolonged vibrations.—*Stafford*. Time, 1.40 p.m. Two shocks. Vibration of ground felt, and objects overturned.—*Uttoxeter*. Time, 1.32 p.m. Duration, about a minute. Tables and chairs moved several inches. Doors and windows rattled. Bells rang.—*Hanley*. Time, 1.40 p.m. Duration, 30–40 seconds. Tables and chairs rocked, and many objects overthrown.—*Leek*. Time, 1.35 p.m. Rumbling noise heard, followed directly afterwards by vibration. Second shock of greater intensity felt a few seconds later. Shocks also felt at Stoke, Longton and Kidsgrove.

CHESHIRE.—*Northwich*. Time, 1.30 p.m. Decided movement. Objects displaced.—*Comberbach*. Chairs rocked as though heavy traction engine was passing.

EAST LANCASHIRE.—*Blackburn*. Time, 1.15 p.m. Crockery overthrown. Second but less severe shock at 1.35.

Prof. Milne's Views.

"My seismograph photographic films are not yet developed, but they will be to-night, and I shall see whether vibrations of this shock reached as far as the Isle of Wight. It is very doubtful whether they did, because my instruments are not constructed to record the exceedingly rapid vibrations which we get from local shocks.

"The probability is that this earthquake is similar to those which from time to time have had their origin in Leicestershire and the Severn Valley, the last of which was on December 16, 1896. That occurred about 5.30 a.m., and about Hereford did a considerable amount of damage in shattering buildings. In fact, its destructive effect was felt even as far as Birmingham, while people were awakened at Alderley Edge, Manchester, and in towns further north. The vibrations extended eastwards, certainly as far as London.

"This latest earthquake probably means that there has been some adjustment or slight slip on the line of a pre-existing fault or fracture in the earth's crust. Careful observation of the times at which this has been felt in different parts of Great Britain will no doubt lead to the determination of the extent of such fault, and thereby help the work of the Geological Survey.

"A very feeble trace of the last Severn earthquake was obtained in the Isle of Wight, but it was difficult to distinguish between what were earthquake and what artificial disturbances. In order to make this distinction in regard to local shocks, it will be necessary for some enthusiast to isolate himself in the centre of a district like Dartmoor, and live the life of a hermit."

NOTES.

THE investigation of the properties of radium salts has led to many remarkable results, among which those contributed by MM. P. Curie and A. Laborde to the current number of the *Comptes rendus* are not the least remarkable. They adduce evidence to show that radium salts give off heat continuously. The experiments were made in two ways. Two small bulbs, one containing 1 gram of a radiferous barium chloride containing about 1/6 of its weight of radium chloride and the other containing a similar weight of ordinary barium chloride, were placed under similar thermal conditions with a junction of a thermocouple in each bulb. The bulb containing the radium preparation proved to be 1°·5 hotter than the other, and this temperature difference was maintained. An independent confirmation was obtained with the Bunsen ice calorimeter. At the moment the radium bulb was introduced, the mercury, which was previously stationary, commenced to move along the tube with a perfectly uniform velocity, and on the bulb being taken out the mercury stopped. From these experiments, which are given as preliminary and only roughly quantitative, the authors conclude that a gram of pure radium would give off a quantity of heat of the order of 100 calories per hour, or 22,500 per gram-atom per hour, a number comparable with the heat of combustion in oxygen of a gram-atom of hydrogen. The disengagement of such a quantity of heat cannot be explained by the assumption of any ordinary chemical transformation, and this excludes the theory of a continuous modification of the atom. The heat evolution can only be explained by supposing that the radium utilises an external energy of unknown nature.

REPORTS of the following volcanic eruptions and earthquakes have appeared since we went to press last week:—*Vienna*. Violent earthquake shocks were experienced during the night of March 19 and early in the morning of March 20 in the Semmering district and the Mürz Valley, in Styria. March 21. *St. Thomas*. Mont Pelée emitting dense clouds. March 22. *St. Thomas*. There was a violent eruption of the St. Vincent Soufrière. Kingstown was covered with a dense black cloud, the sun being completely obscured. Three inches of sand and rock fragments have fallen at Georgetown and Château Belair. *Barbados*. Complete darkness caused by fall of volcanic dust from the Soufrière. *Dominica*. Frequent loud detonations heard to the south-east, and clouds of dust seen to westward. *Kaiserslautern*. At 6 a.m., and again at 2 p.m., violent earthquake shocks were felt almost everywhere in the south of the Bavarian Palatinate from Landau to Wörth. *Cuneo* (*South Piedmont*). Earthquake shocks felt, but no damage done. March 23. *Grenada*. Eruption of the Soufrière began 6.30 a.m.; immense clouds, comparative absence of lightning a feature; no injury beyond heavy fall of sand and small stones two to three inches at Georgetown; quieted down during afternoon. March 24. Earthquake in the Midland Counties (see adjacent column).

THE West African Company's steamship *Sokoto*, which arrived at Plymouth on March 20, reports having encountered a sandstorm. The report reads as follows:—"The vessel was enveloped for eight days in a sandstorm

off the African coast. So dense was the sand that speed was reduced owing to the impossibility of seeing far ahead, and even at midday passengers had to resort to artificial light for the purposes of reading. The ship was navigated by dead reckoning, it not being possible to secure observations. The storm is described as the worst in an experience embracing twenty-five years."

THE annual meeting of the general board of the National Physical Laboratory was held at Bushy House, Teddington, on Friday last. Lord Rayleigh, the chairman of the board, was supported by Sir F. Hopwood, Sir E. Carbutt, Sir W. Preece, Sir A. Rücker, Col. Crompton, Mr. A. Siemens, Prof. Perry, Prof. Larmor, Mr. Kempe, Mr. Stromeyer, and a large number of other members of the board. The annual report of the executive committee, giving details of the work since the opening of the laboratory by H.R.H. the Prince of Wales, was approved. It appears from the report that subscriptions and donations amounting to nearly 1000*l.* a year have been promised by the Institution of Civil Engineers, the Iron and Steel Institute, the Institute of Chemical Industry and various private firms. Efforts are being made to extend the list, and more especially to render the laboratory self-supporting by increasing the work done for firms and private individuals. Examples of such work are given in the report, and in a lecture recently delivered at the Institution of Mechanical Engineers by the director. The scheme of work suggested by the director for 1903 was also approved. After the meeting an inspection of the laboratory took place, and in this the board was accompanied by a number of gentlemen who have assisted the laboratory by serving on its various committees or as donors of apparatus. Among the visitors were Sir Herbert Jekyll, of the Board of Trade; Sir Thos. Elliott, of the Board of Agriculture; Sir Wm. White, Commander Sclater, of the Admiralty; Sir Oliver Lodge, Mr. Dewar, M.P., the Master of the Mercers' Company, Col. Vickers, Mr. Smith Carington, of Messrs. Sir W. G. Armstrong, Whitworth and Co.; Mr. Swinburne, Mr. Ferranti, and many others.

THE death is announced, at seventy-five years of age, of Prof. M. S. Voronin, member of the Imperial Academy of Sciences at St. Petersburg, and distinguished by his botanical work.

THE U.S. National Geographic Society has awarded the Cullum medal to the Duke of the Abruzzi for his ascent of Mount St. Elias and his Arctic explorations.

THE competition for the prize offered by the Academy of Verona for a historical and artistic guide of the city and province of Verona has been deferred until December 31, 1903.

IT is announced in *Science* that Mrs. Rowland has given to the Johns Hopkins University the library of the late Prof. Rowland relating to spectroscopy, and a former student has given more than 1000*l.* to purchase books on this subject. With these gifts there will be established a "Henry A. Rowland Memorial Library," to contain publications in the field of radiation and spectroscopy.

MR. OTTO J. KLOTZ, astronomer of the Department of the Interior, Canada, leaves shortly for the Pacific, in charge of the longitude determinations along the British Pacific cable. It is stated in *Science* that the stations occupied will be Vancouver, Fanning, Suva, Norfolk and Southport, near Brisbane, Australia. Connection will also be made with New Zealand from Norfolk, where the cable bifurcates.

ACCORDING to Reuter's Agency, Mr. Fiala, the leader of the new North Pole expedition which Mr. Ziegler is dispatching to the Arctic, is leaving at once for Norway to join the steamer *America*, which has been lying at Tromsö since the return of the expedition last year. Provisions and stores for two years will be taken, and on leaving Tromsö the *America* will steam direct for Archangel, where she will embark fresh supplies. Mr. Fiala states that the main idea is to make a forced march to the Pole from a base of supplies.

PROF. F. J. STUDNIČKA, whose death occurred on February 21, was a prolific and versatile author. The long list of his papers begins with two or three on physics proper, but his work was mainly in the field of pure mathematics. Among the subjects on which he wrote are determinants, chain-fractions, congruences, magic squares, the eight-square theorem in arithmetic, definite integrals, and quaternions. Meteorological questions seem to have interested him always, and he published several papers on rainfall. Besides all this he was the author of various mathematical treatises, and professor of mathematics in the University of Prague.

THE tercentenary of the close of Queen Elizabeth's reign was celebrated by the Royal Geographical Society on March 23 at an interesting gathering, at which special stress was laid on the importance of that memorable reign as the starting point of progress in every branch of geographical science. The names of the great sailors of those days have become such household words that an occasion of the kind was hardly needed to impress upon the public the great results which have followed from those early beginnings of nautical enterprise. But it is far less generally recognised that the Elizabethan era was quite as important from the point of view of the more scientific branches of the subject, and this fact was clearly demonstrated by Sir Clements Markham in his opening address, in which the services rendered by such men as Hakluyt, Davis, Wright, Blundeville, and Saxton to the science of surveying and map-making was fully set forth. A special address by Prof. Silvanus Thompson emphasised the value of the work of William Gilbert as the first to reduce to a connected system the vague notions previously prevalent on the subject of magnetism, and showed that though by no means free from error, Gilbert's theories were the starting point from which the gradual elimination of those errors followed in due sequence. Short addresses by Mr. Edmund Gosse and Mr. Julian Corbett dealt with special aspects of the work of Raleigh and Drake, while an interesting exhibition illustrated the geographical achievements of the reign in the form of books, maps, instruments, and so forth.

IN the House of Commons on Monday, in answer to a question with regard to the fitting of coastguard signal stations with wireless telegraphy apparatus, Mr. Arnold-Forster said:—The following stations have been established: Dover, Culver Cliff, Portland, Rame Head, Scillys, and Roches Point. The following are proposed to be fitted during the next financial year:—Bere Island, Spurn Head, Alderney, St. Abb's Head, St. Ann's Head, Languard, Port Patrick, Duncansby Head. As regards commercial signalling, it is proposed to carry this out from the stations which will be included in the new Lloyd's-Admiralty agreement, which are:—Culver Cliff, Scillys, Spurn Head, St. Abb's Head, St. Ann's Head, Duncansby Head, and Roches Point.

IT is announced in the Boston *Transcript* that a plan has been definitely approved for holding an International Congress of Arts and Sciences at the St. Louis Exposition on September 19–September 30. The congress will attempt to correlate the scattered theoretical and practical scientific work of our time. In each of the various sub-

divisions two papers will be presented—one on the history of that particular department of knowledge during the past one hundred years, and the other on the problems that now present themselves for solution in that field. Profs. Simon Newcomb, of Washington, Hugo Münsterberg, of Harvard University, and A. W. Small, of the University of Chicago, have been entrusted with the arrangement of the details. It is expected that these three American men of science will spend shortly several months in Europe, conferring with leading European men of science with a view to secure their full cooperation.

THE *Atti dei Lincei* announces that the subject for the Carpi prize for 1903–4 is "Contributions to the Study of the Functions of the Liver in the Animal Series."

IN its *Rendiconti* (xxxvi. 1), the Reale Istituto Lombardo publishes its annual list of prize awards, and subjects for prizes for future years. The following prizes are unawarded:—The ordinary prize of the Institution, the Cagnola prizes for essays on the cure of pellagra and the steering of balloons, the Fossati prize, and the Secco Commeno prize. Under the Cagnola foundation, a prize of 2500 lire and a gold medal of 500 lire are awarded to Prof. G. B. Grassi, of Rome, for his works dealing with the nature of miasma and contagion. Under the same foundation, no other prizes have been awarded, but special awards of 800 and 700 lire have been made to two anonymous competitors on the subject of effect of fumes from manufactories on vegetation, and 1000 lire have been similarly given to one competitor on the subject of prevention of forgery of documents. The Kramer prize of 4000 lire has been awarded to Carlo Valentini, engineer, for his work on the prediction of the floods of the Po. In connection with the Zanetti prize for Italian pharmacists, 700 lire have been awarded to Prof. Egidio Pollacci (Pavia), and 300 lire to Edoardo Baroni (Turin). For the Brambilla prize for manufacturers of Lombardy, seventeen competitors have entered, and the commission has awarded a gold medal and 600 lire to Dr. Daniele Crespi for mercerisation of cotton, &c., the same to Pastori and Co., steel pen makers, a gold medal and 400 lire to Marx and Co. for table cutlery, the same to Besana, Felice, Comi and Co. for hot water and steam heating apparatus, to Ercole Marelli and Co. for electric ventilators, and to M. Boschi and Co. for transparent glass plates for pavements. Awards of 300 lire have been made to Angelo Mantegazza for Italian paste, and to Biagio Bigioggero for seamless upper leathers for shoes. As in previous years, the awards indicate keen competition and progress by rapid strides among the Lombardy manufacturers, while the subjects in pure science attract comparatively few competitors.

FOR future prize competitions, the Reale Istituto Lombardo gives a programme of which the following is a brief summary. The Institution prize for 1903, for developments of Lie's theory of groups; for 1904, on the work of Vittorio Alfieri; the two triennial medals for 1903, for the promotion of agriculture and the introduction of manufacturing industries in Lombardy. The Cagnola prize for 1903, for a monographical study of hypophysis; and for 1904, on the velocity of kathodic rays. The Cagnola prizes on subjects chosen by the founder, cure of pellagra, nature of miasma and contagion, direction of balloons, and prevention of forgery. The Brambilla prize, for manufacturing industries in Lombardy. The Fossati prize for 1903, on the so-called nuclei of origin or termination of cranial nerves; for 1904, on the localisation of cerebral psychic motory or sensory actions; for 1905, on our state of knowledge in neurology. The Kramer prize for 1903, on systems of electric traction. The Secco Comneno prize, on the virus of rabies; Ciani prizes, for published books of the following classes—historical for 1903, narrative or dramatic for 1906, scientific (with preference to philosophy and education) for 1909, the book in each case to have appeared within the eight years preceding the award; also an extraordinary Ciani prize for 1904 for an unpublished Italian popular book. The triennial Zannetti prize for 1905, for progress in pharmaceutical chemistry. Finally, the Tommasoni prize for 1905 is for the best history of the life and works of Leonardo da Vinci.

BY the death, at the early age of fifty-eight, of Dr. Gustav Storm, professor of history at the University of Christiania, Norway in particular, and the world of scientific historians in general, have sustained a loss which it will take a long time to repair. In his own university, his superior intellectual qualities, his indefatigable energy and high character secured for him a position of unique importance and influence; while abroad he was looked upon as the typical representative of scientific research in the wide domain of history. As the main task of the man of science is to weigh and measure with the greatest possible accuracy, so Storm made it his chief business to sift with the utmost minuteness the secondary from the primary sources of historic evidence, and on the results obtained to measure time and truth in history. The only work of his we know of which, in this respect, fell short of success was his "Critical Contributions to the History of the Viking Age" (1878), directed against the redoubtable author of "Normannerne," Prof. Steenstrup, of Copenhagen, and referring to the everlasting contest between Norwegian and Danish historians on the question as to which of their respective nations can lay the best substantiated claim to the lion's share in the glory of the *furor Normannorum*. At the age of seven-and-twenty (1872), Storm won the gold medal of the Royal Society of Copenhagen for a singularly thorough and lucid treatise on the sources, manner and method of the historical writings of Snorri Sturluson, a work which still maintains its standard authority unimpeached. Two years afterwards he published another work of standard value, in which he submitted to a searching criticism the legendary cycles round Charlemagne and Theodoric the Goth with a view of ascertaining what historical elements lay hidden under the heap of mediæval romance. In 1877 he was appointed to the chair of history; in 1883 he was elected perpetual secretary general of the Royal Society (Videnskubernes Silskab) of Christiania; in 1886 he became perpetual chairman of the commission for editing the "Fontes" of Norwegian history. He was the author of a large number of important works, and contributed numerous important papers to the *Transactions* of the Royal Society of Christiania, to *Historisk Tidskrift*, to *Aarböger för nordisk Oldkyndighed*, to *Arkiv för nordisk Filologi*, besides a yearly review, from 1876, on Norwegian historiography to the *Revue Historique*.

A SMALL pamphlet entitled "Über die neueren Dämmerungserscheinungen," by Herr P. Gruner (extract from *Mitteilungen der Naturforschenden Gesellschaft in Bern*, 1903), contains some facts relating to the appearances of coloured sunrises and sunsets during last year caused by the volcanic eruptions in the West Indies. Herr Gruner, from a discussion of the days in each month when this phenomenon was observed, suggests that they indicate a periodicity corresponding with the times of new moon. That this may be so seems more natural than otherwise, since the bright moon in the sky would most probably have a tendency to render very difficult the observation of this phenomenon.

PROF. H. HILDEBRAND HILDEBRANDSSON has just issued the first portion of his report to the International Meteorological Committee on the International observations of clouds, which contains, as an introduction, an interesting summary of the history of the general circulation of the atmosphere. The volume includes the results of computation of all observations of cloud movements which he has been able to collect, the mean directions being determined by the "résultantomètre" of M. Sandström, which gives them to one or two degrees. Numerous plates, twenty-two in all, accompany the report, twenty of which give the mean directions of the wind each month, and for several places scattered over the earth's surface. The book is a valuable contribution to this branch of meteorology.

THE Danish Meteorological Institute has published its valuable annual statement relating to the state of the ice in the Arctic seas in 1902, with charts for each month, from March to August. Some of the general results show that the winter ice broke up very late, that the Polar ice lay nearer Asia and Europe than usually, and that the number of icebergs carried from Greenland to the temperate seas was notably smaller than usual. Also that the summer of 1902 has been rough and unsettled in nearly all Arctic and sub-Arctic regions, northerly and easterly winds predominating in Atlantic Arctic seas. No safe conclusions for 1903 can be drawn from the limited data available, but conditions appear favourable for the passage of a considerable number of icebergs east of Labrador and Newfoundland.

WE have received the "Instructions to Observers of the Indian Meteorological Department," by Sir John Eliot. This book, which is the second edition, is intended to supersede the Indian meteorologist's vade-mecum, now out of print. It is confined simply to a description of the various instruments in use at the meteorological stations in India, the precautions to preserve them in good condition, the methods to restore them to good order when it is possible for the observer to do so, and the proper methods of reading the instruments and of taking and recording the observations. It may be mentioned that these "instructions" are so limited because at the present time the observers in India merely take the readings of certain instruments and forward them on suitable forms to the head office, all the work of reduction and preparation for subsequent use and discussion being done there. For this reason explanations as to the methods of applying corrections, and the procedure of reduction, &c., are absent. The book, however, will be useful nevertheless to observers not stationed in India, especially that portion showing the conditions to be fulfilled in the selection of a site for a meteorological station.

ACCORDING to the *Daily Mail*, six of the Cunard Steamship Company's liners have been equipped with printing machinery for the publication of a paper the news of which is supplied by wireless telegraphy. A facsimile of the front page of the paper published on board the *Etruria* and called the *Cunard Bulletin* was printed in the *Daily Mail* of March 14.

AN interesting paper on distribution losses in electricity supply was read by Messrs. Constable and Fawssett before the Institution of Electrical Engineers. The figures given in the paper have been obtained from the working of the Croydon central station, which has an output of 1250 k.w. Roughly, the total losses amount to 21 per cent. of the units generated, and are divided up as follows:—Switchboards and connections, 0·5 per cent.; cable losses, 8·5 per cent.; transformer losses, 9 per cent.; and meter losses, 3 per cent. The authors consider the losses under each heading separately, and suggest ways in which they may be reduced; the greater part of the paper is devoted to the cable losses, which are the most important and the least easy to reduce.

SOME measurements of the temperature coefficients of magnets made of chilled cast iron are described by Mr. B. O. Peirce in the *Proceedings* of the American Academy of Arts and Sciences. Castings of a size and shape suitable for instrument magnets gave for the temperature coefficient between 10° C. and 100° C. mean values of from 0·0003 to 0·0004. These castings had been subjected to a chilling process at the Jefferson Physical Laboratory; another similar magnet treated by an outside maker had the coefficient 0·0008. Unchilled castings were found to have a coefficient five or six times as large as the chilled magnets. The temperature coefficient generally increases with the temperature, the value between 10° C. and 40° C. being possibly only about one-third of the mean value between 10° C. and 100° C. Using such magnets as these in conjunction with galvanometer coils of copper and manganin it is easy, according to the author, to construct a cheap ammeter almost wholly independent of the room temperature.

OUR contemporary the *Electrical Review* has recently published some particulars of the new storage battery invented by Mr. Edison which we described in NATURE more than eighteen months ago (vol. lxiv. p. 241). It seems that the cell is likely soon to be put on the market, and Mr. Edison is reported as having expressed himself as fully satisfied with the trials, and confident of its ultimate success. "The experimenting with the new battery has all been done," he said, "and the only thing that remains is to adapt it to the use of the public." Mr. Hibbert, in the articles referred to above, publishes some discharge curves communicated to him by Mr. Edison's associate, Mr. Dick, which are very similar to the curve which was published in NATURE; the most noticeable point is the large percentage of the ampere-hour discharge obtained at high discharge rates; with eight times the normal discharge rate the cell has 75 per cent. of its normal capacity, which is a very much better performance than that of any lead cell. The watt-hour capacity per pound is the same as originally claimed—about 11—and the cells are said to be of very good mechanical construction and durability. The result of practical experience of the cell in ordinary working will be awaited with great interest; it certainly seems as if we are a step nearer to the production of a satisfactory automobile cell, and to the ousting of lead from its present position as the only material suitable for secondary batteries.

THE December issue of the *Bulletin de l'Académie des Sciences de Cracovie* contains a paper by Prof. Olszewski dealing with three forms of apparatus for the liquefaction of air and hydrogen. Each apparatus is based on the principle of Dr. Hampson's well-known machine; two of them serve to liquefy air, the third is a hydrogen liquefier which can also, if necessary, be used to liquefy air. The first apparatus is intended for use in laboratories when greater quantities of liquid air are to be prepared in a shorter time than it is possible to do by means of the Hampson liquefier. This result is attained by dividing the coil of the Hampson machine into two parts, and inserting between them a CO_2 cooler. The yield of the apparatus is thus doubled. The second apparatus is a true Hampson liquefier, simplified and reduced in size, and wholly enclosed in a partly silvered vacuum vessel. This serves to demonstrate the liquefaction of air during a lecture, without use of a compressor, by means of air compressed

in a steel flask. The last apparatus described is a hydrogen liquefier which differs from that of Dr. Travers chiefly by the insertion of a second regenerator coil, which serves almost wholly to equalise the temperatures of the arriving and the issuing hydrogen, and by the absence of a low pressure chamber for liquid air, this refrigerant being used boiling under atmospheric pressure. The preliminary experiments carried out with this apparatus are said to have led to satisfactory results.

A SERIES of articles by Prof. Duhem, of Bordeaux, on the evolution of mechanics, is an important feature of the current numbers of the *Revue générale des Sciences*. It commences in the issue of January 30 with a historical account of the development of dynamics, starting with the Greek notions of matter, and tracing the successive theories of Descartes, Leibnitz, Boscovich, Newton and Laplace. In the second part, Prof. Duhem deals with the principle of virtual velocities and the statics of Lagrange, d'Alembert's principle, the Lagrangian equations of motion, the theories of Poisson on elasticity, hydrodynamics and capillarity, and theories of elasticity generally. The third paper is devoted to Prof. Duhem's favourite subjects of study, heat and electricity, especially the former. The kinetic theory of gases is traced from its first introduction in the "Hydrodynamica" of Daniel Bernouilli down to the latest works of Boltzmann. In the section devoted to thermodynamics, we have an account of the discoveries of the first and second laws, Helmholtz's theory of monocyclic systems, and a detailed examination of Gibbs's recent work on statistical mechanics. The dynamical theories of electricity are considered, with especial reference to Clerk Maxwell. Finally, under "Impossibility of Perpetual Motion," we have a critical exposition of the dynamics of irreversible phenomena and Clausius's principle of entropy. Further papers are promised dealing with the revival of atomism, the foundations of thermodynamics and similar subjects. On all these branches of theoretical physics Prof. Duhem speaks with authority, and his papers form a useful summary of the development of modern views of the dynamical properties of matter.

THE *Naturalist* for March contains an account of the work of the Yorkshire Boulder Committee for 1901–2.

IN *Naturwissenschaftliche Wochenschrift* of March 8 Herr L. Plate concludes his account of Weismann's theory of development.

WE have received the *Transactions* of the City of London Entomological and Natural History Society for 1902, which contain the president's address and a number of papers.

DR. O. ZACHARIAS, in *Biol. Centralblatt* of March 1, gives an account of the plankton of the Thames, based on the investigations recently undertaken by Dr. F. E. Fritsch, of the Jodrell Laboratory at Kew.

THE *Anales* of the National Museum of Buenos Aires (vol. i. part ii. of the third series) contains three papers by Dr. Ameghino. In the first of these, the author describes a number of mammalian remains—mostly fragmentary—from the well-known deposits of Tarija, in Bolivia, naming several species as new. The age of the Patagonian mammaliferous deposits forms the subject of the second communication; while in the third the primitive type of mammalian molar teeth is discussed.

AN interesting account of the mode of life of the giant land tortoises of the Galapagos Islands, and the present condition of the different species, is given by Mr. E. Heller in vol. v. of the *Proceedings* of the Washington Academy. From several of the islands of the group, the tortoises have disappeared; in Indefatigable Island, the extermination appears to have been quite recent, some Ecuadorians having told the author that not many years ago they saw a huge tortoise near the central crater. The land and sea iguanas of the Galapagos, and their habits, also come in for a share of attention, the author describing the land iguana of Barrington Island as a new species, under the name of *Conolophus pallidus*.

A MEMOIR on the geology of the country around Salisbury, by Mr. Clement Reid, has just been issued by the Geological Survey. It is accompanied by a capital colour-printed map, and both will no doubt be welcomed by the members of the Geologists' Association who make Salisbury their head-quarters for an excursion at Easter. The famous vale of Wardour, with its Portland and Purbeck strata at Tisbury and Chilmark, the Greensand and Chalk of the bordering heights, the Chalk of Salisbury Plain, and the Tertiary and Pleistocene deposits are duly described. It is interesting, too, to find approval of the Eolithic implements which Dr. Blackmore has so assiduously gathered together from the pits of Alderbury.

M. CHARLES RABOT, secretary of the French Commission on Glaciers, is the author of a pamphlet entitled "Essai de Chronologie des Variations Glaciaires" (extract from *Bulletin de Géographie Historique et Descriptive*, No. 2, 1902). In this work the author discusses the observations which he has collected from numerous places in different parts of the world, and comes to some interesting conclusions, which he summarises at the end. To state in a few words the results obtained, he points out that the same kind of glacial variation does not occur simultaneously in the regions he investigated; thus the last positive variation extended over a century and a half, the beginning of the primary increase occurring in Norway in 1700, and ending in the Alps in 1855–1860. A complete primary oscillation, *i.e.* an increase and decrease, appears to have a duration of one or two centuries. For Norway, for instance, the last primary increase began in 1700, and the decrease has not yet terminated; many other examples are given. There seems further to be a plurisecular period covering, in the case of the Alps, about three centuries.

THE Gresham Publishing Company has published, in drawing-book form, two capital models to show graphically the structure of the bee. One model is of the queen bee, the other of the drone. By the familiar device of overlapping sheets, suitably shaped and coloured, the external anatomy, the organs of respiration, digestion and reproduction, as well as the nervous system, can be followed by successively raising the sheets, which, when folded down, make realistic models of the two bees.

THE fourth instalment has been issued of the report on the physical and chemical soil survey of Dorsetshire, begun in 1898, and being conducted by the Department of Agriculture of the Reading University College. In an introductory note Prof. Percival, the director of the Agricultural Department, says it is hoped that during the present season an examination will take place of the flora and plant associations, more especially of the pastures and meadows, met with upon the different formations and drift areas of Dorsetshire. A thorough botanical or œcological survey taken in conjunction with geological and analytical data will be of great value, and it is proposed, if possible, to secure the assistance of Dorset field botanists.

A SECOND enlarged edition of Prof. A. Fischer's admirable "Vorlesungen über Bakterien" has been published by the firm of Gustav Fischer, Jena. The first edition was published in 1897, and was very favourably reviewed in these columns (vol. lviii. p. 77, 1898). The book is now double the size of the original volume, the number of pages having been increased from 186 to 374. Its value as a scientific treatise on bacteriology has thus been increased, and students of the subject may turn to the book with confidence that they will find the present state of knowledge of bacteriological science satisfactorily represented in it.

THE additions to the Zoological Society's Gardens during the past week include a Bosman's Potto (*Perodicticus potto*) from West Africa, presented by Captain Jas. Startin, R.N.; a Rhomb-marked Snake (*Trimerorhinus rhombeatus*) from South Africa, presented by Mr. George Vanderspar; six Marbled Newts (*Molge marmorata*), three Palmated Newts (*Molge palmata*), three Brown Newts (*Spelerpes fuscus*), European, deposited; two Herons (*Ardea cinerea*), European, received in exchange.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN APRIL:—

April 6. 10h. 11m. Minimum of Algol (β Persei).
9. 11h. 48m. to 12h. 23m. Moon occults ν Leonis (mag. 4·5).
9. 15h. 16m. to 18h. 48m. Transit of Jupiter's Sat. III. (Ganymede).
11. Moon partially eclipsed visible at Greenwich:—
10h. 34·4m. First contact with the shadow.
12h. 13·0m. Middle of the eclipse.
13h. 51·6m. Last contact with the shadow.
Magnitude of the eclipse (☽'s diameter = 1) = 0·973.
15. Venus. Illuminated portion of disc = 0·832, Mars = 0·985.
20–22. Epoch of Lyrid meteoric shower (Radiant 271° + 33°).
26. 11h. 54m. Minimum of Algol (β Persei).
29. 8h. 43m. Minimum of Algol (β Persei).

STELLAR PARALLAX.—The *Transactions* of the Astronomical Observatory of Yale University (vol. i. part vi.) contain a valuable determination of the parallax of the ten first magnitude stars in the northern hemisphere by Dr. W. L. Elkin, the director of the Observatory. This investigation is part of a scheme for making a series of researches on the parallaxes of stars of successive orders of magnitude with the Yale heliometer, and was begun in the year 1885. In the volume before us Dr. Elkin gives details of the method of measurement adopted, the several series and comparison stars, the observations and reductions, and finally a discussion of the results. Referring here only to the actual results he obtained, the following table gives the adopted values of the parallax of each of the stars, with their probable errors:—

	Adopted Parallax.	Probable Error.
	"	"
α Tauri	+0·109	±0·014
α Aurigæ	0·079	0·021
α Orionis	0·024	0·024
α Can. Min. ...	0·334	0·015
β Geminorum ...	0·056	0·023
α Leonis	0·024	0·020
α Bootis	0·026	0·017
α Lyræ	0·082	0·016
α Aquilæ	+0·232	0·019
α Cygni	−0·012	±0·023

MEASURES OF SATURN'S RINGS.—A series of measurements of the distance between the inner edge of the inner ring of Saturn and the planet itself has been made by Prof. F. E. Seagrave, of Providence. The mean result obtained shows a distance of 3″·698 on the preceding side and 4″·005 on the following side, and the diameter of the planet itself is given as 17″·618.

A comparison of this result with the mean of the results obtained by previous observers shows that there is no proof of the theory, first advanced by M. Struve in 1851, that the inner ring of the planet was expanding inwards, and that consequently the space between it and the planet was decreasing (*Popular Astronomy*, No. 103).

OBSERVATIONS OF JUPITER'S FIFTH SATELLITE.—In *Bulletin* No. 28 of the Lick Observatory, Prof. R. G. Aitken gives the details of the measurements made during 1900 and 1902 at the Lick Observatory of the positions of Jupiter's fifth satellite.

In each set of observations the position of the satellite is referred to that of one of the others, and the time of observation, the position angle, the distance in seconds and the number of settings are given in tabular form.

The satellite was observed on ten nights, a magnifying power of 270 being used during 1900, and a power of 350 during 1902. During the former period the planet itself was occulted by means of a drop of Indian ink on a clear glass plate placed between the micrometer threads and the eye-piece, but during 1902 a piece of suitably placed smoked mica was substituted for the glass plate.

OBSERVATIONS OF THE LIGHT OF NOVA PERSEI.—The second publication, by the Harvard College Observatory, of the variations in the magnitude of Nova Persei occurs in vol. xlviii. (No. 2) of the H.C.O. *Annals*.

About three thousand six hundred magnitude observations have been compiled from various sources by Mr. Leon Campbell, under the direction of Prof. O. C. Wendell. The time of observation, the original comparison stars (when available), the magnitude of the Nova reduced to the Harvard photometric scale, the name of the observer and a reference number to the publication in which the observation was originally recorded are given for each observation, and the observations are set out in chronological order.

NEW CATALOGUE OF DOUBLE STARS.—A sixth catalogue of one hundred double stars, discovered by Mr. W. J. Hussey whilst using the 12-inch and 36-inch Lick refractors, is contained in *Bulletin* No. 27 of the Lick Observatory. The previous five catalogues, each containing the names, positions and particulars of one hundred new doubles, have appeared in earlier numbers of the *Astronomical Journal* and the Lick *Bulletins*.

Mr. Hussey calls special attention to two of the stars in the present catalogue, Nos. 507 and 580 respectively. No. 507 (D.M.+49°.95) is a remarkable triplet the components of which are of nearly equal magnitude (A.=9·3m., B.=9·5m., C.=9·8m.) and form an equilateral triangle, and the observer suggests that the measurements thereof should form a conclusive test for determining personal equations. No. 580 (ι Serpentis) is a probable binary the components of which are equal in magnitude (5·0m.) and the proper motion exceedingly small, viz. −0·00477s. and −0″·0582.

MAGNETIC OBSERVATIONS DURING ECLIPSES.—Dr. L. A. Bauer, of the Coast and Geodetic Survey, Washington, has collected all the available observations of the magnetic variations which are shown to take place during a total eclipse of the sun, and has published them in No. 4, vol. vii. of *Terrestrial Magnetism and Atmospheric Electricity*.

It is suggested in the preface to the article that the eclipse variation of the magnetic needle is analogous to the common diurnal variation, and that the causes of the two phenomena are also analogous, inasmuch as the diurnal variation may be caused by the continual eclipse of that side of the earth which, for the time being, is turned away from the sun. For this to be the case we have to premise that these variations are caused by some undetermined radiation from the sun which affects the magnetic needle.

This suggestion is supported by the following result deduced from the collected observations, which refer to every eclipse that has taken place since 1870:—"The precise effect of the eclipse magnetic variation is (1) opposite in the two magnetic hemispheres; (2) opposite for the morning and afternoon hours." In other words, "the nature of the eclipse variation is analogous to that of the diurnal variation, differing from it only in degree."

Supposing that the magnitude of the effect produced varies

proportionately with the amount of sunlight cut off, the earth and moon should produce effects inversely proportional to the square of their diameters, *i.e.* 13·5 : 1, and in analysing the collected data Dr. Bauer finds that the ratio of the diurnal variation to the eclipse variation is of this order, thereby supporting the theory set forth in the preface.

THE SOLIDIFICATION OF FLUORINE AND THE COMBINATION OF SOLID FLUORINE WITH LIQUID HYDROGEN.[1]

IN preceding researches we have shown that fluorine is liquefied at −187° C., and that, at this low temperature, it acts neither upon crystallised silicon, amorphous carbon, boron nor mercury; that, in short, its chemical activity is diminished, but that it still combines with production of flame with hydrogen and solid turpentine.

These researches have been continued since one of us has been able to obtain hydrogen in the form of a stable liquid boiling at −252°·5 C., or at 20°·5 absolute. Since the first experiments published on this subject it has been found that fluorine which is perfectly free from hydrofluoric acid does not attack glass at the ordinary temperature; hence it is now possible to enclose a definite volume of fluorine in a thin-walled glass vessel, and to submit it to the powerful cooling action furnished by the ebullition of liquid hydrogen.

A sealed glass tube filled with fluorine and placed in liquid oxygen, boiling quietly under the atmospheric pressure, showed no trace of condensation. The same tube was lowered slowly into a double-walled vessel containing liquid hydrogen, so as to obtain a progressive cooling. A yellow liquid first appeared, which, after plunging wholly into the liquid hydrogen, froze to a yellow solid. On leaving the tube for some time in the liquid hydrogen, so that the temperature of the fluorine was cooled down to 20°·5 absolute, the solid fluorine, originally yellow, became white, resembling in this respect chlorine, bromine and sulphur. Experiments with liquid nitrogen showed that the melting point of fluorine is below −210° C., and a comparison with the melting point of oxygen, 38° absolute, showed that 40° absolute, or −223° C., is the most probable value for the melting point of fluorine. The ratio of the melting point to the boiling point is a little smaller than the ratios given by chlorine and bromine.

Experiments were also directed to another point, the question of the affinity of bodies for each other at low temperatures, and in view of the fact that fluorine possesses more powerful affinities than any other elements, it was interesting to determine whether any action was possible between liquid hydrogen and solid fluorine, both maintained at a temperature of −252°·5. In order to realise this experiment, a thin glass tube was taken containing about 50 c.c. of gaseous fluorine, which had been completely freed from hydrofluoric acid, the gas completely solidified in one of the points of the tube, and this then immersed in a hundred cubic centimètres of liquid hydrogen. When the temperature of the whole was lowered to that of the liquid hydrogen, the point containing the fluorine was broken off without removing the tube, so as to allow of contact between the hydrogen and the fluorine. A violent explosion was the result, sufficient heat being set free to raise the material to incandescence and to set fire to the hydrogen. The explosion was sufficiently powerful to reduce the fluorine tube and the double-walled hydrogen vessel to powder.

Helium is now the only gas which has not been obtained in the solid state.

THE ACCUMULATION OF METEOROLOGICAL OBSERVATIONS.

PROF. HANN contributes to the *Meteorologische Zeitschrift* for January a translation into German of that portion of Prof. Schuster's address before the British Association at Belfast (NATURE, vol. lxvi. pp. 614–618) which deals with meteorological observations, and adds some comments from which the following extracts are translated.

Prof. Schuster's point of view is that of the theoretical physicist, and it is consequently different from that of the meteorologist, who cannot leave the demands of practical life out of account.

The professor's remarks as to the desirability of short and systematic series of observations for the study of definite problems, that is to say, the introduction of a kind of experimental method into meteorology, will certainly meet with universal approval, but this has already been done in several cases (study of thunderstorms, effect of forests on climate, &c.). Simultaneously with such special observations the regular "routine observations" need in no wise be neglected; they appear to us to be indispensable.

Complaints as to the superabundance of meteorological observations are not new; it may be a quarter of a century since we read in an English periodical: "The need in meteorological science now is not observations, but brains to work out the results." It cannot be denied that there is some justification for this point of view, but it must be borne in mind that by reducing the number of meteorological records the number of "brains" who would discuss already available observations would hardly be increased.

A small amount of consideration will further show that the question of a temporary suspension of meteorological observations cannot be regarded as a practical one. The central institutions could take no such step, for they are not intended solely, or even primarily, to serve the ends of pure science, but chiefly to meet the demands of practical life, which would not brook the interruption of observations for a lustrum. The answer given by Sir George Airy before a Treasury Committee appointed to inquire into the expenditure of the grant in aid of meteorology is characteristic in this connection. Asked whether there were reasons for continuing the publication of the detailed daily reports from the seven (first-class) observatories, Airy replied: "It is desirable they should be preserved, I think; and there is one point which is worth considering, and that is that the public feeling in favour of meteorological publications is very strong. . . . I get a great number of letters and applications of all kinds from persons that I know nothing about. Few requests are made for astronomical information. A greater number are made for magnetic information, but that is to a great extent for practical purposes; but I think that by far the greater number are for meteorological information. . . . Popular feeling is an element not to be put out of question in matters of this kind." This from the same Airy who later on expressed the wish "that an absolute stop should be made from time to time in order to give what I venture to call breathing time." But practical and scientific demands alike pass over such desires.

Had Prof. Schuster ever been at the head of a meteorological office, he would know how constantly public authorities, to say nothing of private individuals, demand authentic meteorological data; he would then be able to estimate what public opinion would say if the director answered: "I have discontinued meteorological observations for five years, to obtain time and opportunity for discussing existing records."

Even if official observations were suspended, private observations would be continued, and a state of affairs would again be brought about similar to that which obtained before the introduction of an organised system of observation. Unchecked observations would be made with untested and badly exposed instruments, and a real waste of time would result, nay more, in many cases positive harm might be done by the circulation of inaccurate data. A natural interest, which has undoubtedly done good service in the past, would also be checked.

As regards the publication of results, it is only by means of such publications that it is possible on the one hand to exercise satisfactory supervision over the observations, and on the other to give all who desire it the opportunity of making use of existing records. To bury the results where they would be accessible only to the staff of an office would be a waste that would indeed justify complaints.

Least of all can we understand how Prof. Schuster could mistake the value of continuous homogeneous records or

[1] A paper, by Profs H. Moissan and J. Dewar, read before the Paris Academy of Sciences, March 16.

the extent of the injury that would be inflicted on the objects of such observations by a temporary interruption of the same. A large number of the problems presented by the physics of our globe can only be attacked with any hope of success from this basis; it is essential to have a number of well supervised principal stations in each country supplying an uninterrupted homogeneous series of observations. These stations are also of service in the study of climatological history, and are destined to prove of great importance in the study of meteorology in the future.

Only in a limited sense can we agree with Prof. Schuster's dictum that before commencing to observe we should make sure that our observations will prove of service, and will give answer to a definite question. Not even in the case of observatories do such instructions hold good. When addressed to private observers we would characterise them as "blinkers" which limit the range of vision to definitely laid down lines. We quote one example: when Schwabe began his sun-spot record, it must have appeared to specialists as a mere hobby, devoid of all scientific object; had it been otherwise astronomers would undoubtedly have commenced such observations earlier. And what scientific value have these observations now attained to?

LEAD IN PEATY WATER.[1]

THE report under notice is a statement of the results obtained from an examination of the water supplies and their gathering grounds and storage reservoirs in twenty-three more or less peaty collecting areas in Yorkshire and Lancashire. The object of the examination was to indicate the origin of the plumbo-solvent nature of these waters, and the best methods of preventing or counteracting this action before the water was distributed to consumers. Dr. Houston concurs with Mr. Ackroyd and with other chemists who have studied the subject in these districts in attributing the power of dissolving lead in dangerous quantity to the presence in these waters of acids derived from the peat; and he further intimates his belief that the acid is produced from the peat by the action of certain bacteria found in the peat itself. He finds that the acid nature of the water is frequently not indicated by litmus paper or by other ordinary means, but that it is easily ascertained by the change in colour produced in an alcoholic solution of lacmoid.

The "erosive" action which is exerted on dull lead by dissolved oxygen is considered to be of relatively slight importance, since, in the absence of peaty acids, the amount of solvent action due to this cause is comparatively slight. The peaty acids apparently produce soluble salts of lead and cause the water to bring a much larger proportion of lead into solution than could be introduced by the formation and solution of the oxide alone. Peat is invariably acid in reaction, and peaty water is also always acid. That the solution of the lead by moorland water is due to the peaty acids which it contains has been proved by direct experiment. Further, a decrease of plumbo-solvent power is noticed when these acids are reduced in quantity by various natural causes, or by artificial neutralisation. Indeed, the methods of counteracting plumbo-solvency in peaty water which are adopted in the moorland districts consist in neutralising the acids in the water with carbonate of soda, with carbonate of lime, or with slaked lime. In this connection, it should be remembered that the quantity of slaked lime used must be carefully adjusted, since when it is present unaltered in solution in the water it promotes and does not diminish the plumbo-solvent power.

The variation in degree of solvent action shown by the same moorland supply at different times is shown to be connected with the varying proportions of acid peaty water and of neutralising spring water which the supply contains. In dry weather, the neutral and neutralising water predominates, while rainy weather tends to increase the proportion of superficial acid water which comes out of the peat; these variations in composition markedly influence the plumbo-solvent power of the water.

The author appears to have confined his attention to the amounts of lead in solution in the water, and, undoubtedly, these are the common sources of danger. But a not inconsiderable amount of lead may be removed from the metal, and exist at first in solution as hydroxide, and subsequently as a deposit of hydroxycarbonate, when pure soft water acts on lead in the presence of the atmosphere; in water supplies this action is often considerably restricted by the presence of carbonic acid in solution in considerable proportion, or by the presence of silica, sulphate or carbonate in small amount.

The vast amount of detailed information contained in the report is worthy of serious consideration by those who have to deal with the supply of soft peaty water, as is also the recommendation that the seasonal plumbo-solvent power of the different sources from which any particular supply is derived should be accurately known; arrangements can then be made either to avoid the collection of portions of the supply at the times when they possess a dangerous solvent power on lead, or to neutralise them by satisfactory treatment before they are distributed to consumers. F. C.

[1] Thirtieth Annual Report of the Local Government Board, 1900–1901. Supplement "On Lead Poisoning and Water Supplies." By Dr. Houston. Pp. xi + 224.

PROGRESS OF THE NEW VEGETATION OF KRAKATÃO.

IT is within a few months of twenty years since the great eruption took place which absolutely killed all life in the island of Krakatão. About three years later, Dr. Treub visited the island and examined the beginnings of a new vegetation, the results of which were recorded in 1888 (NATURE, vol. xxxviii. p. 344). He found that the first vegetable settlers on the covering of pumice-stone, lava and ash were microscopic algæ belonging to the Cyanophyceæ. These organisms covered the surface with a slimy layer, which acted as a decomposing agent and created a suitable substratum for ferns, of which about a dozen species were already abundant in 1886. Dr. Treub also observed a few individuals of fifteen species of flowering plants, most of which had sprung from drift-seeds.

In the spring of 1897, a party of botanists visited the island, and Dr. O. Penzig has published the results of their investigations and observations (*Annales du Jardin Botanique de Buitenzorg*, 2me série, iii. (1902), pp. 92–113, with seven views), from which we learn that sixty-two species of vascular plants were observed on Krakatão and the neighbouring islets, Lang and Verlaten. Fifty of these colonists are flowering plants, representing twenty-one natural orders, and it seems highly probable that they all reached the islands independently of man. Classifying these fifty-three species according to the assumed means by which their seeds were conveyed to the islands, 7·54 per cent. were possibly carried by birds, 32·07 per cent. were probably wind-borne and 60·39 per cent. were almost certainly cast up by the waves of the sea. No additional species of fern appears to have established itself in the islands between 1886 and 1897. This is inexplicable, because the region is rich in ferns, the spores of which, one would suppose, would be brought by winds in abundance. Apart from ferns, the probable "aeolophilous" element consists of eight Compositæ, six grasses and four orchids. After passing the strand belt of vegetation, which is by far the most numerous in species, dense thickets of Phragmites, Saccharum and Gymnothrix were encountered. The interior and higher part of Krakatão is still much less covered with vegetation, ferns largely preponderating. Conspicuous and relatively common amongst the flowering plants was *Spathiglottis plicata*, a terrestrial orchid. The other orchids are *Vanda Sulingi*, *Arundina speciosa* and a species of Phajus. Krakatão is about twenty miles distant from both Java and Sumatra, and the most interesting question suggested by the new vegetation is, How far does it afford a solution of the problem of the origin of the vegetation of much more remote islands which have more than a littoral or coral island flora?

W. BOTTING HEMSLEY.

ANTHROPOLOGICAL NOTES.

THE strange cranial deformation known as trigonocephaly, in which the forehead is constricted and more or less pointed, and the temporal region and the base of the skull are broadened, is the subject of a research by Dr. M. Hanotte in *l'Anthropologie* (tome xiii. No. 5, p. 587).

The weight of the human brain is the subject of a detailed

nvestigation by Mr. F. Marchand (*Abhandl. der math. phys. Classe der Königl. Sächs, Ges. der Wiss.*, No. 4, 1902, p. 393). The average weight of the brain for men between fifteen and fifty years of age is 1400g., that for women 1275g. The smaller size of the female brain is not dependent on shorter stature, as the median brain weight of women is absolutely smaller than that of men of similar size.

The *Mittheilungen der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasaiens* (Band viii. Theil 3) contains two long articles, one by Mr. P. E. Schiller on the etiquette of present-giving in Japan, which is full of quaint customs, and another by Prof. Karl Florenz on the new agitation against the Japanese letter-forms. These, which are of Chinese origin, weigh like an intolerable burden on Japanese progress. Dr. Florenz adds an elaborate essay on comparative European and Japanese phonetics, illustrated by numerous diagrams of palates. This appears to be a valuable contribution to the subject of comparative phonetics.

The interesting excavations in the caves of Baoussé-Roussé, undertaken by the liberality of the Prince of Monaco, under the able direction of M. l'Abbé de Villeneuve and with the assistance of M. Lorenzi, the enthusiastic and skilful *préparateur*, have resulted in important discoveries. The work has been accomplished with the greatest thoroughness and exactitude. Dr. R. Verneau has published in *l'Anthropologie* (tome xiii. No. 5, p. 561) an illustrated account of his study of the remains from the "Grotte des Enfants," in which he states that although the Cro-Magnon type of man is found at a depth of 7m. ·05, at ·70m. lower two skeletons were found which presented a very clear negroid appearance, but they are not true negroes. His hypothesis is that earlier than the race of Cro-Magnon and later than the race of Spy, a third ethnic element was present on the Riviera which presented negroid characters.

We have frequently directed the attention of ethnologists to the mine of information concerning the customs, beliefs and handicrafts of civilised and uncivilised folk that is to be found in the pages of our contemporary *Globus*. The articles are generally a record of first-hand observations, and the majority of them are illustrated. Another feature of the journal are the careful summaries of contemporary geographical, ethnographical and archæological literature. The following titles taken from the current volume (lxxxii.) illustrate the range of subjects:—A historical-ethnological study on gynæcological "ex voto," by Dr. E. Blind, with illustrations (p. 69); Dravidian folk-poetry, by Mr. W. Gallenkamp; dwarfs in history and tradition, by Mr. D. MacRitchie. In the previous volume, there were papers by Mr. G. Thilenius on prehistoric pygmies in Schlesien (p. 273), and by Mr. J. Kollmann on pygmies in Europe and America. Prof. K. Weule raises the question (vol. lxxxii. p. 247) whether there are dwarf people in New Guinea. His remarks are based on photographs of three men whose stature ranged from 1201m. to 1205m. Further evidence must be obtained before we can be sure whether these are a true pygmy people or only dwarfed Papuans. Name-giving and marriage among the Orang Temia of the Malaka Peninsula, by Hrolf Vaughan Stevens, edited by H. Stönner (p. 253). An article by Mr. G. Knosp on the Annamite Theatre is illustrated by a coloured plate. An interesting *résumé* of archæological, somatological and ethnographical researches in Portugal is given on pp. 283–289. Dr. C. Kassner describes and figures (p. 315) various ethnographical survivals in Bulgaria, amongst others the suspended boards that are used as gongs.

In the current number of the *Reliquary and Illustrated Archæologist* is the first of a series of papers on prehistoric Dartmoor, by Mr. R. Burnard, which promises to be a valuable contribution to the archæology of a most interesting region. A few years ago, extremely little was known about the monuments of Dartmoor, but thanks to the labours of the Dartmoor Exploration Committee of the Devon Association for the Advancement of Science, Literature and Art for the past six years, a considerable amount of information has been obtained. The present communication deals with hut-circles.

Designs cut in rocks have previously been recorded from New Caledonia, but M. Archambault in *l'Anthropologie* (xiii., 1902, p. 689), gives a number of photographs of petroglyphs that he has discovered, and certainly many of them are very remarkable, and they open out a promising field for inquiry. Unfortunately, the author was unable to obtain any information from the natives respecting them, but it does not follow that all knowledge about them has passed away, and it is to be hoped that fresh endeavours will be made to elucidate their signification. In the same journal will be found a further paper by M. Ch. de Ujfalvy of his series on the "Iconographie et Anthropologie Irano-Indienne," in which he deals with the physical type of living Hindus, based on the researches of Risley and Crooke. He alludes to Nesfield's view regarding the caste system, and upholds his conclusions in opposition to Risley's adverse criticism.

The French are masters in the art of popularisation of science; to take a recent example, one can buy for 60 centimes a carefully compiled, up-to-date summary of French archæology by Zaborowski ("Bibliothèque utile," F. Alcan, Paris). In the seventh edition of "l'Homme préhistorique," the French people can learn the opinion of specialists on the ancestry of man and the main characteristics of the men of the various archæological epochs. The tools, weapons, artistic efforts of Palæolithic man are described. The feature of this excellent little book is the prominence paid to the transition period between the Palæolithic and Neolithic periods. The Bronze and Iron ages are merely alluded to.

In the current number of *Man*, the monthly journal of general anthropology which is published under the direction of the Anthropological Institute, besides several papers on the physical anthropology of different peoples, there are interesting contributions on the use of diagrams for craniometrical purposes. Archæology, mainly Egyptian Mediterranean, is particularly well represented. The arts and crafts of various peoples are described in numerous interesting papers, and comparative religion is well to the fore, the discussions on totemism and on the Supreme Being in Sarawak being more especially noteworthy. The articles and notes in *Man* are written in non-technical language, and as they are of such general interest, the journal deserves to reach a wide circle of readers.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

PROF. J. J. DOBBIE, professor of chemistry in University College, North Wales, has been appointed director of the Edinburgh Museum of Science and Art.

ON Thursday, April 2, a meeting will be held in the map room of the Royal Geographical Society, when Prof. Elisee Reclus will speak on the subject of geographical education, with special reference to his globular contoured maps, globes and reliefs, of which he will exhibit examples. All interested in the improvement of cartographical methods are specially invited to attend and take part in the discussion.

FIFTEEN science professors of Calcutta colleges have, it is reported in the *Pioneer Mail*, signed a protest against the proposals of the recent Universities Commission in connection with the teaching of science. Their memorial points out that the principal recommendations of the Commission regarding science teaching tend to discourage instruction in science, for, they continue, the Commission propose to exclude it altogether from entrance examinations, and make it optional for the higher examinations; so that if the recommendations of the Commission are adopted, students will be allowed to obtain the highest degrees of the university without being required to acquire a knowledge of even the rudiments of any branch of science at any stage of their university training. Dr. MacKichau, Vice-Chancellor of the Bombay University, in a speech at Convocation on February 24, proposed that a fund of not less than twenty lakhs of rupees be raised to found a science school in the University of Bombay. Part of this money must, he said, come from the public; Government may be safely trusted to provide the remainder. Part of this fund would be employed to provide buildings for the science laboratories and to equip them with the necessary appliances; part of it in providing instruction by professors appointed by the University, aided by lecturers supplied by the various colleges at its request.

WHAT is known as the "National Diploma in Agriculture" is administered by a joint board elected by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland. This diploma took the

place of one which was originally granted by the Highland Society. Teachers of agricultural science have alleged that the regulations in connection with the national diploma are unsatisfactory, but notwithstanding the attempts of the Agricultural Education Association to secure their improvement, the joint board seems unwilling to alter the conditions of awarding diplomas. Prof. Wallace, of Edinburgh University, enumerates some of the disadvantages attached to the present state of affairs in a recent pamphlet, and among them he mentions that Scottish students have to travel twice to Leeds to be examined by a board from which teachers of agriculture are practically excluded, that the present scheme encourages cramming, and that it is national only in name. Prof. Wallace has obtained the opinion of the Solicitor-General of Scotland as to the position of the Highland Society in relation to its Charter on Education, 1856. This Charter empowers and requires the council of the Highland Society to appoint a board of examiners and to grant diplomas, and the opinion of counsel is that by its action in 1899 in agreeing to the joint board, the council of the Society is not acting in conformity with the provisions of its Charter. Prof. Wallace is, it appears, entitled to take steps to compel the council to proceed in accordance with the Charter.

THE following announcements of gifts to higher education in the United States have appeared in *Science* since the beginning of December, 1902 :—Mr. James Stillman, 20,000*l.* to Harvard University for the endowment of a professorship in comparative anatomy. Mr. Peabody has offered to the University of Georgia a 10,000*l.* building, provided the Legislature will appropriate to the University for maintenance the sum of 2000*l.* a year for two years, and make improvements costing 240*l.* A bequest of 16,000*l.* was made to Yale University by the will of Mr. Benjamin Barge. Mr. Morris Jesup, 2000*l.* to Princeton University. Mr. John D. Rockefeller, 200,000*l.* to the University of Chicago, to be added to the endowment, and other sums amounting to 105,200*l.* have been given to the same university. Tulane University has been made the residuary legatee of the late Mr. A. C. Hutchinson, and it is expected that it will receive 200,000*l.* The University of Rochester has received 2000*l.* from Mrs. Steele. Yale University will ultimately receive 10,000*l.* for the aid of poor students by the will of the late Mrs. Courrier. Dr. D. K. Pearsons has given to Illinois College, Jacksonville, 10,000*l.*; to Fargo College, Fargo, N. D., 10,000*l.*; to West Virginia Conference Seminary, Buchanan, 10,000*l.*; to Pomona College, at Claremont, 10,000*l.*; and to Fairmount College, Wichita, Kas., 5000*l.* This makes the total of Mr. Pearsons's contributions to colleges 800,000*l.* Mr. Henry Phipps, 60,000*l.* for the establishment in Philadelphia of "The Henry Phipps Institute for the Study, Treatment and Prevention of Tuberculosis." Cornell College, Iowa, has added 14,300*l.* to its endowment funds. A friend whose name is not yet made public gave 10,000*l.* Mr. Fred W. Brown has given 2000*l.* Harvard University received 10,000*l.* by the will of Rebecca C. Ames, the income to be used for the support of poor students. The University of Pennsylvania received gifts during the year to the value of 187,370*l.* Mr. Robert E. Woodward, 10,000*l.* to the Brooklyn Institute of Arts and Sciences. The Duke de Loubat, 20,000*l.* to Columbia University for the establishment of a chair of American archæology. Oberlin College has received an anonymous gift of 10,000*l.* from the same donor who recently gave 10,000*l.* By the will of the late Prof. Waterhouse, Washington University received 5000*l.*, and Harvard University and Dartmouth College each 1000*l.* Mr. S. M. Inman, 5000*l.* toward the proposed Presbyterian university to be erected in Atlanta, Ga. Cornell University has received an anonymous gift of 30,000*l.* for the establishment of a pension fund. Mr. James B. Colgate, 20,000*l.* to Colgate University, Hamilton, N.Y., to which he had already given more than 200,000*l.* Mr. Andrew Carnegie, 20,000*l.* to Western Reserve University for the establishment of a school for the training of librarians. Columbia University received 2000*l.* for the establishment of a scholarship by the will of Mrs. Banker. It thus appears that in three months universities and colleges of the United States have, owing to the liberality of American citizens, benefited to the extent of more than one and a quarter millions sterling.

SCIENTIFIC SERIAL.

Journal of Botany, March.—Under Limonium Mr. E. S. Salmon discusses the varieties and synonyms which Hooker, in his "Student's Flora," places together under *Statice auriculaefolia*.—The fresh-water algæ reviewed by Messrs. W. West and G. S. West are mostly small Chlorophyceæ, and include five new species and a new genus, Polychætophora.—The notes on Myricaceæ contributed by Dr. Rendle were prompted by a rearrangement of the British Museum plants consequent upon Chevalier's recent revision of the group, whereby certain forms are separated from Myrica to form the new genera Gale and Comptonia.—The diagnoses presented by Mr. Spencer Moore refer to new sympetalous plants collected in the Coolgardie district of W. Australia.—The following short articles occur :—"Rubi of the Neighbourhood of London," by Rev. W. M. Rogers; "*Lepidium Smithii*," var., by Mr. F. Townsend; "Possible Use of Essential Oils in Plant Life," by Dr. G. Henderson.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 5.—"The Differential Invariants of a Surface, and their Geometric Significance." By Prof. **Forsyth**, F.R.S.

The present memoir is devoted to the consideration of the differential invariants of a surface; and these are defined as the functions of the fundamental magnitudes of the surface and of quantities connected with curves upon the surface which remain unchanged in value through all changes of the variables of position on it. They belong to the general class of Lie's differential invariants; and some sections of them were obtained about ten years ago by Prof. Zorawski, who, for this purpose, developed a method originally outlined by Lie. Earlier, they had formed the subject of investigations by a number of geometers, among whom Beltrami and Darboux should be mentioned.

Prof. Zorawski's method is used in this memoir. In applying it, a considerable simplification proves to be possible; for it appears that at a certain stage in the solution of the partial differential equations characteristic of the invariance, the equations which then remain unsolved can be transformed so that they become the partial differential equations of the system of concomitants of a set of simultaneous binary forms. The known results of the latter theory can then be used to complete the solution.

The memoir consists of two parts. In the first part, the algebraic expressions of the invariants up to a certain order are explicitly obtained; in the second, their geometric significance is investigated.

An invariant, which involves the fundamental quantities of a surface E, F, G, L, M, N (these determine the surface save as to position and orientation in space) and their derivatives up to order n, as well as the derivatives of functions ϕ, ψ, of position on the surface up to order $n+1$, may itself be said to be of order n. The invariants up to the second order inclusive are obtained. It appears that, if two functions ϕ and ψ occur, all the invariants that occur up to the second order can be expressed algebraically in terms of 29 algebraically independent invariants; while, if only a single function ϕ occurs, all the invariants that occur up to the second order can be expressed in terms of 20 algebraically independent invariants.

The significance of these respective aggregates of 29 and of 20 invariants is obtained in connection with curves

$$\phi = 0, \ \psi = 0,$$

drawn upon the surface. The investigation reveals new relations among the intrinsic geometric properties of a curve upon a surface. In particular, up to the second order, four such relations exist for a single curve, and their explicit expressions have been constructed.

March 12.—"On the Histology of *Uredo dispersa*, Erikss., and the 'Mycoplasm' Hypothesis." By Prof. H. Marshall **Ward**, F.R.S.

The paper deals with a detailed study of the histological

features of the germination, infection and growth of the mycelium of the Uredo in the tissue of grasses. Primarily, the figures refer especially to the Uredo of *Puccinia dispersa* in the tissues of *Bromus secalinus*, but comparisons are made with the behaviour of this and other Uredineæ—*e.g. Puccinia glumarum* and *P. graminis*—in the tissues of other grasses and cereals.

The research, which has been carried on for more than a year and a half, and has involved the preparation and microscopic examination of thousands of sections, is principally based on the application of improved hardening and staining methods to preparations from tube cultures of the grasses concerned, the leaves of which were infected at definite spots. These tube cultures were prepared according to the method previously described.[1] At definite intervals after sowing the spores—*e.g.* after one, two, to six and eight days—the infected areas were removed and placed in fixing solutions, and the life-history of the fungus traced step by step, and controlled by reference to uninfected areas.

The full paper is illustrated by numerous figures, and deals with the behaviour of the nuclei, vacuoles, septa, branches, haustoria, and other details of the hyphæ up to the commencement of spore-formation.

The relations of the hyphæ and haustoria to the cell-contents of the host are critically examined, and the cumulative evidence not only fails to support Eriksson's "Mycoplasm" hypothesis, but is completely subversive of it, so far as histological facts are concerned.

Eriksson's hypothesis, which refers the epidemic outbreaks of rust to the sudden transformation into the mycelial form of a supposed infective substance, previously latent and invisible in the cytoplasm of the host, is shown to be untenable because the *corpuscules spéciaux* of this author are proved to be the cut-off haustoria of the fungus.

Eriksson supposes that these *corpuscules* (haustoria) are formed by the hitherto latent germs in the host-cells, growing up in the cells into vesicles, which then pierce the cell walls and give rise to hyphæ in the intercellular spaces.

The present paper shows that Eriksson has entirely reversed the true order of events. The haustoria have been formed by the hyphæ, and figures are given showing every stage in their development. The first haustorium may be formed by the infecting tube immediately after its penetration through the stoma, and figures are given showing the remains of the germ-tube outside a stoma, the swelling of its tip over the stoma into an appressorium, the passage through the stomatal cavity, and its development into a vesicular swelling whence the true infection tube arises, which latter may at once put forth a haustorium. In some cases all these latter phenomena are visible in one and the same preparation.

The author expresses his thanks to Miss E. Dale, of Girton College, for valuable aid during the later stages of the work, in the embedding and cutting of numerous sections.

"The Œstrous Cycle and the Formation of the Corpus Luteum in the Sheep." By Francis H. A. **Marshall.** Communicated by Prof. J. C. Ewart, F.R.S.

Physical Society, March 13.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—A paper by Dr. **Farr,** on the interpretation of Milne seismograms, was read by Dr. Chree. Prof. Milne and Dr. Omori have come to the conclusion that the tilts represented by the maximum displacement of the boom of a horizontal pendulum seismograph are too large to be admissible as true tilts. The author has investigated the motion of the boom analytically, and his results show: (1) that the boom does not vibrate with its own natural period, but takes the frequency of the disturbing force; (2) that the friction should be small compared with the difference of the squares of the frequencies; and (3) that the phenomenon of beats may occur between the forced vibration and the free period of the boom. The maximum amplitude of swing of the boom gives no information whatever of the amplitude of the disturbing cause without also a knowledge of the periods of the forced and free vibrations. The author shows how to determine the amplitude of the wave by observations on these quantities. The author has verified the results of his analysis by experiments with artificial waves of known periods produced by an apparatus described in the paper. In conclusion, it appears (1) that strict attention should be paid to recording accurately the period of free vibration of the boom; (2) that the tape should be driven at such a speed as to enable the period of forced vibration to be determined; (3) that the effect of friction should be recorded.—A potentiometer for thermocouple measurements was exhibited and described by Dr. **Lehfeldt.** To make a satisfactory potentiometer for thermoelectric work, it is essential that it shall not introduce a high resistance in the circuit of the couple and galvanometer. Most of the potentiometers on the market, well enough for comparing voltaic cells, fail in this respect. Dr. Lehfeldt has therefore designed an instrument specially suited for thermocouple work.—Dr. J. A. **Harker** exhibited and described a direct-reading potentiometer for thermoelectric work. The instrument represents a form which has been designed and made in the National Physical Laboratory. Dr. Harker has experienced similar difficulties to Dr. Lehfeldt, and the instrument which he has designed is similar in many respects to the one exhibited by him.—A paper on the measurement of small resistances was read by Mr. A. **Campbell.** The object of this paper is to give a brief account of a number of measurements of a set of low resistance standards belonging to the National Physical Laboratory. The tests were made partly with a view to comparing various methods of measurement. The resistances were of manganin, and their nominal values were approximately 0·1, 0·01, 0·001 international ohms. The following methods were employed:—(1) Shunt potentiometer; (2) Kelvin bridge; (3) two-step bridge; (4) differential galvanometer; (5) Matthiessen's and Hockin's method. The last method was found to be much less accurate than the other four. The results obtained from the other methods are tabulated in the paper, and show very satisfactory agreement.—Dr. R. A. **Lehfeldt** read a paper on a resistance comparator. Objecting to sliding-contacts on account of the thermoelectric effects they tend to introduce, and irregularities slide-wires show when a good deal used, the author has substituted for the slide-wire two coils of 99 ohms each connected by twenty coils of 0·1 ohm each. The latter are arranged circularly, so that a switch connected to the galvanometer may be set on any one of the intervening studs. The galvanometer deflections are taken for the two positions nearest balance and interpolation to 1/100 calculated. In this way an accuracy of one part in 100,000 is attainable. The author thinks there is a gain of accuracy as well as of convenience in using the interpolation method.

Royal Astronomical Society, March 13.—Prof. H. H. Turner, president, in the chair.—The secretary read a letter from Mr. S. C. **Chandler** directing attention to a new term in the variation of latitude that had been discovered by Mr. Kimura, of the International Latitude Station in Japan. Mr. Chandler had been unable to find any probable explanation for the term, and proposed that, for its investigation, a southern belt of latitude stations should be established, suggesting stations at Sydney, the Cape of Good Hope and Santiago de Chile.—Mr. **Newall** read a paper on observations made at Cambridge of the velocity in the line of sight of certain selected stars, his communication being the first instalment of a work undertaken in accordance with a scheme of cooperation.—A paper by Dr. Max **Wolf** on three of Sir W. Herschel's observed nebulous regions in Orion was read, illustrated by a photograph, including three of the regions described by Sir W. Herschel as nebulous, but in which Dr. Isaac Roberts's photographs had shown no nebulosity. Dr. Wolf's photographs, on the contrary, showed considerable nebulosities. Dr. Roberts criticised Dr. Wolf's results, and read a communication of his own on photographs of various nebulæ, including ten which are new.—Mr. Whittaker gave an account of a communication from Prof. Simon **Newcomb** on the desirability of a reinvestigation of the problems arising from the mean motion of the moon. Prof. Newcomb called attention to the discrepancies between the predicted and observed places of the moon, and showed the comparative failure of attempts hitherto made to explain them. He considered it necessary to reinvestigate the whole question *ab initio*, and suggested a thorough comparison of the tabular and observed places

[1] "On Pure Cultures of a Uredine, *Puccinia dispersa* (Erikss.)" (*Roy. Soc. Proc.*, 1902, vol. lxix. p. 461).

of the moon, to be undertaken by a system of international cooperation. The Astronomer Royal and others took part in the discussion on Prof. Newcomb's paper.—A series of photographs presented by the Yerkes Observatory was shown on the screen. The photographs were taken by Mr. G. W. **Ritchey,** those of the moon with the 40-inch refractor and a colour screen, and those of nebulæ, &c., with the 24-inch reflector.—A paper by Mr. Stanley **Williams** was read on the short period variable star UY Cygni.—Other papers were taken as read.

Anthropological Institute, March 10.—Dr. J. G. Garson in the chair.—(1) Skulls from the Daurs' graves, Driffield, Yorkshire; (2) a method to facilitate the recognition of Sergi's skull types, by Dr. William **Wright.** Dr. Wright described twenty-two skulls, fifteen being those of males and seven of females. Nine of these he showed were dolichocephalic, five mesaticephalic, while he was in doubt as to the classification of the remaining eight, owing to their precarious state. The cephalic index ranged from sixty-eight to seventy-nine, and the skulls evidently were those of a mixed race which was on the whole dolichocephalic. According to Sergi's natural method ten of them belonged to the class *Ellipsoides isocampylos,* seven to *Isobathys Siculus,* whilst the remainder were of *Ellipsoides ametopus, Ellipsoides depressus,* and *Parallel-epipedoides* types. The graves were of the early Iron age, iron articles being found in them, and the burials being of the usual simple type. As to the origin of the people buried, Dr. Wright suggested two hypotheses: either they were the direct descendants of the dolichocephalic Neolithic British or they were settlers from the Continent. In support of the latter hypothesis, Dr. Wright pointed out that the settlement was very near the coast, and that there were two others close by, at Arras and Beverley. It was clear, from the absence of weapons and the presence of women and children in the interments, that the settlers were peaceful people. On the whole he was inclined to think that the people came from northern Europe and Scandinavia, which at that period were peopled by a comparatively pure dolichocephalic race. In his second paper Dr. Wright explained a method for facilitating the recognition of Sergi's skull types. He said that he felt the great difficulty in Sergi's system was the vague definition of the types. To facilitate the recognition, Dr. Wright draws, on a photograph of the skull, a circle the radius of which is half of the maximum diameter of the skull, when the different types are recognised through different parts of the skull falling either within or without the circle. This method further gives aid to the eye of the observer by providing a uniform curve with which to compare the anterior and posterior outlines of the cranium. Dr. Wright illustrated the system by lantern slides showing the method as applied to the different aspects of the skull.

Royal Meteorological Society, March 18.—Captain D Wilson-Barker, president, in the chair.—Mr. C. V. **Boys,** F.R.S., gave a lecture on the transmission of sound through the atmosphere. He began by contrasting the apparent behaviour of waves of water, sound waves and light waves with respect to physical law, and showed that these were merely an effect of the relative scale of the wave-length and the means of observation. He pointed out the perfection of the behaviour of ripples and very small water waves. There is a difficulty in making experiments with sound with apparatus smaller than houses or hills, unless sound waves so short as to be inaudible are employed. Mr. Boys showed the obedience of sound to the ordinary optical laws. Sound waves may, in special circumstances, become visible. By means of lantern slides the lecturer showed that the air waves in bullet photographs are visible, and animatograph representations were given of the shadow of the sound of a great explosion, and also of Prof. Wood's photographs of the reflection of sound waves. Reference was made to Dr. Rapp's interference observations of sound waves produced by instruments and by the voice. The lecturer explained that light has, in a minor degree, the same kind of imperfection so noticeable with sound. He concluded by referring to mirage and looming in optics, and stated that the corresponding phenomena in acoustics give rise to abnormal audibility of sound.

CAMBRIDGE.

Philosophical Society, February 16.—Mr. Seward, vice-president, in the chair.—On the dynamics of the electric field, by Prof. J. J. **Thomson,** F.R.S. It is shown that all the laws relating to the distribution of momentum in the field follow from the view that the lines of electric force carry along them a portion of the ether through which they pass, the mass of ether entangled with the tubes being per unit volume proportional to the electrostatic energy of the field in that unit volume; the ether thus entangled can slide along the line of electric force, but as far as motion at right angles to the line is concerned, the entangled ether moves with the line of force, the momentum in the electric field is the momentum of the ether gripped by the lines of force. It was suggested that all mechanical momentum and not merely electrical momentum was really momentum of the ether; the molecules of matter containing a number of electrified bodies ("corpuscles"), the lines of force starting from these corpuscles grip a certain amount of the ether and that the mass of the body is really the mass of the ether gripped by the lines of electric force starting from its corpuscles. The potential energy of the field is on this view the kinetic energy of the turbulently moving ether imprisoned by the lines of force.—Rust-fungi and the "mycoplasm" hypothesis, by Prof. H. Marshall **Ward,** F.R.S. The author gave a brief account, illustrated with lantern slides and microscopic preparations, of that part of his researches into the histology of rust-fungi which bears upon the recent pronouncement of Eriksson, that certain *corpuscules spéciaux* observable in the cells of the host-plant are the assumed "mycoplasm" in the act of growing out to form the hyphæ of the fungus. The author's preparations show clearly that Eriksson's *corpuscules* are true haustoria, put forth by the hyphæ of the fungus into the cells of the host. Every stage in their development is traced, and since the entering germ-tube, after swelling up as an infecting vesicle and tube in the stomatal cavity, is found to put forth one of these haustoria at a very early date, the reversed order of the phenomena assumed by Eriksson cannot be accepted.—On radio-activity from snow, by Mr. C. T. R. **Wilson,** F.R.S. An experiment of the same nature as those already made with freshly fallen rain and described before this Society (*Proceedings,* vols. xi., p. 428, and xii., p. 17, 1902) was made with freshly fallen snow at Peebles on January 10. The snow was melted and 50 c.c. of the water were evaporated to dryness in a porcelain basin. This was then inverted over the thin aluminium roof of the ionisation apparatus used as a detector of radio-activity (described in the first of the above-mentioned papers). The results give no indication of any difference in the intensity of the radio-activity obtained from equal weights of snow and rain.—Note on the slipperiness of ice, by Mr. S. **Skinner.** The slipperiness of ice has been attributed to the presence of a layer of lubricating water under the body pressing on the ice. The water is produced by the lowering of the freezing point where the pressure is experienced. On this view the object glides on a liquid layer, and consequently viscous friction in water takes the place of the rubbing friction between the solids. Joly has shown by calculation that the weight of a man concentrated on the blade of a skate is sufficient to lower the freezing point very considerably, and Reynolds, arguing from the difficulty of slipping on very cold ice, comes to the same conclusion. In the present paper it is pointed out that sliding on a liquid layer is a condition under which cavitation will occur in the liquid, and that this will aid the slipping.—On the rise of a spinning top, by Mr. E. G. **Gallop.**—On automorphic functions and the general theory of algebraic curves, by Mr. H. W. **Richmond.**

March 2.—Dr. Baker, president, in the chair.—On the probable presence in the sun of the newly discovered gases of the earth's atmosphere, by Prof. **Liveing,** F.R.S. Stassano recently pointed out that the chromospheric rays measured by Deslandres and Hale correspond closely with rays found to be emitted by the most volatile gases of our atmosphere, and of the 339 chromospheric and coronal rays photographed by Humphreys during the total eclipse of May, 1901, 200 agree within one unit of wave-length with rays either of the more

volatile gases or with rays of krypton, xenon, or argon. Until more exact measures of the wave-lengths are to hand it is not possible to prove coincidence. The author shows that theoretically there must be an interchange of atmospheric gases between sun and planets, that the interplanetary space could not be a vacuum but must contain many millions of molecules per cubic centimetre, and that the interchange would not depend on the number of molecules which would chance to acquire velocity enough to carry them beyond the earth's attraction, but upon diffusion with only the average kinetic energy of the molecules, which takes place with extreme rapidity when the free path is long.—On a synthesis of carboxy-derivatives of pyridine, by Mr. W. J. **Sell,** F.R.S., and Mr. F. W. **Dootson.**—Experiments illustrating new reactions for the identification of urea and of primary amines, by Mr. H. J. H. **Fenton,** F.R.S. These experiments illustrated the application of a certain new derivative of methyl-furfural as a reagent for the identification of certain organic nitrogen compounds.—(1) A rapid method of estimating sugars; (2) selection of seeds by chemical methods, by Mr. T. B. **Wood** and Mr. R. A. **Berry.** Attention was directed to the importance of selecting for seed production, mother plants of superior chemical composition, and to the great improvement brought about in sugar beet, and in certain American wheats, by the systematic application of such methods. A description was given of the first year's work in attempting to apply chemical methods to the selection of mother plants of the mangel, swede and kohl rabi for growing seed.—Methods of preparation of osones, by Mr. R. S. **Morrell.**—Note on the stereochemistry of benzene, by Mr. H. O. **Jones** and Mr. J. **Kewley.** The authors prepared the dextro-camphor-sulphonate (Reychler) and the dextro-bromo-camphor-sulphonate of 1 : 3 : 4-methyl-chloro-amino-benzene and examined their rotatory powers after repeated recrystallisation from non-hydroxylic solvents. Both salts were found to have values for their molecular rotatory power practically identical with those of salts of the respective acids with inactive bases, and the base recovered from the salts was quite inactive. Hence, unless both salts are partially racemic, the benzene compound is incapable of showing optical activity.—A method of detecting nickel and cobalt in presence of each other, by Mr. F. W. **Dootson.** The method depends upon the difference in colour of ethereal solutions of the double thiocyanates of nickel or cobalt and potassium.—On the Joule-Thomson effect, by Mr. P. V. **Bevan.**—On a sensitive gold-leaf electrometer, by Mr. C. T. R. **Wilson,** F.R.S. The electrometer is sufficiently sensitive to give a deflection per volt of 180 scale divisions of the eye-piece micrometer of the reading microscope. The increased sensitiveness has been secured without increasing the capacity of the instrument. It is therefore specially suitable for the measurement of very small quantities of electricity.—A new mineral from the Binnenthal, by Mr. R. H. **Solly.** This mineral belongs to the group of sulph-arsenites of lead, and is closely allied to rathite and baumhauerite.

MANCHESTER.

Literary and Philosophical Society, March 3.—Mr. Charles Bailey, president, in the chair.—A paper entitled "Further Investigation of the Detection and Approximate Estimation of Minute Quantities of Arsenic in Malt, Beer and Foodstuffs" was read by Mr. W. **Thomson,** who pointed out that he had greatly improved the process which he had already published, and that by this improved method he had been able to obtain a very distinct mirror of arsenic in beer, for instance, when it existed to the extent of 1/3000 part of a grain per gallon, when working on 50 c.c., which is equivalent to less than a sherry glassful of the beer. This is equivalent to the detection of about one part in two hundred and eighty millions of beer.—Prof. H. B. **Dixon,** F.R.S., exhibited an electrolytic Marsh apparatus for the detection of arsenic, which had been approved by the Government authorities, and he claimed that it was sufficiently delicate for the purpose in view.—Mr. Francis **Jones** referred to the recent observations on the bending of marble made by Prof. See, of Washington, and pointed out that similar phenomena have long been known. Lantern slides were shown of marble tombstones (particularly that of Prof. Black) in Edinburgh churchyards, which have fallen to pieces in the course of sixty or seventy years, the marble in each case having bent outwards.

PARIS.

Academy of Sciences, March 16.—M. Albert Gaudry in the chair.—On the solidification of fluorine and on the combination at −252°·5 of solid fluorine and liquid hydrogen, by MM. H. **Moissan** and J. **Dewar** (see p. 497).—The heart in a pathological state, by MM. Ch. **Bouchard** and **Balthazard.** It has been shown that the cardiac area, A, is not sufficient to characterise the dimensions of the organ. It is necessary to determine the ratio of this area to a quantity which characterises the individual examined; the magnitude of the ratio S/A, where S is the albumin normally fixed in the tissue, gives figures which are comparable between themselves. This ratio has been determined in seventy-four cases, and the results obtained are tabulated. It was found that in certain pathological states the heart may have its normal dimensions, in others, tuberculous cases being left out of consideration, the ratio may be above the normal, but never below it.—On bacilliform bovine piroplasmosis, by M. A. **Laveran.**—On the effect of temperature on electrocapillary phenomena, by M. **Gouy.** In general, the maximum height observed decreases with a rise of temperature, and for water and certain inorganic salts the temperature coefficient is practically the same. The coefficient is smaller for the organic substances examined.—On the present state of the Soufrière de Guadeloupe, by M. A. **Lacroix.** The volcanic manifestations of Guadeloupe have not changed their nature; the present observations, like all those which have been made since the last eruption in 1837, shows that the activity of the fumerolles undergoes variations in intensity, and also that they are not fixed in position.—On the existence of derived functions, by M. H. **Lebesgue.**—On geodesics of three dimensions, by M. A. **Boulanger.**—On the theory of the tempering of steel, by M. André **Le Chatelier.**—Propagation in conducting media, by M. Marcel **Brillouin.**—On the dielectric cohesion of mixture of gases, by M. **Bouty.** The critical field for a gaseous mixture is intermediate between that of either of the constituent gases, and for gases which do not act chemically on each other the critical field is exactly the mean of the critical fields of the two gases considered separately at the pressure of the mixture.—On the production of induced radio-activity by actinium, by M. A. **Debierne.** The experiments with actinium described show that there exists a new radiation characterised essentially by the property of rendering radio-active, in a temporary manner, the bodies which it strikes.—On the heat given off spontaneously by radium salts, by MM. P. **Curie** and A. **Laborde** (see p. 491).—On the combination of plumbic acid with organic acids, by M. Albert **Colson.** The author has prepared lead tetra-acetate, tetrapropionate and tetrabutyrate by the action of red lead on the corresponding acids.—On the heat of transformation of yellow into red phosphorus, by M. H. **Giran.** The value currently held for this transformation, 19.2 calories, is too great. The application of the Clapyron formula gives a much lower result, about 4 calories, and this has been confirmed experimentally in two ways, by the combustion of the two varieties of phosphorus in the Berthelot bomb, and by the action of bromine.—On collargol, by M. H. **Hanriot.** An examination of the substance sold commercially as collargol showed that it contained 87 per cent. of metallic silver, traces of ammonia and nitric acid, together with an albuminoid material. From the reactions of this substance, the conclusion is drawn that collargol is the soluble salt of an acid, collargolic acid, which is sufficiently strong to displace carbonic acid from carbonates. The fact that silver, or rather a deposit containing silver, is deposited during electrolysis at the positive pole is in accordance with this view.—The action of hot metals on the fatty acids, by M. Al. **Hébert.** The fatty acids, by the action of the more oxidisable metals at a high temperature, are first transformed into ketones, which are then decomposed, giving rise chiefly to carbonic acid, hydrogen and ethylenic hydrocarbons.—The properties of a solution of sodium sulphate, by MM. C. **Marie** and R. **Marquis.** In order to determine whether hydrated sodium sulphate undergoes dehydration in solution on warming, measurements were made of the

solubility of sodium chloride in the solution at varying temperatures. The solubility curve was continuous, hence the authors conclude that there is no reason to suppose that the hydrated salt exists as such in solution.—On a new method of preparation of ammonium chloroplumbate, by MM. A. **Seyewetz** and P. **Trawitz.** Lead chloride is treated with hydrochloric acid and the calculated quantity of ammonium persulphate. The transformation is very rapid, 125 grams of lead chloride being converted into the chloroplumbate in two hours.—Diaminoethylenic compounds of cadmium, by M. Ph. **Barbier.**—On some new derivatives of acylcyanacetic esters, by M. Ch. **Schmitt.**—The methylation and condensation of ethyl glutaconate, by M. E. E. **Blaise.**—On tetraphenylbutanediol and its products of dehydration, by M. Amand **Valeur.** This substance is obtained by the action of phenyl-magnesium bromide upon ethyl succinate.—On the distribution in the organism and the elimination of arsenic given medicinally in the form of sodium methylarsenate, by M. A. **Mounyrat.** The arsenic given as sodium methylarsenate has no tendency to accumulate in the organs, and whatever may be the dose absorbed, only a very minute quantity is retained, this being completely eliminated about the thirtieth day after the ingestion.—On the transformations and the epithelial growths which provoke mechanical lesions of the subcutaneous tissues, by M. Ed. **Retterer.**—The Pteraspis in the Ardennes, by M. Louis **Dollo.**—The reflex augmentation of the biliary secretion by the introduction of acid into the duodeno-jejunum, by M. C. **Fleig.**—On the signification of the Cenomanian layer and the fauna of the Maine du Saint-Laurent near Vaches (Basses-Alpes), by M. Charles **Jacob.**—On the anomalies of gravity in certain unstable regions, by M. F. de Montessus **de Ballore.**—The action of zinc on the microbes of water, by M. F. **Dienert.**—Lesions of the nervous system of the newly-born whose mothers are diseased: the mechanism and its consequences, by MM. A. **Charrin** and A. **Léri.**—Regulating apparatus for the circulation of the blood of the newly-born animal, by M. Edouard **Meyer.**—On the diminution of the intensity of the solar radiation, by M. Henri **Dufour.** A comparison of the solar observations made with the Crova actinometer during the first three months of the present year with the results of preceding years shows a distinct falling off in the radiation. Thus it would appear that there is present in the atmosphere a special absorbent for solar radiation which did not exist in the six preceding years, and it is suggested that this may be fine dust from the recent volcanic eruptions.

DIARY OF SOCIETIES.

THURSDAY, MARCH 26.

ROYAL SOCIETY, at 4.30.—Some Physical Properties of Nickel Carbonyl: Prof. J. Dewar, F.R.S., and H. O. Jones.—The Electrical Conductivity imparted to a Vacuum by Hot Conductors: O. W. Richardson.—An Attempt to Estimate the Relative Amounts of Krypton and of Xenon in Atmospheric Air: Sir William Ramsay, F.R.S.—On a New Series of Lines in the Spectrum of Magnesium: A. Fowler.—An Inquiry into the Variation of Angles Observed in Crystals, especially of Potassium-Alum and Ammonium-Alum: Prof. H. A. Miers, F.R.S.—On the Dependence of the Refractive Index of Gases on Temperature: G. W. Walker.—Solar Prominence and Spot Circulation, 1872–1901: Sir Norman Lockyer F.R.S., and Dr. W. J. S. Lockyer.—On the Evolution of the Proboscidea: Dr. C. W. Andrews.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Distribution Losses in Electric Supply Systems: A. D. Constable and E. Fawssett.—A Study of the Phenomenon of Resonance in Electric Circuits by the Aid of Oscillograms: M. B. Field.—*Time permitting*:—Divided Multiple Switchboards: an Efficient Telephone System for the World's Capitals: W. Aitken.

FRIDAY, MARCH 27.

ROYAL INSTITUTION, at 9.—The Pearl Fisheries of Ceylon: Prof. W. A. Herdman, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Advantages of Motor-Driven Printing Machines: J. G. Y. D. Morgan.

PHYSICAL SOCIETY, at 5.—Evaluation of the Absolute Zero: Dr. R. A. Lehfeldt.—On Refraction at a Cylindrical Surface: A. Whitwell.

SATURDAY, MARCH 28.

ROYAL INSTITUTION, at 3.—Light: Its Origin and Nature: Lord Rayleigh.

MONDAY, MARCH 30

INSTITUTE OF ACTUARIES, at 5.—The Mortality Experience of the Imperial Forces during the War in South Africa, October 11, 1899, to May 31, 1902: F. Schooling and E. A. Rusher.

TUESDAY, MARCH 31.

ROYAL INSTITUTION, at 5.—Great Problems in Astronomy: Sir Robert Ball, F.R.S.

SOCIETY OF ARTS, at 4.30.—British North Borneo: Henry Walker.

INSTITUTION OF CIVIL ENGINEERS, at 8.—American Locomotive Practice: P. J. Cowan.

WEDNESDAY, APRIL 1.

SOCIETY OF ARTS, at 8.—Application of Polyphase Motors to the Electrical Driving of Workshops and Factories: A. C. Eborall.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Recent Advances in the Bacteriological Examination of Water: W. H. Jollyman.—The Ash of British Pharmacopœia Drugs: W. Chattaway and C. G. Moor.

ENTOMOLOGICAL SOCIETY.—Contributions towards the Life History of *Orina* (*Chrysochloa*) *tristis* var. *Smaragdina*: Dr. T. A. Chapman.

THURSDAY, APRIL 2.

LINNEAN SOCIETY, at 8.—List of Marine Algæ collected at the Maldive and Laccadive Islands by J. Stanley Gardiner: Mrs. Gepp (Ethel S. Barton).—The Comparative Anatomy of Cyatheaceæ and other Ferns: D. T. Gwynne-Vaughan.

CHEMICAL SOCIETY, at 8.—On the Absorption Spectra of Nitric Acid in Various States of Concentration: W. N. Hartley.—The Dioximes of Camphorquinone and Other Derivatives of *Iso*nitrosocamphor: M. O. Forster. Salts of a Mercaptoid Isomeric Form of Thioallophanic Acid, and a New Synthesis of Iminocarbaminethioalkyls: A. E. Dixon.—Discoloured Rain: E. G. Clayton.—Derivatives of *o*-Aminobenzophenone and *p*-Aminobenzophenone: F. D. Chattaway.

ROYAL GEOGRAPHICAL SOCIETY, at 4.—Geographical Education; with Special Reference to Globular Contoured Maps, Globes and Reliefs: Prof. E. Reclus.

RÖNTGEN SOCIETY, at 8.30.—Some Effects produced by Radiations: J. H. Gardiner.

FRIDAY, APRIL 3

MALACOLOGICAL SOCIETY, at 8.—Additions to the genus Streptaxis: G. K. Gude.—On a New Species of the genus Xylophaga from the English Coast: E. A. Smith.—Notes on some New or Little Known Members of the Family Doridiidæ: Sir Charles Eliot.—On a New Species of Cerastus from near Aden, with a Note on *Otopoma clausum*, Sby.: E. R. Sykes.—Descriptions of Two Supposed New Species of Cyathopoma: H. B. Preston.—On Shells Floating on the Surface of the Sea: August Krogh.

ROYAL INSTITUTION, at 9.—Drops and Surface Tension: Lord Rayleigh.

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