THURSDAY, MARCH 8, 1906.

A REVISED DOCTRINE OF VALENCY.

Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. By Prof. A. Werner. Pp. xii + 189. (Brunswick: F. Vieweg and Sohn, 1905.) Price 5 marks.

IN 1893 Prof. Werner published his first important paper on the constitution of inorganic compounds, and expounded a new theory for the classification of the large and complex group of substances known as metal-ammonia compounds. Of these compounds a few are common enough, such as the deep blue substance formed by the addition of ammonia to solutions of copper salts, but the greater number do not come within the range of ordinary analytical chemistry; they are for the most part of no industrial importance, and consequently they are scarcely heeded except by a very limited number of chemical workers. The class of cobaltamines which has vexed many a generation of chemical students does not measure the limits of complexity to which these compounds extend, and certainly, without the guiding light of some good theory as to their structure, the metal-ammonia group constitutes one of the most bewildering tracts of inorganic chemistry.

It is therefore a real service that Prof. Werner renders in publishing in this volume (No. 8 of a series of monographs on natural and mathematical science, collectively called "Die Wissenschaft") a full exposition of his theory and an *aperçu* of the compounds to which it specially applies. We must not give the impression, however, that Werner's theory applies only to metal-ammonia compounds. It is a general theory ranging over chemistry as a whole, and is applied to so simple a substance as sulphuric acid. To describe it in a few words is almost impossible. Perhaps the most central thing is the substitution of the idea of association (Anlagerung) for the strict and definite linkage implied in the ordinary valency theory. This idea has, in a vague way, long prevailed in chemistry in the distinction drawn between atomic and molecular compounds. In $CuSO_4$ we are accustomed to represent definite atomic linkages according to the definite valencies of the component atoms. How are we to represent the attachment of $5H_2O$ to $CuSO_4$ in the hydrated salt? The idea that valency is not a sharply fixed quantity, and that it is not necessarily exhausted when a stable compound is formed, is familiar to us in the hypothesis of residual affinity.

Prof. Werner would have us revise our somewhat diagrammatic and artificial ideas of valency. We are to think of an atom as a small material sphere, from the centre of which the attractive force of affinity is exerted uniformly in every direction. Segregation of the affinity into units of valency is not to be supposed; valency is merely to mean the observed proportional numbers in which atoms associate with one another. It is not dependent on one atom alone, but on the nature of all the atoms that form the molecule. The proportion of the affinity which is spent between two atoms is confined to the restricted circular surface of contact [theoretically one would say a point], the *Bindefläche*, and depends in a high degree on the nature of the atoms. Thus, the author adds, we obtain a rational picture to represent the varying valency of an atom, whilst from the dependence of the distribution of the surfaces of contact on the relative magnitudes of the atoms we reach, without further hypothesis, a space configuration of the molecule.

As the simplest possible illustration of the advantage claimed for these views we may cite the formation of sulphuric acid by the union of SO_3 and H_2O. In each of these molecules it is usually considered that the valencies of the atoms are satisfied. That being so, the readiness of the two molecules to unite must be attributed to some selective action. This is found in the tendency for the group (OH) to be formed, and hence we write $SO_3+H_2O=O_2S(OH)_2$. According to Prof. Werner, on the other hand, we must suppose that neither the sulphur in SO_3 nor the oxygen in H_2O has spent its affinity, and that accordingly the combination of the two molecules is to be represented as follows: $O_3S+OH_2=O_3S.OH_2$. At the same time he admits that the compound may pass into the configuration $O_2S(OH)_2$. It might seem, then, that there is not much gained. But he claims that the great merit of this view lies in its conformity with that which must be taken of analogous combinations where a secondary arrangement does not take place. Such a case is to be found in the union of halides to form what are, though commonly called double salts, compounds strictly of the same order as oxysalts. Thus we have $KCl+AuCl_3=KAuCl_4$ analogous to $K_2O+SO_3=K_2SO_4$. $KAuCl_4$ is as much a potassium salt as K_2SO_4, and, though it may not be impossible to give an ordinary valency formula to some of these compounds, their formation cannot be explained by anything corresponding to the supposed primary cause (the formation of KO groups) in the union of K_2O and SO_3. The attempt to bring double halides as a whole within the ordinary valency doctrine has not been successful.

But, as stated above, Prof. Werner's theory has arisen in connection with the metal-ammonia compounds, and we will conclude this notice with a slight indication of its application there. In the metal-ammonia compounds we have an electropositive atom, a number of (NH_3) groups, and electronegative atoms or groups. It is supposed that the positive atom has the power of associating itself with or *coordinating* a certain number of atoms or groups which must be supposed to be in contact with this central atom and to constitute a sort of first layer. The whole group also forms the positive ion. Beyond and outside this we have negative atoms or groups which give the negative ions.

Luteo-cobalt chloride has the composition

$$CoCl_3 6NH_3.$$

Cobalt is here shown with the valency of a triad, and as a matter of fact the whole of the halogen may be precipitated by silver nitrate. Purpureo-cobalt chloride

is $CoCl_3.5NH_3$, but only two-thirds of its chlorine can be precipitated. In praseo-cobalt chloride, $CoCl_3.4NH_3$, only one-third of the chlorine reacts as an ion, whilst the compound $CoCl_3.3NH_3$ is not ionised at all.

Now, according to Prof. Werner, the coordination number of cobalt in all these compounds is six, that is to say, the cobalt atom is in all cases associated with six groups or atoms. Outside this are the negative ions. The valency of the positive ion diminishes as the electronegative element in it is increased. Thus we have the following series of compounds:—

$[Co(NH_3)_6]'''Cl_3$; $[Co(NH_3)_5Cl]''Cl_2$; $[Co(NH_3)_4Cl_2]'Cl$; and $[Co(NH_3)_3Cl_3]^\circ$.

It will be seen that here again the essence of the theory lies in the idea of coordination or association as distinct from ordinary valency with its separate linkages. The same ideas may be extended to water of crystallisation in hydrated salts.

This slight sketch will, it is feared, give but a poor idea of the ingenuity and comprehensiveness of Prof. Werner's theory, but it is all that the limits of space allow. The book before us may be strongly commended to all who are interested in the development of chemical theory, and though, no doubt, the new doctrine cannot by any means be called unexceptionable, there is much in Prof. Werner's book that is interesting and stimulating quite apart from the clear exposition of the particular views it is intended to disseminate. A. SMITHELLS.

THE DANISH FISHERY INVESTIGATIONS.

Meddelelser fra Kommissionen fra Havundersøgelsen. Serie Hydrografi, Bd. i., Nos. 7–8; *Serie Fiskeri,* Bd. i., Nos. 4–8; *Serie Plankton,* Bd. i., No. 3. (København, I Kommission Hos C. A. Reitzel, 1905.)

THE reports issued by the Danish section of the International Fisheries Investigation Organisation deal to a greater extent with purely biological matters than do the publications of the corresponding British committee. Thus of the present instalment of reports two relate to hydrographical researches, one to plankton studies, while five deal with the life-histories of species of fishes of economic importance.

The hydrographic reports consist of an investigation by Mr. J. P. Jacobsen on the solubility of oxygen in sea-water, with a description of the methods and apparatus employed. Mr. J. N. Nielsen also contributes an account of several hydrographic cruises made by the *Thor* in the summer of 1904 on the north coast of Iceland, and a discussion of the results obtained. The sea-water on the north coast of Iceland is derived from warm Atlantic water in the Denmark Strait—the Irminger current—and from much colder, but lighter, water of Arctic origin, which comes from the East Greenlandic polar current. The climate of the North Icelandic coast is dependent to some extent on the relative distribution of these two contributing currents. The Irminger current flows north along the west coast of Iceland, and then, as a result of the earth's rotation, along the north coast. This latter cause, and also the interference of the East Greenlandic polar stream, produce a further rotation of the current, so that it may even round the north-east coast of Iceland and flow south. Along its whole course the Irminger current yields up heat to the atmosphere, cooling by convection as it does so, so that even the lower layers give up their heat. Land-water, produced by the melting of ice and snow masses, cools down the coastal waters, and, being of lower salinity, causes a surface current seawards during the summer and an undercurrent landwards. In winter the lower temperature of the land cools the sea-water, which then sinking in consequence of its greater density, flows seawards as an undercurrent, while it is replaced by a surface current moving towards the land.

The distribution of the comparatively warm Irminger current is affected by the presence of drift ice; in those years when drift ice is abundant on the Icelandic coasts, the cold (though less dense) Arctic water spreads over the surface, and blocks to a variable extent the eastward passage of the Atlantic water. But it also prevents the conduction of heat from the latter to the atmosphere, and as a result, during these hard ice years, the mean temperature of the air of the first six months of the year is much lower than in those years when drift ice is absent or less abundant during the months in question. In this connection the suggestion that telegraphic cable communication with Iceland, and a coast telegraph line, should be established is of considerable interest, for the advent of the ice can usually be foretold by observations of the temperature of the sea.

Not only does the temperature of North Iceland during the winter depend on the distribution of the eastern branch of the Irminger current, but the fisheries vary in an analogous manner. This appears to be the case with the great herring fishery, and cod appear also to travel to the west, north, and east of Iceland with the current, not appearing in abundance until the temperature of the water reaches a certain value. The pelagic larvæ of the latter fish are also distributed by the current, as well as by the offshore and inshore movements of the water due to the cause mentioned.

A short note by Mr. C. G. J. Petersen on the occurrence of Leptocephali is of exceptional interest. It is well known that finds of this stage of the common eel have been very rare in northern waters. Dr. Petersen tells us that it occurred to him to look for these larvæ in warm and deep Atlantic water, using special fishing apparatus. Accordingly in May, 1904, Dr. J. Schmidt found a typical Leptocephalus at a station south-west of the Færöe Isles, in water more than 1000 metres in depth, and in a postscript it is also added that great quantities of *Leptocephalus brevirostris* have been found by Schmidt "in the depths of the Atlantic," presumably near the same place. Dr. Petersen concludes that it is here, not in the Baltic or North Seas, that the eels of Northern Europe breed, passing in their migrations either the North Sea or

the English Channel; and he discusses the value of this discovery from the point of view of the Swedish, Danish, and German eel-fisheries. We await with considerable interest the further account of these remarkable investigations.

The other reports are also of considerable interest. Mr. A. C. Johansen writes on the life-history of the young post-larval eel. Mr. A. S. Jensen contributes a paper on the occurrence of the otoliths of Gadoid fishes in the bottom deposits of the polar seas between the Færöes, Jan Mayen, and Scotland. Samples of mud obtained from the sea-bottom in these regions frequently contained otoliths derived from various Gadus species. Nevertheless, the trawling operations of the *Michael Sars* showed that the cod does not live at the bottom of these seas. The occurrence of Gadus otoliths is therefore to be explained by the horizontal migration of these fishes from the shore grounds near the surface of the sea. Some observations made by Mr. T. Scott on the occurrence of whiting otoliths in the stomach of the porpoise show also that these structures may be distributed over wide areas of sea-bottom, since whiting are eaten in large numbers by the porpoise and the otoliths may be evacuated in an undecomposed condition. This is presumably the case also with other of the smaller gadoid fishes.

The remaining papers include a study of the post-larval stages of Gadus, spp., and of *Brosmius brosme* by Mr. J. Schmidt, both notable additions to the literature of the subject, and a description of several new Peridinians by Mr. O. Paulsen.

JAS. JOHNSTONE.

THE EVOLUTION OF BIOLOGY.

Geschichte der biologischen Theorien, seit dem Ende des siebzehnten Jahrhunderts. Teil i. By Dr. Em. Radl. Pp. vii+320. (Leipzig: W. Engelmann, 1905.) Price 7*s.* net.

ALTHOUGH biology is now permeated by the evolution idea, and has continually before it the ideal of giving a genetic description of the present phase of the animate world, there is some reason to fear, as Dr. Radl indicates, a growing apathy towards the study of the evolution of the science itself. Whether it be that many workers share Nietzshe's view that the study of history paralyses the intelligence, or that they feel it their primary business to make history, not to read it, or that they regard historical inquiries as the philosopher's task, not theirs, it seems certain that too little attention—in our investigations, theories, and teaching alike—is paid to the historical evolution of the science. A notorious example may be found in the biological work of Herbert Spencer, who, though he had almost accidentally found inspiration from a slight acquaintance with the work of von Baer, deliberately set his face against looking for more. He preferred to think for himself. But all cannot be excused as we excuse Spencer, and even his work suffered from his peculiarly detached independence of outlook. Whether we will or no, the past lives in the present, and he who thinks himself most emancipated from all scientific tradition may be a signal instance of the rehabilitation or recrudescence of doctrines which characterised his unknown intellectual ancestors. It is not as if scientific discoveries were successive special creations which had their day and ceased to be, giving place to others unaffiliated to them. On the contrary, as Dr. Radl's book, and any other piece of careful historical work, shows, biology is an evolution. Generalisations grow and vary, there is an amphimixis of ideas, there is an adaptation to the social environment, there is a struggle for existence and a survival of the fittest.

Without much discussion of the factors which brought about the scientific renaissance, Dr. Radl begins by showing how the influence of Aristotle persisted in men like Cæsalpinus, Harvey, Glisson, and Redi. The second chapter shows how the mechanical modes of interpretation, vindicated by the physicists, began to insinuate themselves into biology, through Descartes, Borelli, Fr. Hoffmann, and Dr. Willis. The advent of the microscope is then discussed, and an interesting account is given of the work and influence of Malpighi and Swammerdam. A reaction from Cartesian mechanism found expression through the genius of Leibnitz, and vitalism its first thoroughgoing exponent in Stahl.

The fifth chapter deals with the first half of the eighteenth century, with the successors of Malpighi and Swammerdam, and with the early preformationists, such as Bonnet, Haller and Buffon. Then follows an account of Linné's systematic work. Wolff is the central figure of the next chapter, which deals with the foundation of the epigenetic theory. Gradually the conception of individual development expanded into that of racial evolution, but even more in the minds of philosophic thinkers than of naturalists. The ninth chapter gives us the history of the rise and progress of morphology, illustrated especially with reference to Cuvier and Étienne Geoffroy St. Hilaire, Jussieu and P. De Candolle. After a brief chapter on Bichat as representative of vitalism at the end of the eighteenth century, the author passes to a more detailed study of the German "Naturphilosophie," as illustrated by Herder, Kant, Fichte, and Schelling among philosophers, by Kielmeyer, Goethe, Oken, Blumenbach, and Treviranus among biologists. The present volume merely begins the story of the evolution of evolution theory, the two last chapters being devoted to Erasmus Darwin and Lamarck.

Having indicated the scope of this valuable historical treatise, we must now express our high appreciation of the author's workmanship. He shows a first-hand acquaintance with the works with which he deals, and yet he has not allowed himself to be overwhelmed by his scholarship. He has a keen selective instinct and a rare terseness, and although he has written in what was to him a foreign language, his style is lucid and often vivid. One cannot but be impressed in reading the interesting history with Dr. Radl's calmness and independence of judgment; he is neither depreciative of men like Oken nor eulogistic of men like Lamarck; he states their case with justice, and gives chapter and verse for his judgments. In some cases,

e.g. that of Lamarck, his estimate is by no means that which many authoritative writers have expressed.

As we lay aside the volume some general reflections remain convincingly with us—that the history of biology is a rational evolution, and at the same time inextricably intertwined with social evolution; that the same general ideas are re-incarnated century after century in more evolved forms; that each generation meets the same old difficulties on a higher turn of the spiral; that clearly thought-out conceptions which seem for a time to be vanquished re-assert themselves with renewed vigour, and find their position in a more complete synthesis. The modern biologist, intent on new discoveries, has no use for Aristotle, Descartes, and Leibnitz, but their influence may be upon him none the less. In speaking of the aqueduct of Sylvius, the Malpighian tubules, the Graafian follicle, or the Cuvierian organs, we quaintly acknowledge our debt to the past, but perhaps we betray our indebtedness more when we are least conscious of it, for even the most modern system of biology is, like our own body, a veritable museum of relics. J. A. T.

STOMATA AND PHYLOGENY.

Der Spaltöffnungsapparat im Lichte der Phylogenie. Ein Beitrag zur "phylogenetischen Pflanzenhistologie." By Dr. Otto Porsch. Pp. xiv+196. (Jena: Gustav Fischer, 1905.) Price 8 marks.

THIS work, as its title announces, is an attempt to use the stoma as a mark of relationship, and thus to make it serve as a guide to the phylogeny of plants. The author is filled with a pleasant enthusiasm for his subject, and this he contrives to convey to his readers, who, whether or no they are in complete agreement with his views, will not deny that he has produced an interesting and suggestive book. Personally, we think he has done more, and that his work has decided value. He begins by showing (what has to some extent been shown before) that definite types of stoma run through certain classes or natural orders. He makes it clear that these types remain recognisable even in plants exposed to various environments. The gymnospermous type, for instance, occurs in plants of such diverse habit as Bowenia, Gingko, Dioon, and Gnetum.

The author allows that the gymnosperm type is essentially a stoma adapted to xerophytic conditions. This brings us face to face with what is a difficulty in inquiries of this sort—namely, how far persistence of type is due to adaptation. This is especially difficult in regard to the xerophytic habit, because our knowledge of the conditions which make this habit of value is recent, and probably incomplete. It is only comparatively lately that conditions of life in a salt-marsh, an English heath, and in the alpine regions of the tropics have been recognised as equivalent environments in regard to transpiration. The author is, however, fully aware of the difficulty in question.

It is interesting to find the gymnospermous stoma occurring in Casuarina, a genus known to possess morphological characters which have suggested that it may be an offshoot from an ancestor common to gymnosperms and angiosperms. In concluding this section the author has some remarks on the minuter taxonomic value of the stoma, *e.g.* in Dasylirion, where the stomatal characteristics may be used to distinguish the species. He also directs attention to the Commelinaceæ and Eriocaulaceæ, and to the genus Eucalyptus, in all of which the stoma is characteristic. As showing the possible value of the stoma to the palæobotanist he quotes the case of a fossil Potamogeton recently shown by its stomatal type to belong to the Loranthaceæ. Porsch gives an interesting account of reduced and rudimentary stomata in the true leaves of Ruscus, in parasites, and in submerged plants. The latter case is especially interesting because here the stomata can hardly be of use for gaseous exchange. But in the petals of flowers or the bulky stems of holoparasites it is clear that they may be of importance for respiration. This is a function of the stoma which Porsch does not sufficiently discuss; thus in referring to the stomata of petals he considers transpiration alone. The fact that large petals occur devoid of stomata while others (Galtonia) have perfect ones shows that the question is in need of physiological inquiry.

In another interesting section the author describes the stomata of seedling leaves, which are generally of an undifferentiated type, even when the adult leaves have highly specialised stomata, *e.g.* in Hakea, *Spartium junceum*, &c. This seems at first sight a case of "recapitulation," but the author is careful to supply an alternative view, viz. that in the early stages of existence a plant is less subject to drought, so that the simple stomata of the seedling may be an adaptation to conditions less rigorous than those to which the adult is exposed. The author, however, accepts, with certain reservations, the recapitulation point of view.

The last section of the book deals with stomata in relation to alternate generation. Porsch holds (with Wettstein) the sporophyte to be an adaptation to life on dry land in contrast to the gametophyte, which retains aquatic characters. Taking the Bryophytes as the lowest class in which stomata occur, he again follows Wettstein in placing the mosses in the lower division, the liverworts being a more specialised form. It is in harmony with this view that in the mosses stomata should occur only in the sporophyte. Among the normal two-celled stomata are occasionally found others of the four-celled type. This he looks on as a "reminiscence" of an earlier form, in which the intercellular spaces open externally in the simplest manner between four epidermic cells.

In the liverworts, on the other hand, the gametophyte possesses openings which function as stomata. There is only one group in the liverworts which exhibits a highly organised sporophyte, and here in Anthoceros we find true stomata having a pair of guard cells, which are probably of a higher type than occurs elsewhere among the Bryophytes.

Among the Pteridophytes the most interesting fact is that the stomata are of a type that may be supposed to be the forerunner of the gymnospermous stoma. The characteristic lignification is not always present

but in some cases, *e.g.* in Todea, we find lignification almost identical with that of certain gymnosperms.

On the whole the author may be congratulated on having attained the end which he had in view, namely, by tracing the history of a definite organ through the vegetable kingdom, to demonstrate the fruitfulness of the phylogenic method. F. D.

OUR BOOK SHELF.

Economic Geology of the United States. By Heinrich Ries. Pp. xxi+435. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1905.) Price 2.60 dollars net.

THIS volume embodies the elementary course of economic geology at Cornell University, where the author is assistant professor. Some knowledge of geology and mineralogy on the part of the student is presupposed, and the work deals exclusively with North American mineral deposits. At the same time North America is so preeminently the continent of mineral deposits, nearly all types and forms being represented within its vast mineral areas, that a treatise on American economic geology is nearly the same thing as a study of mineral deposits in general.

The mode of arrangement differs from that of other books on the same subject in that predominance is given to the non-metallic minerals, the value of the production of which exceeded that of the metallic minerals in 1903 by thirty million pounds. The twenty chapters into which the book is divided deal respectively with (1) coal; (2) petroleum, natural gas, and other hydrocarbons; (3) building stones; (4) clay; (5) lime and calcareous cement; (6) salts; (7) gypsum; (8) fertilisers; (9) abrasives; (10) minor non-metallic minerals; (11) mineral waters; (12) soils and road materials; (13) ore deposits; (14) iron; (15) copper; (16) lead and zinc; (17) gold and silver; (18) silver lead; (19) aluminium, manganese, and mercury; and (20) minor metals.

In each chapter the treatment is the same. An account of the minerals is followed by particulars of their distribution in the United States, with sketch maps, details of their use, recent statistics of their production in the United States and in the world, and a carefully selected bibliography. The twenty-five plates reproducing photographic views of mines and the ninety-seven diagrams in the text are alike excellent. Altogether the work is an admirable one, and we strongly commend it to teachers in this country as a source of concise, accurate, and recent information regarding the mineral deposits of the United States.

Botanische Jahrbücher. Edited by Dr. A. Engler. Vols. xxxiii., xxxiv., and xxxv. Parts i.–iii., with index vols. i. to xxx. (Leipzig: W. Engelmann, 1902–5.)

THE series of papers produced under the direction of Dr. Engler, as the "Beiträge zur Flora von Afrika," continues to engage the attention of workers at the botanic museum in Berlin. The papers that give merely descriptions of new species are chiefly serviceable to monographers, but the results become more interesting when they are collated for a genus or an order, as in the revision of the Ochnaceæ by Dr. Gilg. In a short article that will be found in *Beiblatt*, No. 79, Dr. Engler summarises the general progress of the study of African botany in Berlin, and indicates where further collections and explorations are required. He refers to Dr. Fülleborn's collections of the lower algæ and Bacillariales taken from Lake Nyassa. They have been examined by Dr. Schmidle and Dr. Otto Müller, and their descriptions and deductions are published in these volumes. Other systematic compilations include a contribution to the flora of Madeira and the Canary Islands by Mr. J. Bornmüller, some notes by Drs. Gilg and Loesener on the flora of Kiao-chau, the Chinese territory that was occupied by Germany in 1898, and the "Fragmenta Phytographiæ Australis occidentalis," written by Drs. Diels and Pritzel. Among the cryptogamic contributions, Mr. G. Hieronymus publishes an account of the pteridophytes collected in Ecuador and Colombia by Mr. H. C. Lehmann, German Consul, and Mr. E. Lemmermann deals with the algal vegetation in the Sandwich Islands. Among the ecological papers, Mr. J. Holmboe sketches the botany of the Norwegian moors. Mention should also be made of the notices in the *Beiblätter* of addresses delivered before the Society of Systematic Botanists, of which not the least interesting is that by Prof. K. Fritsch discussing the systematic position of the monocotyledons.

The index to the first thirty volumes published in 1904 is an important reference book to systematic botany from 1881; the systematic index, and the catalogue under countries, will be found most useful.

The Practical Photographer. Edited by the Rev. F. Lambert. (Library Series.) No. 27, *Photographic Optics and Lenses*, pp. xxiv+64. No. 28, *The Optical Lantern for Projection and Enlarging*, pp. xxiv+64. (London: Hodder and Stoughton.) Price, each vol., 1s. net.

THESE two volumes form the December and January issues of this useful series of photographic handbooks. As usual, each is prefaced by a short essay on the pictorial work of some well known photographer written by the editor, and in these cases we are made acquainted with the photographic work of Mr. W. A. I. Hensler and Mr. Charles H. L. Emanuel. They are also accompanied by a series of reproductions from the best works of these photographers, which illustrate, more than words can describe, the particular styles of treatment.

In the volume on photographic optics we have a series of notes by numerous authors on various points relating to lenses. These are more or less miscellaneous in their nature, but the several items are generally clearly described, and may prove serviceable. Numerous diagrams and process reproductions are included in the text.

The volume on the optical lantern contains many useful wrinkles which will materially aid the beginner and prove useful to those who are already acquainted with the manipulation of a lantern. Forms of lanterns, illuminants, condensers, reflectors, are all fully treated, and in addition there is much miscellaneous information on lantern optics, and sundry items pertaining to lantern work. Included in these pages are process reproductions of several photographs, details about which are given under "Pictorial Notes."

The Sanitation of a Country House. By Dr. Harvey B. Bashore. Pp. vi+103. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1905.)

THIS little book would form a useful, popular, and non-technical guide on sanitary matters to anyone about to build a country house, but is necessarily one for America, and the practice recommended and details given would not always suit this country. The illustrations and diagrams, sixteen in number, are excellent.

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.*]

The Perkin Jubilee and Chemical Industries.

AT the meeting held at the Mansion House on February 26, with the Lord Mayor in the chair, many men of position and influence in the scientific world met to do honour to Dr. W. H. Perkin, and to agree to celebrate the jubilee of his discovery of the first coal-tar colour. Whilst all felt not only the importance, whether from a purely scientific or from an industrial point of view, of this discovery, and whilst they all applauded Perkin's researches in other branches of science and his modest and retiring bearing throughout, the fact could not be lost sight of that although England was the country in which the coal-tar industry was founded, it had practically, since those days, passed out of our hands into those of the Germans. The cause of this, I remarked, was not due to any want of knowledge or power on the part of Dr. Perkin himself, but rather to the absence of appreciation by capitalists and others engaged in industry of the importance of scientific method, or, in one word, to English Philistinism, the result being that the successful prosecution of a new industry the very existence of which depends on high scientific attainment was impossible. In corroboration of this opinion, which was also expressed in an excellent article in the *Times* a few days before the meeting, I ventured to direct attention to the fact that, being at that time (fifty years ago) engaged in building up a chemical school at Owens College, I knew three talented young German chemists whose names have since become watchwords in Germany (Caro, Martius, and Pauli) who were then employed in chemical works in Manchester and the neighbourhood. These men were intimately acquainted with the colour industry, both in theory and practice, so far as it had then advanced, and were perfectly capable, as was afterwards proved, of carrying it on successfully. Had they been supported by men of financial light and leading in Lancashire the industry might have flourished in this country. Not, however, finding the necessary support here, they returned to Germany, where they became the leading members of the great colour works at Ludwigshafen, Höchst, and Berlin.

But the Germans, not content with having secured an industry the value of which is reckoned at 50,000*l.* annually, are preparing for future attacks. On the very day of the Perkin meeting I received a letter from my friend Dr. Hagen, the director of the Physikalische Reichsanstalt in Charlottenburg, in which he informs me of the determination to found a corresponding Anstalt for chemistry, and in the last number of the *Berichte* I find a statement made by the committee of the German Chemical Society in support of this proposal. In this they point out, in the first place, that the due development of chemistry, influencing as it does so powerfully national life, cannot be ensured by individual effort, and that the establishment of a Reichsanstalt for chemistry is for this purpose necessary. In the second place, they proceed to indicate a large number of questions requiring solution which can only be satisfactorily answered by long-continued research. They conclude by the remark that such an institution must be of a national character, inasmuch as the subjects dealt with are of national importance, influencing the welfare and progress of the country.

Here we have a true trumpet call. Will England answer to it or will she otherwise make up her mind again to take a second place? In his admirable letter on "Science and the Industries" in the *Times* of Saturday, March 3, Prof. Silvanus Thompson points out that the electrical industry, and that of the manufacture of steel, are likely to fall, if they have not already fallen, into the hands of Germany and America, and insists, as many of us have been doing for the last twenty years, on the necessity of our commercial and educational leaders becoming aware of the absolutely vital nature of the bearing of scientific research on industrial prosperity. This conclusion is emphasised in a letter printed in the *Times* of March 6 from Sir Joseph Lawrence, in which he urges the plea that English manufacturers are too poor and too closely run by competition to be able to afford scientific leading! This is indeed an appeal *ad misericordiam!*

The long and the short of it is that the Germans, and the Americans I may add, see this, and are strenuously working the principle into practice, whilst we remain "blind leading the blind." When will our eyes be opened?

HENRY E. ROSCOE.

Cooperation between Scientific Libraries.

DR. BATHER'S letter in your issue of March 1 is one which deserves the hearty support of all scientific workers, in the United Kingdom at least. I have long felt that the whole of the literature indexed in the International Catalogue ought to be available for reference in some one locality, and preferably in London. In my address as president of the Chemical Society in 1894, foreshadowing the time when our meeting-room would be too small, I ventured to point out that "This is a difficulty that threatens to oppress all the Burlington House societies, and must become more pressing as the importance of bringing all societies having cognate aims into juxtaposition is realised. Perhaps some day our friends and neighbours the artists will have found quarters elsewhere more suited for the display of their works—for they appear already to have far outgrown the space at their disposal, and to be therefore obliged to impose undesirable limitations on exhibitors; when this occurs, it should be possible to find accommodation more adequate to the needs of science and fit presentment of its Imperial importance" (Chem. Soc. Trans., 1894, 358).

Since then, the University of London has vacated the portion of Burlington House in which it long had its quarters, and the Royal Society has let slip a golden opportunity of securing these rooms for its own use, and at the same time of affording to other cognate societies—including the British Association—the increased accommodation they so much need. The quad. roofed in would make a magnificent reading-room. Sad experience teaches me that there is little hope in this country that those who are engaged in scientific work will consent to work together for some serious common purpose: apparently every little show must be run separately; but if they could be persuaded—if the Royal Society would for once have courage and lead—much might be done to further a project such as Dr. Bather advocates and bring it to a practical issue at no distant date.

HENRY E. ARMSTRONG.

THE letter of Dr. Bather on the above subject in NATURE of March 1 (p. 413) is of much interest.

My experience in the preparation of the Royal Society Catalogue of Scientific Papers fully confirms the statements of Dr. Bather and of Dr. Muir, to whose paper he refers, as to the inconveniences arising from want of coordination between different libraries.

When we were commencing the indexing of the scientific papers from 1884 to 1900, it was necessary to ascertain the names of new serials that had come into existence since 1883, and also to take note of the serials that had been omitted from the twelve volumes of the Catalogue already published. Members of our staff were sent to some of the scientific libraries in London, and a list was thus obtained containing more than 1400 serials of various degrees of importance. Many of these were, of course, unsuitable for our purpose; a large number, however, were incomplete, single volumes and sometimes single parts only being available. These separate portions had probably come to the various libraries as specimens, or for the purpose of obtaining exchanges; and if there had been a general agreement between the libraries of London, arrangements might have been made to maintain such serials complete in one or other of the libraries. If a joint hand-list, as suggested by Dr. Bather, had been in existence, much time expended by us in searching for these serials would have been saved.

A few days ago I heard that the Royal Society of Edinburgh is engaged in considering a scheme of cooperation amongst the principal scientific libraries of Edinburgh and Glasgow, and that a complete list of scientific serials in these libraries is to be compiled. It would be of great advantage if a similar scheme could be carried out in

London. In the libraries of the learned societies at Burlington House alone there are many serials in duplicate; some of these might profitably be replaced by others which are not at present in these libraries. It often happens that books and serials are sent to library committees on approval, and are rejected because they are thought to be more suitable for other libraries; but attempts are not always made to ascertain whether these other libraries possess them. At the present time, from want of space and other causes, the duplication of periodicals at Burlington House is avoided as much as possible.

In the subject index to the scientific literature of the last century which the Royal Society is preparing, it is proposed to indicate, in the introductory list of serials, the libraries in which the cataloguing has been done, and also to mention other libraries in which the books may be found. This will be useful to workers, but it cannot be quite complete, for the task would be too great to undertake in its entirety. For example, there are more than 600 serials which contain mathematical papers, and it would be impossible to name all the libraries where they are found.

March 3. HERBERT MCLEOD.

The Bees of Australia.

UP to the beginning of 1905, 224 species of wild bees had been recorded from Australia, no less than 183 of them having been described by F. Smith, of the British Museum. I had the opportunity in 1904 to study Smith's types at the British Museum, and since then I have worked up the unnamed Australian material belonging to that institution, with the exception of some species of Halictus yet to be examined. The following list shows the genera found in Australia (including Tasmania), New Zealand, and the Austro-Malay Islands (taking the region as defined by Wallace), and the number of species in each.

Family.	Genus.	Australia.	New Zealand.	Austro-Malay Islands
Colletidæ	Phenacolletes *	1	—	—
	Paracolletes (sens. lat.)	52	8	—
	Anthoglossa *	4	—	—
	Cladocerapis *	1	—	—
	Andrenopsis *	1	—	—
Prosopidæ	Hylæoides *	2	—	—
	Callomelitta *	1	—	—
	n.g. aff. Callomelitta*	1	—	—
	Prosopisteron *	1	—	—
	Euryglossa *	29	—	—
	Prosopis	54	7	6
	Stilpnosoma *	2	—	—
Andrenidæ	Sphecodes	1	—	1
	Halictus	22	3	1
	Parasphecodes *	18	—	—
	Nomioides	1	—	—
	Meroglossa *	1	—	—
	Nomia	19	—	21
	Stenotritus *	2	—	—
	Andrena ?	3	—	—
Family ?	Gastropsis *	2	—	—
Panurgidæ	Scrapter ?	2	—	—
Ceratinidæ	Ceratina	—	—	6
	Exoneura	5	—	—
	Allodape	3	—	1
Xylocopidæ	Xylocopa	2	—	27
	Lestis *	2	—	—
Anthophoridæ	Anthophora	11	—	6
	Saropoda	2	—	1
	Tetralonia	1	—	—
Melectidæ	Crocisa	8	—	7
Nomadidæ	Nomada	—	—	2
Megachilidæ	Megachile	50	—	57
	Lithurgus	4	—	—
	Thaumatosoma	1	—	—
	Ctenoplectra	—	—	1
	Coelioxys	2	—	4
	Parevaspis	—	—	1
	Anthidium	—	—	1
Apidæ	Apis	(1 introd.)	—	3
	Trigona	5	—	7
		317	18	153

The list proceeds from the most primitive bees up to the most specialised. The genera marked with an asterisk are wholly peculiar to Australia, so far as known; and it will be observed that, as with the mammals, there are many endemic genera of a primitive type. Lestis is the only endemic genus allied to the ordinary long-tongued bees, and that consists of two closely allied species, which represent an offshoot from Xylocopa, probably not of very ancient date. True Xylocopa, it will be noticed, just enters Australia (but one species is common in the north), but is rich in species in the Austro-Malay Islands, and extends into Asia, Europe, Africa, and America. The Xylocopas are the large carpenter bees, which nest in wood, and may be transported across the water in floating trees. Until recently, the genera Thaumatosoma and Exoneura were supposed to be peculiar to Australia, but the first has now been found in Burma and the second in Syria. They may possibly be genera which are verging on extinction, but as each differs only in one important particular from its nearest ally (these allies being Megachile and Allodape respectively), it is not impossible that they arose by parallel mutations in the widely distant localities in which they occur, quite independently.

The most interesting of the primitive genera is Phenacolletes, based on a new species (*P. mimus*) discovered by Commander J. J. Walker on the *Penguin* Expedition. The Colletid bees are supposed to have been derived from the fossorial wasps, and Phenacolletes is so like certain wasps that I was not sure whether it was a wasp or a bee until I had examined its pubescence with a compound microscope. Unfortunately, we know nothing of the habits of this insect, but Commander Walker kindly informs me that it was taken on November 12, 1890, at Turtle Bay, north end of Dirk Hartog Island. He finds in his journal for that day that "an upright growing shrub with ovate glabrous leaves and large whitish-rosy mallow-like flowers" was the only plant which seemed to be at all attractive to insects, so perhaps the Phenacolletes came off that.

I have supposed that the bees with emarginate tongues (Colletids and Prosopids) arose from the wasps independently from those with pointed tongues, this seeming the more likely, because the wasps themselves exhibit both types. However, there are indications that in Australia the first form may have become modified into the second within the limits of the bee-group. This is especially suggested by the tongue of Callomelitta, and by one of the new species placed for the present in Paracolletes.

The new genus allied to Callomelitta, indicated in the table, is for *Sphecodes antipodes*, Smith. Colonel Bingham very kindly made a critical examination of this species at my request, and found that it was not a Sphecodes, but belonged to a new genus differing from Callomelitta in the shape of the thorax, pubescence of hind tibiæ, &c. It will undoubtedly prove an important form from the standpoint of the evolutionist.

The species marked as Andrena? and Scrapter? stand in our lists as members of these northern genera, but they have not been critically examined recently, and it is questionable whether they are rightly classified. The name Mellitidia has been applied to the so-called Andrena of Australia, and it is probably valid. Nevertheless, there are some undoubted cases of well known northern genera having endemic Australian species, while they have none, so far as known, in the Austro-Malay region. These are Nomioides (found from Burma to Europe) and Tetralonia (India to Europe, &c.); Saropoda (also European) is really in the same category, as the single Austro-Malay species is one of the Australian ones, which has reached the Aru Islands. The case of the Tetralonia seemed a little doubtful, but Colonel Bingham has critically examined Smith's type, and reports that it is a true Tetralonia, but is a female, not a male, as Smith had it. Lithurgus is also a genus of Europe and Asia, and likewise Africa, which has Australian species, though none are known from the Austro-Malay islands. In this case, it is practically certain that the genus is dispersed more or less through the islands, and has been overlooked, for one of the Australian species is exceedingly close to one of India.

Gastropsis, placed by Ashmead in the Andrenidæ, is apparently allied to the European Meliturga, and is in a

way intermediate between the two groups (long-tongued and short-tongued) of pointed-tongued bees. Cladocerapis and Prosopisteron are extraordinary endemic genera, which do not lead in the direction of anything known elsewhere.

It will be observed that the native bee-fauna of New Zealand is very poor, and quite lacking in distinction. Two of the genera are world-wide, while the third (Paracolletes) is found only in New Zealand and Australia, the species of the two regions being quite closely allied. It would seem that New Zealand received its bees in comparatively recent times from Australia (one of the species of Prosopis is even identical with an Australian one), and it may be added that all the affinity is with the southern part of Australia, especially Tasmania. There is still a possibility, of course, that New Zealand may contain some ancient endemic genus, which is now rare and has been overlooked by collectors.

The bees of the Austro-Malay islands are not at all adequately known, though we have a good idea of the general facies of the fauna. Most of the species were discovered by Wallace; I find that about a dozen were known before Wallace went to the islands, about seventy-four were added by him, and sixty-six have been discovered since. The species of Celebes are best known (41), but from Amboina we know only 9, Lombok 3, Timor 8, Ceram 3, Bourn 3, New Caledonia 4, Timor Laut 1, and so forth. It is evident that a very rich field lies before the collector in this region; but it is curious that so far we have not a single endemic genus of bees from the Austro-Malay islands, and it appears probable that few or none exist. Instead, we have numerous species of widely dispersed tropical genera; a varied, but not, apparently, very isolated fauna. The contrast with Australia is extreme. Of the eighteen genera represented, only six are even confined to the eastern hemisphere, these being Crocisa,[1] Allodape, Aspi, Saropoda, Ctenoplectra, and Parevaspis.

To sum up, it is apparent that Australia posesses a very old and long isolated bee-fauna, containing types which seem to link, in greater or less degree, the bees and fossorial wasps, the emarginate-tongued and pointed-tongued bees, and the long-tongued and short-tongued bees. It is therefore evident that the study of this fauna is likely to yield much of interest in the future; and, it must be added, there is little doubt that the number of species awaiting discovery far exceeds the number already discovered. On the other hand, we find in Australia also a more modern fauna, containing even a few species quite identical with those of the Asiatic mainland, and several closely allied thereto. Such are certain species of Nomia, Xylocopa, Anthophora, and Trigona. Of such forms, it appears that they are either strong fliers (as Anthophora) or else they have the habit of nesting in trees (as Trigona), and thus it is not difficult to understand how they crossed the sea. None of these genera, however, have reached New Zealand, which is not only too remote, but also out of the path of suitable marine currents. In the case of certain cosmopolitan genera which have numerous Australian species, such as Prosopis and Megachile, it is to be noted that only a few of the species are specially related to those of the Malay Islands and Asia; the others constitute part of the peculiarly Australian fauna, although they have not become generically altered.

T. D. A. COCKERELL.
University of Colorado, Boulder, Colorado, U.S.A.

The Intelligence of Animals.

IN his review of Father Wassmann's book (NATURE, February 1, p. 351) Lord Avebury dissents from Father Wassmann's conclusion that the sagacity of ants is "instinctive and essentially different from intelligence and reflection," and repeats the opinion which he has held for many years, that "it is difficult altogether to deny to them the gift of reason." The following incidents, which I observed on a footpath in the Donetz Coalfield, in Russia, in the summer of 1898, appear to me to show that the insects here referred to possess both intelligence and the gift of reason, and, therefore, to lend a general support of Lord Avebury's views.

Numerous small black-beetles, about three-eighths of an inch in length, were busily engaged in rolling, hither and thither, balls of cow-dung, about half an inch in diameter, which they had cut away from the edge of a still soft mass of that substance that lay near the middle of the path. As a rule, two insects were engaged in rolling each ball, both walking on their hind legs with their fore-feet resting on the upper curve of the ball—the one behind pushing and walking forwards, the one in front pulling and walking backwards. When the ball commenced to roll on any declivity it passed over the body of the one in front, which then lost its hold and was left behind. But the other always held on tightly to the ball, and was carried over and under it, several times in succession, until the ball either ceased rolling or the insect was thrown off. In the latter case the beetle followed to the bottom of the slope on foot, and usually recovered the ball without difficulty.

The principal slope upon which these disasters happened constituted one bank of a small dry water-course about six inches deep. The length of the bank from top to bottom was ten or twelve inches. The dry bed of the water-course was slightly inclined. In one instance, in which the beetle was thrown off at the fourth or fifth revolution of the ball, the latter rolled to the bottom of the bank, and then, turning at right angles to its former direction, continued to roll down the bed of the water-course to a further distance of nine or ten inches. The beetle followed to the foot of the bank, but did not find the ball where it obviously expected to do so. After hesitating and moving about in various directions to a distance of an inch or two, it ran down the bed of the water-course to a distance of three or four inches, returned, ran down again to a greater distance, returned a second time, then ran down to within two inches of the ball, but, failing to find it, gave up the quest and climbed up the bank to the level part of the path. All its movements, from the time it was forcibly parted from the ball, had the appearance of being dictated by intelligence and reason.

Again, a solitary beetle rolling a comparatively new ball had reached a distance of nine or ten inches from the heap when a second unoccupied beetle coming from the opposite direction stood up in front of the rolling ball as if with the intention of pulling it forward and assisting the first. Instead of doing so, however, it brought the ball to a dead stop. In vain the first beetle tried to move the ball; the second held it fast. The first then got down and peered round the side of the ball, apparently with the object of ascertaining the nature of the obstacle. While this examination was proceeding, the second, with its fore-feet still resting on the upper part of the ball, neither pushed nor moved in any way. The first then stood up again behind the ball and pushed it as before, but still the ball did not move. For the second time the beetle got down, made an examination as before, then, crouching with its back well under the lower curve of the ball, heaved with all its might—in the same way as a workman does in similar circumstances—but the ball remained stationary. The first beetle then came out from under the ball, and was proceeding round its right-hand side, with some new intention, when the two seemed to catch sight of each other. The second beetle threw itself on the ground with the quickness of thought, and fled pursued by the other, both running at their utmost speed. Fear, and a sense of guilt, seemed to spur the flight of the one, resentment and anger the pursuit of the other. In a chase which was continued for a distance of six inches, the fleeing beetle, which had started with an advantage of about an inch and a half, increased the distance between its pursuer and itself to more than two inches, when the former, seeing the futility of further pursuit, stopped, returned to the ball, and resumed its occupation of rolling it.

The reason why the second beetle stopped the ball, remained absolutely motionless when the other got down to reconnoitre, and ran away when it saw it was discovered is not apparent. Dare we suppose that it was simply amusing itself at the expense of the other? This was the impression left on my mind at the time.

W. GALLOWAY.

[1] Crocisa has been reported from the neotropical region, but the species are probably not correctly referable to that genus.

Result of War affected by Soldier's Stature.

IN your issue of March 1 Major-General Warrand denies that the chance of being shot in war depends, *ceteris paribus*, merely upon the square of the soldier's stature.

He would therefore introduce another factor, the thickness of the body, which presents a target varying in size according to the direction from which the fire comes.

This, however, is unnecessary. The stature alone should be considered, because, for the sake of simplicity, we assume that oblique fire is experienced equally by both armies, and we also assume that all soldiers are of similar build. The assemblage of human targets in each army is therefore proportional in size to the square of the average stature. JOHN HILL TWIGG.

The Hydro, Ben Rhydding.

WHAT IS WHISKEY?

DURING the last three months readers of the daily Press have from time to time been the recipients of informations concerning the nature of whiskey. Their education must have been somewhat heterogeneous in that what whiskey should or should not be seemed to change each week, in accordance with the witness whose evidence was being reported; perhaps now the so-called whiskey test case is over it will be convenient to place before our readers some of the most important facts brought to light by it.

The borough of Islington began its work in the matter of potable spirits with brandy, and succeeded in practically enforcing for this article of commerce a chemical standard. This standard, as in the case of the one which it has, at any rate for the time, succeeded in establishing for whiskey, is a minimal standard, *i.e.* brandy must contain at least a certain proportion of so-called compound ethers, and whiskey must, if the judgment in this case be maintained, at least contain a certain proportion of so-called impurities, viz. substances other than ethylic alcohol and water. Before dismissing from our notice the brandy standard, we would emphasise the fact that in the case of brandy a minimal amount of one class of by-product, the individual members of which almost certainly have the same therapeutic effect, is demanded. In the case of whiskey, the Islington magistrate fixed a chemical standard based upon an analytical, not chemical or even therapeutical, entity containing such different substances as compound ethers, higher alcohols, acids, and aldehydes. He further strictly enjoined the kind of apparatus in which whiskey must be produced, and the materials which shall in the two countries producing whiskey be solely used in the mash from which the spirit is to be distilled. The question of a chemical standard for brandy, and the protection which such a standard affords to the public, was thoroughly discussed in NATURE of November 3, 1904. The anomaly of having a fixed minimum and no fixed maximum for alcoholic impurities in potable spirits is too palpable to need amplification, and has been definitely recognised by the Belgian authorities, who refuse to allow the sale of a potable spirit possessing a coefficient of impurities of more than 300. This fact is of special interest at the present time, for if the Islington judgment is to stand, no potable spirit can be sold as whiskey which, *inter alia*, possesses a coefficient of impurities of less than 380.

To the average reader the judgment containing the definition of what for the future must be sold as Irish and Scotch whiskey would read, and it consists of some five thousand words, as if this question had never been considered before; and, indeed, a leading article upon this subject which appeared in a medical contemporary last week contained the extraordinary statement that "five years ago there was no suggestion even that potable spirits might be brought within the operation of the Sale of Food and Drugs Act, with a view to the detection of foreign or added spirit." It can scarcely be news to the readers of NATURE that a Select Committee under the chairmanship of Lord Playfair was appointed in 1891 to inquire into precisely the same question as was laid before the Islington magistrate, and had at its disposal practically the same material; it examined numerous witnesses, chemical, physiological, and commercial, and reported in 1891.

The best way of criticising Mr. Fordham's judgment is to summarise carefully the conclusions of this committee. At the onset it is a relief to find that upon one point at least they agree, viz. that according to both there is no evidence that any potable spirit sold in the United Kingdom as whiskey contains constituents other than ethylic alcohol which are injurious to health; in other respects we are afraid the Islington magistrate in his judgment is diametrically opposed to the report of this committee. Perhaps the shortest way of dealing with this report in the present article is to quote verbatim the Committee's view with regard to the definition of whiskey.

"Your committee do not attempt a legal definition of whiskey. Whiskey is certainly a spirit consisting of alcohol and water, with a small quantity of bye-products coming from malt or grain, which give to it a peculiar taste and aroma. It may be diluted with a certain quantity of water without ceasing to be whiskey, and it may be diluted with spirits containing little of the bye-products to suit the pocket and palate of customers, and it still goes by the popular name of whiskey. Your committee are unable to restrict the use of the name as long as the spirits added are pure and contain no noxious ingredients." Then again:—"There are varieties in the purity of patent or silent spirits. When they are made for blending it is the object of the distiller to retain a percentage of bye-products, though to a smaller extent than in pot-still whiskey."

We cannot think that the Islington magistrate was not aware of these conclusions, although it is exceedingly odd that in so lengthy a judgment no mention is made of the report of the select committee. However, the Islington dicta with regard to whiskey are certainly clear. Irish and Scotch whiskey must be produced by the distillation in a pot-still of the wort derived from a mash consisting in Ireland of 75 per cent. barley malt and 25 per cent. indigenous grain, in Scotland of barley malt alone. We are not told what kind of pot-still is to be used, although it is quite clear to anybody who has studied the subject that, with regard to the degree of rectification capable of being produced, pot-stills differ *inter se* as much as the patent-still differs from the pot. Whether or not the chemical standard of the Islington analyst is also to be maintained is not quite clear, but if so it appears that at least some of the pure malt pot distilleries will have to modify their technique. So far as concerns the actual term whiskey itself, it is not stated definitely that this term, provided it be not prefixed by the epithet Scotch or Irish, should be refused to blended whiskies, that is, to whiskies consisting in some part of patent-still or grain spirit, provided they consist of "a very considerable proportion" of pot-still whiskey. If these blended whiskies are to conform to the chemical standard laid down by the Islington analyst, practically all the blended whiskey on the market at the present day will have to undergo a considerable alteration. It is to be noted that, as distinct from the report of the Select Committee, no

importance is attached by the Islington magistrate to the question of taste or flavour, and no limit is placed by him upon the amount of chemical impurities which whiskey may contain. Although there is scanty reason to believe that the higher alcohols, furfural, and compound ethers in the proportion in which they exist in pot-still whiskey as ordinarily consumed are injurious to health, yet, nevertheless, one cannot view with complaisance a legal definition of whiskey which allows the quantities of these substances to be unlimited. The only safeguard which the public will have will be their own taste. They have shown distinctly what they like in that nine-tenths of the whiskey consumed to-day consists of a blend, with more or less pot-still whiskey, of this same patent-still whiskey, which is to be whiskey no longer, because technologically, if not chemically and dietetically, it diverges too widely from the mediæval and sentimental "usquebaugh."

Two further points in the judgment of the Islington police magistrate will be of interest to technologists; the first is the absolute condemnation of maize as a constituent of the mash from which whiskey is to be made. This is especially interesting because to those cognisant of the literature of the subject this question of maize as a constituent of brewing and distilling mashes is by no means a new one. Although precedent seems to be no justification at Islington, it is a fact that maize was used as a constituent of distilling mashes previous to 1881. We choose this date advisedly, because in 1881 the use of this same opprobrious maize as a constituent of brewing mashes was by the Free Mash Tun Act actually legalised. Again, the Select Committee on bonded spirits was fully cognisant of the use of maize in distilling mashes, and in its report of 1891 had nothing to say against this grain. Still further, in 1898 the Beer Materials Committee, after a most exhaustive inquiry, refused to prohibit the use of maize. Lastly, the American Pharmacopœia, which includes whiskey as an official preparation of alcohol, specifically states that it may be made from maize. So far as we can gather, the objection to maize is that it cannot be, or at any rate is not, ripened in this country.

The last point which we have space to consider is the statement that, apart from taste and flavour, patent-still whiskey has a different effect upon the consumer from pot-still whiskey. It is true that the therapeutic evidence at present at our command upon this subject is somewhat scanty, but what there is points to the conclusion that practically the only active constituent in whiskey is ethylic alcohol, and that if a given dose of whiskey differs otherwise than in taste and flavour from a proportional amount of pure ethylic alcohol equally diluted, this difference is due entirely to the presence of certain compound ethers. Now as a matter of fact, although patent-still whiskey contains a smaller coefficient of impurities than pure pot-still whiskey, the ethereal moiety of the impurities is approximately the same in both. At any rate, the amount of compound ethers taken in an ordinary dose of patent-still or blended whiskey so nearly approximates to that taken in any ordinary dose of pot-still whiskey that no therapeutical difference is, *a priori*, to be expected between the two beverages as consumed. The direct evidence we have upon this subject bears out this *a priori* reasoning.

Over and above the details which have been brought to light in these whiskey prosecutions, everyone must be struck by the curiousness of a legislation which allows disputes of this kind to be decided in a police court. During the past few years many special committees have sat upon subjects relating to the working of the Sale of Food and Drugs Act, and not a few of them have specifically recommended either the institution of a permanent court of reference for these matters or at any rate that they should be laid before some specially organised tribunal. It is sincerely to be hoped that before long these recommendations may be adopted.

THE ROYAL COLLEGE OF SCIENCE.

THE relation between the University of London and the proposed new Royal College of Science has been the subject of some discussion since the publication of the report of the departmental committee on the college, described in our issue of February 8 (p. 344). It is devoutly to be hoped, however, that the consideration of this matter will not divert attention from the essential point of the committee's report, namely, "that it is desirable that the new institution should be established immediately, and that its organisation should proceed without delay." Divergent views may be held as to the nature of the connection between the University and the new College, but there can be no two opinions as to the folly of delaying the establishment of the institute, as recommended by the committee, while questions of control are being decided.

The subjoined letter from Mr. C. McDermid, hon. secretary to the British Science Guild, appeared in yesterday's *Times*, and the plea of urgency contained in it is endorsed in a leading article in the same issue.

I am directed by the executive committee of the British Science Guild to request you to be good enough to give publicity to the following expression of the views of the committee on a matter of great national importance.

The departmental committee on the Royal College of Science has shown in its final report that a start can at once be made to provide for the most advanced instruction and research in several branches of applied science, which all are agreed are imperatively necessary in the interests of our national industrial progress.

The danger of delay in giving effect to the recommendations of the departmental committee is recognised by the leaders in science and industry, who are largely represented among the members of the British Science Guild.

The Government have signified their willingness to hand over to a new governing body the present buildings of the Royal College of Science and Royal School of Mines, the new chemical and physical laboratories, which are approaching completion, and some adjacent acres of land on which to erect new buildings. In addition to this it is understood that the Commissioners of the 1851 Exhibition will provide an additional building site, and that the council of the City and Guilds of London Institute will cooperate in the scheme.

The Government are prepared to provide a yearly grant about equal to the interest at 2½ per cent. on one million pounds sterling, and there is reason to hope that the London County Council will vote an approximately equivalent sum. In addition to this there is the munificent gift of 100,000*l*. from Messrs. Wernher, Beit, and Co., and the sum that it is expected will be provided for the equipment of the new mining and metallurgical laboratories as the central object of a national memorial to the late Sir Henry Bessemer.

In view of all these most favourable conditions the executive committee of the Guild earnestly hope that neither the question of the ultimate and final relationship of the new institution to the London University nor any other matter will be allowed to interfere with the immediate appointment of at least an organising governing body. This body might deal *inter alia* with the status and qualifications of the professional staff required and obtain detailed expert advice with regard to the new buildings to be erected.

Probably no more propitious time for founding a college of the kind contemplated could be offered

than the present. The Perkin jubilee has been the means of arousing a certain amount of interest as to the cause of lost industries, and the remedies to be applied if we are to secure industrial progress in the future. Enlightened manufacturers are prepared to give substantial support to an institution which will aim at bringing scientific knowledge in close relation with industries and industrial needs. Not to take advantage of the present desire for action would be dilatory policy; and if the scheme is held up while discussion takes place upon its academic aims and relationships, nothing could be more disappointing to those who are anxious to see the establishment of an institute capable of rendering great service to the community.

In the proposed new college no provision is to be made for biological subjects; and Prof. Ray Lankester has written a letter to Lord Rayleigh, president of the Royal Society, pleading for the recognition of the fact that the needs and the importance of these sciences are as great or greater, and that they are at present well-nigh destitute of any endowment, or of adequate provision at the public charge of laboratories and the means of research. Prof. Lankester shows that there are many branches of applied biology of importance to the State, and though he does not propose any formal action to the council of the Royal Society he trusts "that means may be devised of obtaining an assurance from the Government of not merely continued, but increased, provision for the highest work and training in the various sciences of the biological group—including geology."

PROF. SAMUEL PIERPONT LANGLEY.

AT the zenith of his reputation, and possessed of his full capacity for work, America and science have to regret the death of Prof. Langley, who for nearly twenty years directed and controlled the energies of the Smithsonian Institution. The objects promoted by such an establishment are so varied, the interests that it has to maintain are so numerous, that its direction can only be confidently entrusted to one who combines the skill of the administrator with the training of the man of science. The energy displayed by Prof. Langley in the conduct of the Smithsonian Institution, and its steadily increasing influence under his direction, show that he loyally appreciated the intentions of the founder, and that he proved himself a worthy successor to Joseph Henry and Spencer Baird, names still warmly treasured in the memory of the American nation. We may recall, though we cannot do justice to, some of the more important features that have marked his connection with the institution. His supervision of the museum, and his earnest endeavour to make it more valuable for instructed and uninstructed alike, led to rearrangement, and especially to the foundation of the children's room, a feature which may serve as a model for similar institutions. The Bureau of American Ethnology is a national undertaking that has long been conducted on spacious lines, but under the late director this department has assumed magnificent proportions, the care of which was an enormous responsibility that even the assistance of able colleagues could not wholly remove. The publications of this bureau show only the thoroughly digested scientific conclusions, and represent but a fragment of the immense amount of work actually accomplished. But, perhaps, in the establishment and management of the zoological park we see the personal influence of the director most conspicuously exhibited. It was his dream to establish a park in which the wild animals of his native land might live as nearly as possible under conditions natural to them, so that they might breed and thrive in captivity as in their native haunts. The difficulties in the way might well have daunted one less enthusiastic. More than once the question of abolishing the park has been considered, and over and over again he had to fight the battle in the teeth of hostile or indifferent politicians, who could not be made to appreciate the value of the scheme, or to recognise that the preservation of the native animals, threatened with extinction, was a trust committed to their charge. He lived to see this scheme placed on a permanent footing, and if on a more modest scale than he could have wished, he could feel that his insistence had not only preserved the nation's heritage of wild animals, but had opened up important regions of biological research and of zoological art.

But, notwithstanding the severe demands the care of such an establishment must make, Prof. Langley did not allow his activity to be wholly absorbed in the interests of the Institution. He never forgot that he was a physicist and an astronomer before he became an administrator. As a physicist, the problem of flight largely engaged his attention, a subject to the consideration of which he was led by his studies on the internal force of the wind. To what extent his experiments advanced the problem of aviation it would be premature to pronounce. The form of aërodrome which he favoured was capable of making flights of a mile, unsupported except by the mechanical effects of steam engines. But these successful flights were carried out on models. The application of the same principle to larger machines was, as he contended, never fairly tried. The launching apparatus was ineffective, and his machine never got into the air at all. But if its capacity for sustained flight was never tested, some of the mechanical features that he tried and adopted will no doubt find their place in later constructions. As an astronomer he will be remembered for his direction of the Allegheny Observatory and the important work which he accomplished there on the sun and in the department of spectroscopy. His drawings of the solar surface, made nearly forty years ago, remain unsurpassed for delicacy and truthfulness, while his views on the physical constitution of the sun are worthy of the closest attention. As an experienced observer of solar eclipses he was also well known, and thirty-five years ago, when the spectroscopic examination of the sun's surroundings had made but little advance, he rendered yeoman service. The invention of the bolometer constitutes a distinct claim on our gratitude. This sensitive instrument affords the means of measuring minute changes in heat arising from the change in the electrical resistance of an extremely thin strip of metal. By its use Prof. Langley showed that the corrections for atmospheric absorption, deduced by earlier observers with less perfect instruments, are all too small, and consequently the generally received value of the "solar constant" has been considerably increased. With the same instrument our knowledge of the infra-red spectrum has been greatly increased. The heating effects from rays unsuspected in previous investigations have doubled the known extent of the solar spectrum. By the aid of rock-salt lenses and prisms Prof. Langley was able to show that bands of atmospheric absorption were found to alternate with bands of solar radiation, a fact of no inconsiderable importance in terrestrial meteorology.

As a writer the late director of the Smithsonian Institution was well known for his powers of graphic description and vivacious style. His "New Astronomy," published many years ago, attracted very

considerable attention, and did much to popularise the science in America. It is needless to say that he was a member of many learned societies, American and European; it will be sufficient to refer here to the fact that he was elected a foreign member of the Royal Society in 1895. At the age of seventy-two he is removed from that position he was so well fitted to adorn, and the respectful sympathy of the men of science of all nations will be offered to those who suffer by his loss. W. E. P.

NOTES.

ONE good purpose served by the movement referred to last week (p. 419) to commemorate the jubilee of the discovery of the first artificial coal-tar colour by Dr. Perkin is that public attention has been directed to the relations between scientific research and industrial progress. The complete lack of sympathy between the capitalist in this country and the scientific worker, largely due to the indifference shown by statesmen to scientific studies, has been persistently deplored in these columns for many years; and we are glad that the general public is now being enlightened as to the results of neglect of scientific research. The coal-tar industries, founded upon an essentially British discovery, have been lost to us, and are now represented in Germany by two industrial groups which, with a capital of 50,000,000*l.*, can pay dividends of from 20 per cent. to 30 per cent. per annum. Prof. S. P. Thompson, in a letter to Saturday's *Times*, refers to this lost industry, and shows that the electrical industry and the manufacture of steel must pass to other countries unless our manufacturers realise the industrial value of higher technical education and scientific research. "Pioneering," he remarks, "as it is understood in an electrical factory in the United States or in Germany, is now almost non-existent in England; and the result on the electrical industry in the next ten years must be simply disastrous. Where are the newer kinds of electric lamps being developed? The Nernst lamp, the flame lamp, the vapour lamp, the oxide lamp, the osmium lamp, the tantalum lamp, all rich in future possibilities, where are they being perfected? Not in England. I doubt if there is a single British firm that is spending on such development a tenth part of the sum that one single American firm is spending on this one thing alone. If we cease to pioneer we become mere followers at a distance of those who are going forward—ourselves cease to lead in the development of the industry." To save our country from future disaster, our commercial and educational leaders, and our statesmen, must realise the vital nature of scientific research to national prosperity, and act upon this conviction by making adequate provision for it.

THE town council of Hamburg has voted the sum of 586,000 marks (29,300*l.*) for the construction of a new observatory at Bergedorf, about ten miles from Hamburg, and 309,000 marks (15,450*l.*) for the instrumental and electrical equipment of the observatory.

PROF. W. OSLER, F.R.S., has been elected a member of the Athenæum Club under the provisions of the rule which empowers the annual election by the committee of nine persons "of distinguished eminence in science, literature, the arts, or for public services."

THE American Geographical Society has awarded Captain R. F. Scott its gold medal in recognition of his services as commander of the British Antarctic Expedition. The Paris Geographical Society has awarded one of its gold medals to Major C. H. D. Ryder in recognition of his work as surveyor and explorer in connection with the recent Tibet mission, and his expedition to the sources of the Brahmaputra.

THE Berlin correspondent of the *Times* states that on Monday the German Emperor formally opened the new Museum for Marine Science, Berlin University. Among those present at the opening ceremony were the Prince of Monaco, the Rector of the University, Geheimrath Diel, and many distinguished representatives of natural science. The institute, which owes its existence to the direct initiative of the German Emperor, is intended to promote and encourage the interest of the German people in marine matters, and to place the subject upon a scientific basis.

THE Empress Frederick Institute for the higher scientific and practical education of medical men, which owes its inception to a project initiated by the late Empress Frederick, was opened in Berlin on March 1. The German Emperor and Empress, accompanied by many members of the Prussian Royal Family, were present. Sir Felix Semon attended the ceremony in accordance with the commands of King Edward, and in the course of a short address referred to the King's personal interest in the new institution.

A ROYAL COMMISSION has been appointed to inquire into the canals and inland navigations of the United Kingdom, and to report on their present condition, financial position, the facilities, improvements, and extensions required to complete a system of through communication by water, the expediency of canals being made or acquired by public bodies, and other matters related to these subjects.

SIR EDWARD FRY will preside at the twenty-third annual congress of the Royal Sanitary Institute, which will be held at Bristol from July 9 to 14. The presidents of the various sections will be:—Section i., sanitary science and preventive medicine, Sir William J. Collins, M.P.; section ii., engineering and architecture, Mr. Edwin T. Hall; section iii., physics, chemistry, and biology, Dr. W. N. Shaw, F.R.S.

AT the third International Seismological Conference, held at Berlin on August 15, 1905, Signor Luigi Palazzo was elected vice-president of the permanent board of the International Seismological Association. As Prof. A. Schuster was unable to accept the presidency offered him, the assembly deputed Signor Palazzo to act as president until the new elections take place next summer. Signor Palazzo desires it to be known that the Italian Government has consented to his acceptance of the office and responsibility, and he asks for the support of all who take an interest in the progress of seismology.

DR. C. W. ANDREWS, of the British Museum, left England last week to resume the quest for the remains of extinct vertebrates from the Tertiary deposits of the Fayum and other parts of Egypt. Recent discoveries in Egypt have demonstrated the descent of the Eocene zeuglodonts from creodont Carnivora, and it is one of the objects of the present expedition to endeavour to discover, in higher beds, the missing links between zeuglodonts and true cetaceans. It may be added that the present expedition (like the earlier ones) of Dr. Andrews has been rendered practicable by the generosity of Mr. W. E. de Winton.

Science reports that, according to a despatch to the daily papers from Washington, the Carnegie Institution has purchased a tract of six acres in the north-west section of Washington, near Rock Creek Park, where it will erect a permanent home. The site is near the building of the

United States Bureau of Standards, and is in a commanding position, overlooking the entire city. The purchase price was 700*l.* an acre, and a building to cost 20,000*l.* will be erected at once.

THE great horticultural exhibition, to be held in the gardens of the Royal Botanic Society on Wednesday, June 13, will be opened by Princess Alexander of Teck.

THE Badische Anilin- und Soda-Fabrik, of Ludwigshafen, proposes to lay down a hydraulic power plant for the preparation of nitric acid from atmospheric nitrogen by the Birkeland process. Instead, however, of preparing calcium and sodium nitrate for artificial manures, as in the Norwegian installations, it is intended, in the first place at least, to make potassium nitrate for explosive purposes.

ACCORDING to the *Chemiker Zeitung*, the proposed new offshoot of the General Electrical Company, Berlin (p. 421), for the manufacture of mercury lamps in Europe is to be known as the "Quarzlampengesellschaft." The great advantage of the lamps will be the possibility of preparing them for all voltages up to 500 volts, and, in addition to the fact that no carbons are required, the lamps should be usable for 1000 hours without attention; it is expected that the lamps will in many cases replace arc-lamps.

AT the meeting in the Aula of the Berlin University on February 21, which was held at the invitation of the preliminary committee appointed last year to investigate the question of the formation of a Chemische Reichsanstalt, there were present some 150 of the most eminent representatives of German academic and industrial chemists, as well as several representatives of the Prussian Board of Education. After a few remarks by the president, Prof. Emil Fischer, the report of the preliminary committee was presented by Prof. Nernst. The great majority of the scientific and industrial societies consulted were decidedly in favour of such an institution; sympathetic answers were also received from most of the different German States and from the Imperial Government offices. Prof. Ostwald, who referred to the experiences gained during his recent stay in America, spoke of the necessity of the proposed institute from a scientific point of view, while Prof. Duisberg spoke from the technical side. After further discussion, the meeting unanimously agreed to the plans submitted by the preliminary committee, and moved that the Imperial Treasurer be approached on the subject. It is proposed that the institution be placed either in Berlin or in one of the suburbs; further particulars and details of the proposed scheme will be given in a subsequent issue.

A REUTER message from Rome states that the convention for the establishment of an International Institute of Agriculture has been signed by Italy, Russia, Servia, Belgium, San Salvador, Portugal, Mexico, Luxemburg, Switzerland, Persia, Japan, Ecuador, Bulgaria, Spain, France, Denmark, Greece, Sweden, Holland, Uruguay, Germany, Nicaragua, Austria-Hungary, Great Britain, Egypt, the United States, and Cuba. Other Powers have notified their intention of signing the convention. The creation of the International Institute of Agriculture is therefore assured, and it will be able to begin its labours next year. King Victor Emmanuel has determined that the palace of the institute shall be completely finished by 1907. His Majesty has presented the funds necessary for this enterprise, and the work will be started very shortly.

THE twenty-eighth annual general meeting of the Institute of Chemistry of Great Britain and Ireland was held on March 1, Mr. David Howard, the retiring president, in the chair. In his address, Mr. Howard referred, among other matters, to the great advances in chemistry that had been due to the work of private practitioners, giving his opinion that any action which tends to interfere with the individual practitioners would be fatal to progress. With greater facilities for training, and, consequently, a larger supply of chemists, it was evident that only the most efficient could hope to be successful. In conclusion, Mr. Howard referred to the new president, Prof. Percy F. Frankland, F.R.S., who had long been associated with the institute, and whose father, Sir Edward Frankland, was the founder and first president of the institute.

THE annual meeting of the Liverpool School of Tropical Medicine, which was held last week in the Liverpool Town Hall, under the presidency of the Lord Mayor (Alderman J. Ball), was attended by a large number of prominent citizens, including Sir Alfred Jones (chairman of the school), Mr. William Adamson (vice-chairman of the school), Prof. Carter, Prof. Ronald Ross, C.B., Dr. Caton, Mr. Charles Booth, jun., and Mr. Philip Davey. Princess Christian wrote expressing her constant warm personal interest in the progress of the school, and sympathetic messages were received from other prominent persons. The report shows that excellent work is being done by the school. The committee acknowledges the continued generous support of the public, but further funds are needed in view of the great development of research work. A sympathetic reference was made to the regretted death of Dr. J. E. Dutton, who lost his life while engaged in the investigation of trypanosomiasis and tick fever on the Congo.

AN agricultural conference was held in Bombay on February 5 and following days. In opening the meetings, Mr. Muir MacKenzie, the president, said that important beginnings had been made in the department of agricultural research and education. It was the late Mr. Ozanne who gave the first effective impetus to the scientific development of agriculture in the west of India. He established the Kirkee demonstration farm and dairy. This dairy has developed into an industry which has spread all over India. Referring to the agricultural colleges, the president said that by a course of study at the colleges it was not expected to make a man into a scientific and practical farmer. The colleges give an agricultural bent to the student's mind, and enable him to think correctly about agriculture and to bring to bear upon agricultural problems in India the information thus acquired. Referring to the experiments with Egyptian cotton made in Sind, he said this year the crop was estimated at 1200 bales, and next year 4000 bales were expected. They were justified, he continued, in entertaining some confidence that the establishment of that valuable product in Sind would be an accomplished fact, and would prove a substantial addition to the agricultural resources of the country.

Naturen for February contains an article by Prof. G. Guldberg on the pigmies of the Congo forest.

WE have received a copy of a paper by Mr. C. O. Esterly on the nervous system of copepod crustaceans, issued in the Zoological Publications of the University of California.

AMONG the contents of the February *Zoologist* reference may be made to an article by Mr. G. Renshaw on the extinct Mauritius dove, or "pigeon hollandais" (*Alectoraenas nitidissima*). Discovered between 1774 and 1781, it was still common in 1790, but when it was exterminated

cannot be determined. There is a specimen in the Edinburgh Museum of Science and Art, and another at Port Louis.

To the January number of *Spolia Zeylanica* Dr. O. von Linstow contributes a paper on parasitic worms (Helminthes) in the Colombo Museum, while Mr. N. Annandale discusses certain lizards and stalked barnacles in the same collection. Among the lizards, a curiously striped skink, which had been described as *Euprepes hallianus*, is made the type of the new genus Theconyx. In reference to the recent discovery by Dr. Willey that the lemurs of the genus Loris are almost peculiar among Primates in having four mammæ, Mr. Annandale records that the same condition obtains in their allies of the genus Nycticebus.

ACCORDING to the annual report for 1905, the Royal Zoological Society of Ireland enjoyed an unusually good year, the gate-money having increased by one hundred pounds, while the entrance-fees and subscriptions reached a total which has only once been exceeded, and then only by a few shillings. The balance-sheet has also benefited to a considerable extent by the sale of superfluous animals. Very wisely, the council has spent a considerable portion of this increased income in improving the accommodation provided for the denizens of the gardens, the most important addition being an open-air aviary measuring 90 feet by 50 feet, with a height of 20 feet. Experiments have also been made, with most satisfactory results, in placing tropical animals in the open air, a number of parrots having been introduced into one of the smaller outdoor aviaries, while a party of Indian rhesus monkeys has likewise been kept for some months without any shelter. An excellent coloured plate, forming the frontispiece to the report, shows these monkeys in the snow, apparently in a high state of health and contentment.

IMPORTANT information with regard to the origin, rise, and decline of British whaling, both in the icy north and in the southern seas, is furnished by Mr. T. Southwell in the February issue of the *Zoologist* at the conclusion of an article on last season's catch of the Dundee whaling fleet. Although Hull and Bristol had for a long time previously been in the habit of sending vessels to Newfoundland and St. Lawrence Bay for seals and walrus, Greenland whaling was initiated from London and Hull in 1610 or 1611. The Dutch opened the route to Davis Strait in 1719, but were not allowed for long to enjoy the whaling by themselves. Scotland commenced Greenland whaling in 1750 from Leith; Dundee, the only British port from which whalers are now dispatched to the north, not joining in until 1790. Sperm-whaling in the South Seas, which appears to have been confined to the port of London, commenced in 1775 and continued until 1853, when it was abandoned to the Americans. During last season more whales were seen in Davis Strait than for some years past, the total catch being twenty-three.

WE have to acknowledge the receipt of four parts (Nos. 1434–7) of the Proceedings of the U.S. National Museum, in the first of which Mr. E. A. Klages describes a collection of moths belonging to a certain group from Venezuela. A fossil raccoon from a cave in California, described by Mr. J. W. Gidley, forms the subject of the second. We regret to see that in describing, in the third, certain macaque monkeys from the Malay countries, Mr. G. S. Miller seeks to replace the well known and universally accepted generic name Macacus by Macaca, on the ground that the latter is the earliest form of the name to be found in scientific literature. We stand sorely in need of a statute of limitation in regard to altering and replacing names. In the fourth Dr. L. Stejneger describes a new species of lizard belonging to the group of "horned toads" from Mexico. Whether, however, this species is entitled to be included under the latter title is almost doubtful, seeing that it lacks the horns from which the others take their name. It is also characterised by a peculiar downward expansion of the lower jaw.

FROM Dr. F. Ameghino, director of the Buenos Aires Museum, we have received copies of two papers from the *Anales* of that institution, one dealing with the remains of fossil penguins from the Tertiary deposits of Seymour Island, in the Antarctic, and the other with the Tertiary edentate mammals of France and Germany. Judging from their metatarsal bones, some of which indicate birds of very large size, the Seymour Island penguins are represented by a large number of species, these being referred by the author to no less than eight generic types, all of which are regarded as distinct. Of wider interest is the paper on the Oligocene and Miocene edentates of Europe, especially since the author's familiarity with American representatives of the group renders him peculiarly well qualified to test the determination of the European fossils. It is satisfactory to learn that Dr. Ameghino is fully convinced that among the latter are included armadillos, aard-varks, and pangolins, some of the armadillos coming very close to South American forms. This assemblage of three groups of edentates in the countries fringing northern Africa is suggestive that the latter continent may have been the original home of the group, which reached South America by direct land-connection.

THE Bausch and Lomb Optical Co., of Rochester, New York, the makers of the Minot microtomes, has recently issued a new catalogue of its instruments, in which reference is made to certain improvements in the Minot automatic rotary microtome.

UNDER the title "Glycogène et Paraglycogène chez les Végétaux," some notes written by the late Prof. L. Errera are published in the *Recueil de l'Institut botanique*, Brussels, vol. i., 1905. The notes refer to microchemical experiments on certain low organisms to test for the presence of these substances.

THE Trinidad Bulletin for January contains articles on cocoa diseases observed in Ceylon and the West Indies, and on the use of lime in agriculture. Two new instruments for rubber-tapping are mentioned, the one a revolving pricking instrument, the other an improved V-cutting knife. Reference is also made to the small fish, species of Girardinus, found in Trinidad and Barbados, that feed on the larvæ of mosquitoes; it is suggested that it would be useful to place them in pools in malarial districts.

THE first stage in the inquiry as to the possibility of establishing a beet-sugar industry in this country consists in making cultivation trials in the districts where the industry is likely to be located. Under the superintendence of Mr. G. Clarke, of the County Technical Laboratories, Chelmsford, sugar-beets were grown last year on experimental plots on five different farms. The reports from the growers giving cost and yield per acre are printed, together with the chemical analyses, in a pamphlet published by the Essex Education Committee. The cost of cultivation, manures, and of raising the beets averaged rather more than ten guineas per acre; on a large scale probably eighteen to twenty tons of roots could be grown for about

ten pounds per acre, and it is estimated that the farmer would receive from seventeen to twenty shillings per ton of trimmed roots delivered at the factory.

IN a paper read before the Royal Geographical Society on January 29 Prof. G. F. Scott Elliot gave an account of his observations on the various plants that aid in the formation of alluvial flats in the valleys of such rivers as the Aconcagua, in Chile, and the La Plata. The composite shrub, *Baccharis marginalis*, protected from drought by gum-containing leaves, was found to be one of the first settlers to fix the banks on the Aconcagua, after which other plants, including poplars and willows, could secure a hold, and gradually a river-side wood might be formed; or in the deeper backwaters plants of the nature of *Scirpus americanus* or *Juncus dombeyanus*, and in the shallows species of Eleocharis, spread out their horizontally creeping stems and upright stalks holding the mud and catching the drift until, in the marshy condition, grasses could grow over and fill up the swamp.

AN experimental station for the study of sugar-cane cultivation and of the diseases of the sugar-cane was opened at Samalkot by the Madras Government in 1902. Mr. C. A. Barber presents a report of the work for the year 1903–4 in Bulletin No. 51 of the Department of Land Records and Agriculture, Madras. Two local varieties, Bonta and Yerra, and an introduced cane, Red Mauritius, were selected for special experiment; the Bonta was eaten out by jackals, the Yerra did not suffer much and gave good results, but the Red Mauritius produced the greatest weight of cane and the largest amount of jaggery. The practice of wrapping the canes that is usual in the Godávari district will form the subject of experiment; the older leaves are twisted and wrapped round bamboos fixed in the ground; the object is two-fold, the leaves serving as a protection against jackals, and the bamboo supports preventing the canes being blown down in cyclonic storms.

A TORNADO of considerable violence occurred at Meridian, in the State of Mississippi, on the evening of March 2, involving much loss of life and causing great destruction of property. The tornado is said to have travelled at the rate of seventy-seven miles an hour, and to have passed away in two minutes. It apparently travelled from south-west to north-east, and in its progress it is reported to have ploughed a path 600 feet wide and one mile long.

A SEVERE hurricane occurred in the South Pacific on February 7 and 8, and was attended by very serious loss of life and property. According to the report received in this country from San Francisco, received there through the steamship *Mariposa*, damage to the value of 200,000*l.* was wrought in Tahiti, and it is believed that similar damage was caused in the Tuamotu Islands. The loss of life is rumoured as numbering several thousands. Papiete, situate on the north side of Tahiti, is said to have been inundated, and it would appear that the hurricane was accompanied by a series of high waves. The storm is reported to have struck the islands with a wind velocity of 120 miles an hour at midnight on February 7, and to have continued until four o'clock on the following afternoon. In this part of the world storms usually travel from the north-westward. According to the Admiralty sailing directions for the Pacific Islands, the hot months, December to March, are those in which storms may be expected, and clearly they are of fairly common occurrence in the Society Islands and in the Tuamotu Archipelago, but as a rule the hurricanes do not appear to be so severe as those of the Atlantic and Indian Oceans or of the China Seas. At present the information to hand with respect to the recent storm is very meagre, and further details will be anxiously looked for.

JAPAN has gained her supremacy in the East by a careful and minute study of the methods of the West. It is now the turn of the West to look towards the East for enlightenment, and we do not look in vain. Weather is an important item in commercial prosperity, and the study of it is therefore of the highest importance to every nation. If a country is subject to devastating cyclones, it is of the utmost necessity that inquiry should be set on foot to try to solve the causes of their frequency, and forecast, if possible, their advent, in order to mitigate so far as possible the damaging results which will eventually ensue. One old British possession, a valuable asset to the British Empire, is occasionally visited by these destructive air movements, and instead of concentrating a meteorological attack by erecting a first-class station, the British Government reduces the already microscopic annual grant of 100*l.* to 50*l.* In Japan science is respected, and respected probably because that country knows that scientific method is at the base of progress. In meteorological matters Japan does not mean to be left behind, and as the first duty of a German colonist seems to be to set up a barometer and thermometer and read them, so Japan follows suit by organising a meteorological service in Korea and Manchuria. An article upon this service, and the first-class observatory at Chemulpo, appeared in the *U.S. Monthly Weather Review* for September, 1905, and has already been noticed in these columns (February 15, p. 374).

A CONSPICUOUS and valuable feature of recent numbers of the Proceedings of the Tokyo Physico-mathematical Society is the number of short papers containing simple applications of deductive reasoning to physical phenomena. Thus we have an extension of Gibbs's phase rule to systems in which the potential differences between the phases enter into the equations, by Shizuwo Sano (ii., 25); a theory of the rainbow due to a circular source of light, by K. Aichi and T. Tanakadate (ii., 27); a discussion of the whistle produced by the vibration of a liquid drop, by T. Terada (ii., 26); and an explanation of the existence of secondary vibrations in seismic waves, by H. Nagaoka (ii., 28), based on the supposition that the acceleration due to the elastic force of the rock contains terms proportional to powers of the displacement higher than the first.

"A PROBLEM in Analytic Geometry with a Moral" is the somewhat attractive title of a paper by Prof. Maxime Bôcher in the *Annals of Mathematics*, vii., 1. The problem, which is quite elementary, consists in the determination of all the families of conics which cut a given conic, say $x^2-y^2=1$, at right angles. Taking the intersecting conic as given by the general equation of the second degree, the method of solution is to find the locus of the points the polars of which with respect to the two conics are at right angles, and to make this locus pass through the intersection of the two conics. At this stage the author advises the reader to complete the solution himself before reading further; if he does so, there is considerable probability that he will fail to obtain all the four solutions. The reason of this is that there is one family of orthogonal conics such that the polars of *any* point with respect to one of these conics and the original conic are at right angles, so that the coefficients in the equation of this locus vanish identically. The interesting point is that these conditions determine, not a single curve, but a family of curves with the same degree of generality as the families determined by the other conditions.

A NUMBER of papers on aërial navigation have appeared comparatively recently. Of Captain Ferber's work on stability of aëroplanes mention has been already made (p. 350), and it may be sufficient to add that in this particular connection, contrary to the old adage, "an ounce of theory is worth a pound of practice." But the same writer has since sent us a reprint of papers in the *Revue d'Artillerie* for August last, now published by Berger-Levrault, of Paris, under the title "Pas à Pas, Saut à Saut, Vol à Vol," which, to emulate the author's style, constitutes a comprehensive *vol au vent* of experimental gliding up to date, illustrated by many figures. Turning a little further back to the *Revue scientifique* (5, iii., 24, 25), we find an interesting discussion by M. Bazin of the source of energy in sailing flight of birds. The theory is essentially identical with that brought into prominence by Langley's work, in which variations in wind-velocity account for the phenomenon; but the author has also shown how models can be constructed in which this explanation is illustrated by the motion of a marble rolling on a movable kind of switchback. More recently, in the *Revue générale des Sciences* (xvi., 21), M. M. Léger details his attempts at obtaining the necessary lifting force in a machine of the "plus lourd" type by a combination of "helicopters" (vertical screws) and aëroplanes; his experiments have been carried out with the assistance of the Prince of Monaco. A little further back in the same series Lieut.-Colonel G. Espitallier discusses the materials and construction of balloons. Prof. S. P. Langley's work is described in a pamphlet, reprinted from the Smithsonian report by the Washington Government. A paper has also reached us from Madrid detailing the formation of a Royal Aéreo-Club of Spain. The current numbers of the *Aëronautical Journal* contain too much matter to be summarised here. Attention should, however, be directed to the flying model competition organised by the Aëronautical Society for July of this year.

A COPY of the twenty-sixth volume of the Proceedings of the Dorset Natural History and Antiquarian Field Club has been received. The volume has been edited by Mr. W. Miles Barnes. It contains the presidential address of Mr. Nelson M. Richardson, and, in addition to other contributions, papers by the Rev. O. Pickard-Cambridge, F.R.S., on new and rare British Arachnida; the Rev. E. F. Linton, on Dorset plants; Mr. H. Stillwell, on the returns of rainfall in Dorset; the Rev. H. S. Solly, on the landslip at Lyme Regis; Mr. W. B. Barrett, on the flora of the Chesil Bank and the Fleet; and the president, on first appearances in 1904 of birds, insects, and first flowering plants in Dorset.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF A NEW COMET, 1906*b*.—A telegram from the Kiel Centralstelle announces the discovery of a new comet by Herr Kopff at the Königstuhl Observatory on March 3.

At 14h. 52·8m. (Königstuhl M.T.) on the day of discovery the position of the comet was

R.A. = 11h. 35m. 56s., dec. = +1° 40′,

and the following values were determined for the daily movement:—in R.A. −7′ (−28s.), in dec. +4′.

A second telegram from Kiel announces that Dr. Valentiner, observing at the Königstuhl Observatory, Heidelberg, on March 4, recorded the position of this object as

R.A. = 11h. 35m. 35·8s., dec. +1° 40′ 37″

at 10h. 13·4m. (Königstuhl M.T.).

Thus it will be seen that the comet is in the southern part of the constellation Leo, and was about half-way between *ν* Leonis and *β* Virginis when discovered. It is travelling very slowly in a W.N.W. direction, and is on the meridian about midnight. No intimation of its magnitude has, as yet, been received.

THE RING NEBULA IN LYRA.—In 1902 Dr. Newkirk showed, in his inaugural dissertation for the doctor's degree at Munich, that the central star in the annular nebula in Lyra had a proper motion, and, from the value he obtained for this movement, he deduced the parallax of the nebula, finding it to be 0″·10.

As this was the first nebula for which any proper motion and parallax had been deduced, the verification of Dr. Newkirk's results became a matter of great importance, and therefore Prof. E. E. Barnard has made several measurements, photographic and visual, with the 40-inch refractor at Yerkes Observatory.

The results obtained do not verify those of Dr. Newkirk. According to the latter the total displacement of the nucleus during the five years which elapsed between Prof. Barnard's observations in 1898–9 and those of 1903–4 would have amounted to 0″·90, an easily measurable quantity, but no displacement at all could be detected.

As Dr. Newkirk's parallax for the central star depended upon his value for the proper motion, it must now, according to Prof. Barnard's results, be rejected as fallacious.

The latter observer concludes from his observations that everything in the immediate region of this nebula seems to have the usual fixity of the ordinary small stars (Monthly Notices R.A.S., vol. lxvi., No. 3).

A CLUSTER OF NEBULÆ IN PERSEUS.—In No. 4069 of the *Astronomische Nachrichten* Dr. Max Wolf describes his discovery of a number of small nebulæ in the regions about *β* and Nova Persei. These objects were seen, and their positions measured, on photographs obtained with the Bruce telescope, and they mostly lie in two bands, for which Prof. Wolf gives the positions.

The nebulæ are especially dense where these two bands coalesce, a region of 12′ (of arc) square containing 148 of them. Their forms are generally recorded as "round, with central condensation," and "form of Andromeda nebula."

TWENTY-FIVE NEW VARIABLE STARS.—Circular No. 107 of the Harvard College Observatory contains the positions and magnitudes of twenty-five variable stars recently discovered by Miss Leavitt from the examination of six plates taken with the 24-inch Bruce telescope.

The plates are of fine quality, and probably show altogether some 200,000 star images. The twenty-five variables contained in the list lie in the constellations Orion, Virgo, and Cygnus, and two of them in the last named constellation have magnitude ranges of 3·5 and 3·0 respectively.

THE GLOW SURROUNDING THE LUNAR CRATER LINNÉ.—Some interesting results of observations of Linné are published by Prof. E. E. Barnard in No. 4075 of the *Astronomische Nachrichten*.

The glow surrounding the crater was measured, on various dates between December, 1902, and November, 1904, with a micrometer attached to the 40-inch refractor at Yerkes, and Prof. Barnard concludes that its diameter does vary with the moon's age. The following table represents the curve, obtained from the observational results, for the varying diameters:—

Moon's age d. h.	Diam. of glow ″	Moon's age d. h.	Diam. of glow ″
7 0	6·6	14 0	3·4
8 0	6·0	15 0	3·3
9 0	5·4	16 0	3·3
10 0	4·8	17 0	3·4
11 0	4·3	18 0	3·5
12 0	4·0	19 0	3·8
13 0	3·7		

The diameters have been reduced to the moon's distance on January 12, 1903, viz. 221,820 miles. Whilst not certain of the exact form of the curve after full moon, Prof. Barnard thinks there is no doubt that it rises.

Two measures of the crater itself gave a mean of 0″·63 when reduced to the above distance. This corresponds to an actual diameter of about 3600 feet. Other interesting details of the crater and the glow are given in Prof. Barnard's notes.

THE VERTICAL DISTRIBUTION OF THE METEOROLOGICAL ELEMENTS ABOVE THE ATLANTIC.

IN a previous article (vol. lxxiii. pp. 54–56) we described our expedition to the tropics, and gave the results of the observations with balloons and on mountains, so far as they related to the movements of the upper currents. In the present article we will consider the observations with kites, which furnished nearly continuous records of temperature, humidity, and wind velocity from sea-level to a height of 2300 metres, and the direct observations to a greater height which Mr. Clayton obtained in ascending and descending the tropical peaks on the islands of Teneriffe and Fogo. During a voyage of the White Star steamer *Romanic*, from Boston to Gibraltar, Mr. Clayton executed six kite-flights, and on board the steam-yacht *Otaria*, between latitudes 37° and 10° N., longitudes 16° and 31° W., with the assistance of M. Maurice, seventeen kite-flights were made, besides two in the harbour of Santa Cruz to investigate the sea breeze, and one in latitude 43° 43′ N., longitude 8° 43′ W., for the study of the changes in the free air produced by the total solar eclipse. The observations obtained at the height of 1000 metres, compared with those at sea-level, are given in Tables i. and ii. The first table contains the observations made in a general east and west direction between longitudes 69° and 16° W., latitudes 42° and 33° N. West of the Azores, that is to say, on the westward slope of the permanent area of high pressure, the decrease of temperature with height was slow, there being two cases out of the four in which the temperature increased immediately above the ocean, the average decrease in the thousand metres being but 0°·41 C. On the eastern and southern slopes of the high pressure the temperature decrease approached the adiabatic rate, amounting on the average to 0°·73 C. per hundred metres. The relative humidity diminished with altitude over the western barometric slope and increased in the observations obtained over the eastern slope, while the wind veered and increased with altitude in the former locality and backed with diminishing velocity in the latter. Fig. 1 shows the typical vertical distribution of the meteorological elements to the westward of the Azores.

The observations made at the height of 1000 metres and at sea-level in a general north and south direction, between latitudes 35° and 10° N., appear in Table ii. It will be seen that the temperature decrease is most rapid (average 0°·78 C. per 100 metres) near the northern and southern limits of the north-east trades, and is least rapid within the trade-wind region (average 0°·07 C.), due to the presence of strata with inverted temperature gradients, of which a typical example, with the corresponding changes of humidity, is shown in Fig. 2. The relative humidity varies inversely with the temperature, being slightly greater at 1000 metres just outside the trade wind, and much less at this height within the trade belt. While the observations of wind do not indicate any marked deviation from the north-easterly direction, there is a considerable decrease in the velocity of the trade with increasing height.

Mr. Clayton's study of the data collected in the tropics points to the existence of three strata between the sea and 4000 metres, characterised by differences in tempera-

TABLE I.—*Conditions at sea-level and at* 1000 *metres over the Atlantic, between Longitudes* 69° *and* 16° *West.*

Date	Long. W.	Temperature in degrees Centigrade			Humidity			Wind direction		Wind velocity in metres per second		
		0	1000 metres	Diff.	0	1000 metres	Diff.	0	1000 metres	0	1000 metres	Diff.
1905	°							°	°			
June 3	69	11·0	7·5	− 3·5	86	87	+ 1	—	—	—	—	—
June 6	47	15·8	13·4	− 2·4	96	52	− 44	S. 14 W.	S. 32 W.	8·5	12·0	+3·5
June 7	39	19·8	13·4	− 6·4	90	73	− 17	S. 9 W.	S. 20 W.	5·5	5·7	+0·2
Means	—	—	—	− 4·1	—	—	− 20	—	—	—	—	+1·8
June 10	19	17·5	9·8	− 7·7	68	60	− 8	—	—	—	—	—
July 3	16	23·0	13·3	− 9·7	71	100	+ 29	N. 28 E.	N. 8 W.	7·0	6·5	−0·5
July 4	16	20·8	16·3	− 4·5	—	—	—	—	—	—	—	—
Means	—	—	—	− 7·3	—	—	+ 11	—	—	—	—	−0·5

TABLE II.—*Conditions at sea-level and at* 1000 *metres over the Atlantic, between Latitudes* 35° *and* 10° *North.*

Date	¶ Lat. N.	Temperature in degrees Centigrade			Humidity			Wind direction		Wind velocity in metres per second		
		0	1000 metres	Diff.	0	1000 metres	Diff.	0	1000 metres	0	1000 metres	Diff.
1905	°								°			
Aug. 19, p.m.	35	23·8	15·9	− 7·9	80	90	+ 10	N. 56 E.	N. 56 E.	8·0	13·5	+5·5
Aug. 19, a.m.	35	23·6	14·7	− 8·9	79	96	+ 17	N. 64 E.	N. 64 E.	7·0	10·0	+3·0
Aug. 18, p.m.	34	23·7	16·5	− 7·2	84	92	+ 8	N. 33 E.	N. 26 E.	6·0	5·5	−0·5
Aug. 18, a.m.	34	23·2	15·8	− 7·4	83	90	+ 7	N. 38 E.	N. 50 E.	8·0	10·7	+2·7
Means	—	—	—	− 7·8	—	—	+10·0	—	—	—	—	+2·7
Aug. 14	31	21·7	23·7	+ 2·0	85	18	− 67	N. 6 E.	N. 27 W.	13·0	5·0	−8·0
Aug. 9*	28	23·2	23·9	+ 0·7	72	41	− 31	S.E.	Calm	1·0	0·0	−1·0
Aug. 10*	28	23·6	21·1	− 2·5	82	85	+ 3	N.E.	Calm	3·0	0·0	−3·0
July 12	27	20·3	28·9	+ 8·6	84	9	− 75	—	—	—	—	—
Aug. 4	24	23·0	19·0	− 4·0	76	52	− 24	N. 28 E.	N. 60 E.	8·0	9·0	+1·0
July 15	19	22·7	22·6	− 0·1	89	52	− 37	—	—	—	—	—
July 20	16	24·3	21·2	− 3·1	83	48	− 35	?	N. 57 E.	6·0	10·5	+4·5
July 27†	15	25·7	28·2	+ 2·5	68	13	− 55	E.	N.E.	8·0	9·5	+1·5
July 28†	15	25·2	20·5	− 4·7	60	66	+ 6	N.	S.	7·0	1·5	−5·5
Means	—	—	—	−0·07	—	—	− 35	—	—	—	—	−1·5
July 24	11	26·0	18·7	− 7·3	83	93	+ 10	—	—	—	—	—
July 22	10	24·0	18·0	− 6·0	96	100	+ 4	—	—	—	—	—

* Peak of Teneriffe. † Peak of Fogo.

ture, humidity, cloudiness, and wind. The trade wind, limited to about 1000 metres in thickness, varies in direction between north and east, is damp, and usually carries cumulus or strato-cumulus clouds in its upper portion. Above the surface trade is a current about 2000 metres in depth, varying in direction between north-east and north-west, but coming always from a direction to the left of the lower wind when facing it. This current is extremely dry and potentially warm, and its velocity is usually much greater than that of the lower wind. At their plane of meeting occurs a belt of calms or light winds with a marked inversion of temperature, and this rise of temperature is

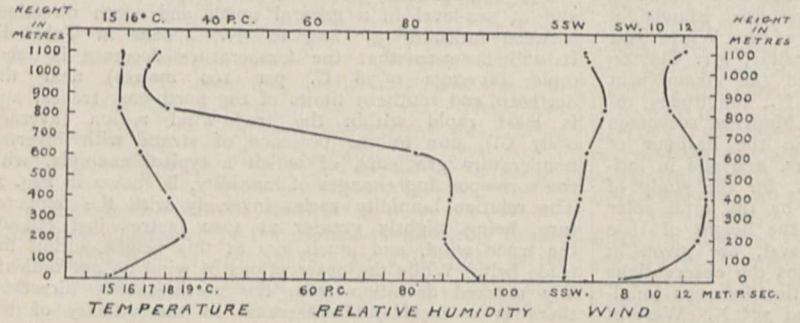

FIG. 1.—Vertical Distribution of Temperature, Humidity and Wind, June 6, 1905; Lat. 40° 33′ N., Long. 46° 43′ W.

accompanied by a very decided fall of humidity, the relative humidity in some cases falling to nearly zero. The third stratum, which begins at a height of about 3000 metres, moves from a direction varying between east and south or south-west, being generally from the east in equatorial regions and from the south between latitudes 15° and 30° N. As observed on the Peak of Teneriffe, this stratum was dry in its lower portion, but had a slightly larger vapour contents than the air immediately below. Alto-cumulus and alto-stratus clouds were seen floating in it at a height of perhaps 4000 metres or 5000 metres, and from them light sprinkles of rain fell occasionally. In passing into this upper current a rise of temperature was noted, but this was less marked than

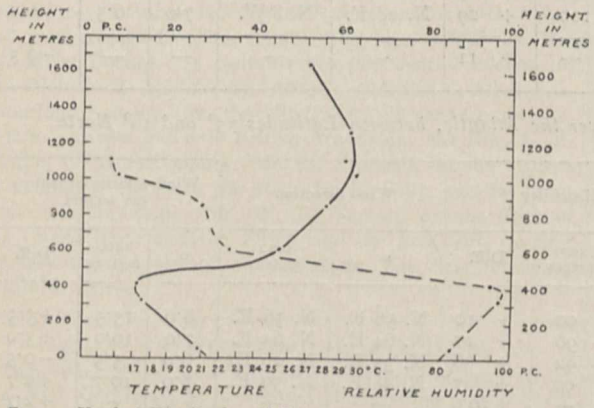

FIG. 2.—Vertical Distribution of Temperature and Humidity, July 12, 1905; Lat. 27° 30′ N., Long. 16° 48′ W.

the rise encountered above the surface trade. Mr. Clayton also deduces the following facts from the observations:—(1) the bases of the cumulus clouds are low over the ocean, rarely exceeding 500 metres; (2) the height of the inverted temperature gradient varies from day to day between 300 metres and 1500 metres, with a probable average of 1000 metres, and its height also appears to undergo a diurnal change, being lowest at night or in the morning and highest in the afternoon; (3) the adiabatic rate of decrease of temperature prevails over the ocean at night as well as during the day.

The vertical distribution of temperature and humidity revealed by our observations up to a height of 4000 metres agrees in general with that found by Prof. Hergesell during the cruises of the Prince of Monaco's yacht in 1904 and 1905 (see *Comptes rendus de l'Académie des Sciences*, January 30, 1905, and *Bulletin du Musée Océanographique de Monaco*, November 30, 1905). From the latter publication it is interesting to learn that a balloon, liberated by Prof. Hergesell on August 7 last far to the westward of the Canary Islands, indicated the same currents which were found by us in the neighbourhood of these islands, since it met the south-east and south-west winds above the north-east trade. It is significant that this balloon reached a greater height than did the other balloons, which showed winds having a northerly component. We perceive that Prof. Hergesell no longer denies the possibility of an upper anti-trade in a lower latitude than the Canaries, but now simply states that in the central part of the Atlantic he found almost exclusively north-west winds, from which he concludes that the route followed by the currents bringing the air from the equator appears to be less simple than had been supposed, and seems to depend on the relative positions of the continents and oceans. The study of the daily isobars over the ocean, which was first made under the direction of Le Verrier in 1864, showed that the pressure is not distributed in uniform belts, and that the isobars are everywhere deflected by the influence of temperature distribution dependent upon the land and sea, relations which were demonstrated by M. Teisserenc de Bort's study of isonormals more than twenty years ago. Hence it would appear that there are certain regions where the anti-trade is more regular than elsewhere, the zone between the Cape Verde and Canary Islands being no doubt one of these; but this view is quite contrary to the idea that the south-east and south-west winds observed in the upper atmosphere near these islands, and hitherto accepted as proof of the anti-trade, are due to local influences, which Prof. Hergesell still affirms to be true.

A. L. ROTCH.
L. TEISSERENC DE BORT.

THE TRANSFORMATIONS OF ROCK-MASSES.[1]

THE study of the changes which rock-masses undergo under natural conditions is in itself by no means an inconsiderable branch of geology, and its pervading importance throughout the whole field of the science brings it continually to the front in stratigraphical as well as petrological research. The literature of the subject is a large one, but until now no serious attempt has been made to deal fully and comprehensively with the principles and phenomena of metamorphism as a whole. Prof. van Hise's wide experience in the Lake Superior region and elsewhere has made him well fitted for a task to which he has devoted seven years of labour; and the outcome of that labour, as represented in the massive volume before us, will have a permanent value for all who come after him in this field.

This treatise, as we are told in the preface, is "an attempt to reduce the phenomena of metamorphism to order under the principles of physics and chemistry, or, more simply, under the laws of energy." Metamorphism is understood to include all alterations of all rocks by all processes. This extension of customary usage may be defended on logical grounds, and it has the advantage of constantly keeping in view the essential unity underlying the complex operations of nature; but it involves a corresponding enlargement of the subject-matter. The scrupulous—almost relentless—manner in which the author follows out in every detail the general scheme of treatment laid down further swells the bulk of the volume, and, brought out in the handsome style which characterises the produc-

1 "A Treatise on Metamorphism." By Charles Richard van Hise. (Monographs of the U.S. Geological Survey, vol. xlvii.) Pp. 1286 and 13 plates. (Washington, 1904.)

tions of the Survey, it is physically not an easy book to handle.

In the first chapter a general discussion leads to the conclusion that the most important factor in metamorphism is the depth of the rocks below the surface. In the upper zone of the earth's crust the chemical changes are such as result in the production of simpler compounds from more complex ones, while in the deeper part the reverse is the case. The starting point of the author's treatment is this antithesis between the upper zone of *catamorphism* and the lower zone of *anamorphism*. It appears to us that, while the broad rule here laid down is doubtless of significance, it has scarcely sufficient precision to serve as a basis of classification. The productions of muscovite from orthoclase, and of natrolite from albite, are, according to this geological distinction, catamorphic changes, but it cannot be said that they result in the formation of simpler from more complex compounds.

The second chapter deals with the forces of meta morphism, and the third with the agents of metamorphism, *i.e.* especially gaseous and aqueous solutions. This involves a *résumé* of the principles of physical chemistry, so far as they are applicable to the subject. Although somewhat handicapped by the author's scepticism concerning the doctrine of electrolytic dissociation, this summary will be very useful to students of geology. Chapter iv. treats of the characteristics of the two zones of metamorphism. The law is found to be that in the zone of catamorphism the alterations are attended by liberation of heat and expansion of volume; in the zone of anamorphism by absorption of heat and diminution of volume. The zone of catamorphism is divided into the belt of weathering, lying above the level of underground water, and the belt of cementation, lying below that level; and the geological processes characteristic of these two belts are contrasted.

Chapter v., which might perhaps have been abridged without impairing the value of the book, considers the actual alterations undergone in nature by each of the rock-forming minerals. The chemical reactions are illustrated by equations, and the percentage increase or decrease of volume is calculated in each case. The precise application of these calculations is perhaps debatable, since special assumptions have to be made regarding such gaseous and soluble substances as take part in the reactions, and in some cases the equations themselves are rather conjectural. The next three chapters are an analysis of the processes of change in the belt of weathering, the belt of cementation, and the zone of anamorphism respectively. Under the last head the most important discussion is that relative to secondary gneissic and schistose structures. The author concludes that "Rock-flow is mainly accomplished through continuous solution and deposition, that is, by re-crystallisation of the rocks through the agency of the contained water. But rock-flow is partly accomplished by direct mechanical strains." The ninth chapter deals with the phenomena of metamorphism of individual rocks, and with this the systematic treatment of the subject ends; but there remain some interesting chapters applying the principles enunciated in this treatment to certain other branches of geology.

Chapter x. discusses the difficulties which metamorphism often introduces into stratigraphical investigation and the manner in which these difficulties may be overcome. The next chapter, which is the most novel part of the book, has for its subject the relations of metamorphism to the distribution of the chemical elements. It is shown that, as compared with the parent igneous rock-masses, most sedimentary rocks become impoverished in certain elements, which are thus segregated in particular deposits. Some of the numerical results are of a surprising kind. Thus, it is calculated that to oxidise the ferrous iron of the original rocks to the ferric state, in which most of it occurs in the sediments, required 35 per cent. of the oxygen now in the atmosphere. To oxidise the sulphur and iron of iron-sulphides to produce the sulphates of the ocean and gypsum deposits, with concurrent transformation of the iron to the ferric form, required one and a half times the oxygen now in the atmosphere. The final chapter, occupying no less than 240 pages, might perhaps have been deemed sufficiently complete in itself for separate publication. It is practically a treatise on the principles of ore-deposition. The subject is one upon which much divergence of opinion is still found. Prof. van Hise, as is well known from his former writings, has devoted long study to it, and the complete exposition which he now offers will be read with general interest. From his point of view, the majority of ore-deposits have been produced by metamorphism, in the broad sense of the term already defined, and it results that the theory of their genesis consists mainly in bringing the phenomena which they exhibit under the general principles of metamorphism. The conclusion is reached that in many cases the ores have resulted from repeated segregations of the kind considered in the preceding chapter.

FIG. 1.—Fairview Dome, Sierra Nevada, from the north; illustrating the manner in which granite scales parallel to the periphery as a result of expansion and contraction due to changes of temperature.

It is impossible to study Prof. van Hise's work without admiring the boldness of his design and the skill with which it is carried out, and being grateful for the stores of carefully arranged information which he has brought together. We must readily admit, too, that he has done good service in insisting upon the necessity for the geologist to familiarise himself with the recent progress of physical chemistry, a knowledge of which, as van 't Hoff and others have shown, is a pre-requisite for attacking many of the most pressing problems of geology. Granting this, however, we may still be permitted to doubt whether a purely geological subject like metamorphism is most advantageously dealt with in the manner which is appropriate to the exact sciences. In such a formal schematic treatment there is some danger of making it appear that our knowledge of metamorphism is to be deduced from chemical principles instead of depending upon observation. Although the criticism would not be a just one in the present case, we venture to express a wish that the author had chosen to describe the facts first and explain them afterwards, and that he had made freer reference to actual rocks and specified localities.

A. H.

A NEW OXIDE OF CARBON.

THE current number of the *Berichte der deutschen chemischen Gesellschaft* (1906, xxxix., p. 689) contains a preliminary communication by Messrs. Otto Diels and Bertram Wolf, of the Berlin University, giving an account of the preparation and properties of a new oxide of carbon having the composition C_3O_2, for which they propose the name *carbon suboxide*. The new oxide is obtained from ethyl malonate, $CH_2(CO_2C_2H_5)_2$, by subjecting the vapour of the latter to the action of phosphorus pentoxide at 300°; under these conditions two molecules of water are removed by the action of the latter reagent, and a mixture of ethylene and carbon suboxide formed, the reaction being expressed by the equation

$$CH_2(CO_2C_2H_5)_2 = 2C_2H_4 + 2H_2O + C_3O_2.$$

The ethylene and carbon suboxide are condensed together in a receiver cooled with liquid air, and subsequently separated by fractional distillation.

Carbon suboxide is a gas at the ordinary temperature, which burns in the air with a smoky flame, has a most penetrating smell, resembling that of acroleïn and mustard oil, and attacks the eyes, nose, and respiratory organs violently. On cooling it condenses to a colourless, highly refractive liquid, which boils at 7° under 761 mm. pressure. The results of the analysis and of the determination of the vapour density show that the molecular formula is C_3O_2.

Carbon suboxide at once combines with water, re-forming malonic acid, and also unites with ammonia, hydrogen chloride, and aniline, forming malonamide, malonyl chloride, and malonanilide respectively; it therefore contains the chain of carbon atoms previously existing in the malonic acid derivative from which it is prepared, and in all probability possesses the constitution represented by the formula OC : C : CO. Hence in both its constitution and properties it has a close analogy with the metallic carbonyl derivatives, and especially with Mond, Langer, and Quincke's nickel tetracarbonyl, $Ni(CO)_4$.

When the liquid suboxide is sealed in glass tubes it slowly undergoes change at the ordinary temperature, and is finally converted into a dark red solid, which dissolves in cold water, yielding an intense eosin-red solution. At higher temperatures the alteration takes place much more rapidly, and the product is then no longer completely soluble in water. The nature of the changes here taking place is still under investigation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—One hundred and fifty-five students have entered for the First Part of the natural sciences tripos and twenty-five for the Second Part in the coming June. In the mechanical sciences tripos there are fifty candidates. These figures show a considerable increase in the numbers for the last few years. There are seventy-seven in for the First Part of the mathematical tripos, and seven entered for the Second Part.

The Vice-Chancellor has announced that the Girdlers' Company has offered to renew, for a further period of three years, its grant of 100*l.* a year towards the study of economics in Cambridge.

The General Board of Studies has approved for the degree of doctor in science Mr. F. W. Keeble, Gonville and Caius College.

The Special Board for Physics and Chemistry has agreed to expend its share of the Gordon Wigan Fund as follows:—(1) A sum of 50*l.* per annum is to be granted to the department of chemistry for five years for the establishment of a prize or otherwise for the encouragement of research in chemistry. (2) The balance of the income is to be used for the assistance of research and teaching amongst the departments of the University directly connected with the Board, other than that of chemistry, it being understood that on the average the departments should share equally. (3) Applications for grants are to be made by the heads of departments and be considered at a meeting of the Special Board held not later than the division of the Michaelmas term in each year. Grants not exceeding 74*l.* have been made out of the balance on income account for 1905 to the departments of physics and mineralogy to defray the cost of special apparatus.

IT is reported from Berlin that Mr. Alfred Beit has presented 100,000*l.* to Hamburg for the establishment of a university.

THE Goldsmiths' Company has made a grant of 1000*l.* to the building and endowment scheme for Bedford College, University of London. The Grocers' Company has granted 25*l.* for the same purpose.

THE Goldsmiths' Company has made a grant of 10,000*l.* to the Institute of Medical Sciences Fund, University of London, on the assumption that a site will be provided for the institute at South Kensington.

PRESIDENT THOMAS, of Bryn Mawr College, has announced, says *Science*, a gift of 16,000*l.* from Mr. John D. Rockefeller, to enable the college to meet the expenses incurred by the trustees over and above the gift of 50,000*l.* in 1902 for the new library. Mr. Rockefeller has contributed in all 91,000*l.* to the college. From the same source we learn that McGill University will receive 10,000*l.* from the estate of the late Mr. Edwin H. King, former general manager of the Bank of Montreal.

MR. F. C. FORTH, principal of the Municipal Technical Institute, and director of technical instruction for Belfast, has compiled a very useful "Student's Guide to Prizes and Scholarships." The guide is primarily intended for the information of present and future students of the institute over which the compiler presides, but, as it contains details of scholarships at universities and other institutions of higher education, it should appeal to a wide circle of students elsewhere. The guide demonstrates in a convincing manner the numerous facilities in existence to assist earnest students of slender means to continue their education so far as their abilities allow.

MR. WYNDHAM, M.P., delivered an address at the distribution, on March 3, of prizes won by the students of the Dover municipal schools of science, art, and technology. He said the study of science is the study of truth. The pursuit of science is not beset by those pitfalls which are now called "terminological inexactitudes." In science, if the cause is known the effect can be foretold; it is the only safe form of prophecy. The pursuit of pure science is the noblest calling to which earnest endeavours can be given. The present age is preeminently the age of science, and all who study it feel they are comrades in the great quest for truth. The pursuit of science has brought in its train gifts of various kinds, and to the worker in technology it has brought perhaps the greatest gift that anyone can obtain—the gift of independence, not only pecuniary independence, but the gift to men and women of an ample field for their own energy in which they can win distinction, and at any rate justify their existence upon earth.

ON February 28, in the presence of a large and representative gathering of agriculturists, representatives of county councils, the Scotch Education Department, and others interested in agricultural education, Lord Balfour of Burleigh formally opened the new buildings of the Edinburgh and East of Scotland College of Agriculture. The new buildings, situate in George Square, Edinburgh, consist of well equipped chemical, botanical, and bacteriological laboratories and lecture-rooms, and class-rooms for the various other subjects which form part of the college course. Adequate provision is also made for the staff of lecturers engaged in extension work in the counties. The cost of the present scheme has amounted to more than 9000*l.*, and has been almost entirely met by grants from the Scotch Education Department, the Carnegie Trust, the Highland and Agricultural Society, and subscriptions from landowners and farmers. In the course of an interesting address, Lord Balfour referred with satisfaction to the improved relations which now exist between the farmer and those engaged in the work of agricultural education and in the application of the various sciences to the investigation of agricultural problems.

THE Education Committee of the London County Council has issued a report, drawn up by a subcommittee, dealing with the question of apprenticeship. A carefully thought out scheme of scholarships for particular cases is, the report states, the only effective, as well as the only legal, substitute for the old-fashioned apprenticeship premium within the reach of a local authority. The report shows that there are in London various apprenticeship charities with an aggregate income of 24,000*l.* a year, and not more than one-third of this sum has been expended in the payment of premiums. It is suggested that these funds might with advantage be devoted to technical scholarships for poorer children in higher elementary schools, or to the maintenance of boys while they are attending day technical instruction, and thus unable to earn wages. Attention is directed in the report to the lack of technical training in London, and the subcommittee urges that if the apprenticeship system is destined to disappear, it is necessary to find a substitute for such training. Scholarships tenable at evening classes, industrial scholarships at day technical classes, and at trade schools, and the part-time system by which the boy or girl spends a portion of the day in the workshop and the remainder in a day technical school, are mentioned as ways of training which will take the place of the old indentured apprenticeships.

THE scheme of training urged upon the London County Council by its Education Committee as a substitute for the apprenticeship may be summarised briefly as follows:—The intelligent boy, as he leaves the elementary school, will have offered him the choice of two courses of instruction which will assure him an all-round training in a skilled trade. There will be, first, the "part-time" system, in which he will spend a portion of the week in the workshops and the remainder in the day technical school, and, secondly, there will be evening classes. In certain cases scholarships carrying free tuition and a maintenance grant will be awarded to the day students to compensate for the small earnings received during the years of training. Other scholarships of less value will be allowed to some of the evening students in order to encourage regularity of attendance. From this class of student will be drawn the skilled worker of the future. The boy, as he leaves the higher elementary school, will be able to enter the day trade school, either by paying the fees himself or by winning one of the trade scholarships. With this stream of boys coming from the higher elementary school will mingle another stream of boys who, having completed their course at the secondary school, have competed for one of the trade scholarships. From this class of student will be drawn the future foremen and managers of industrial undertakings. Finally, a development of the senior County Council scholarships will make it possible, not only for intermediate scholars, but also for certain of the holders of trade scholarships, to proceed, for the highest technological instruction in the engineering, electrical, chemical, or other industries, to the university. From these will be drawn, we may hope, the future inventor, the future managers of large businesses, and the future "captains of industry." A somewhat less elaborate system will afford similar facilities for girls.

THE science laboratories and class-rooms at Dulwich College have long been inadequate for the demands made on them. The governors of the school, with their chairman, Lord Davey, have now, owing to the cooperation of the Estates Governors with the Charity Commissioners and the Board of Education, been able to commence the building of a new science school, the foundation-stone of which was laid with due ceremony on Saturday last by Lord Rayleigh, P.R.S. The school is to consist of two floors, the upper for chemistry, providing an advanced laboratory, a large combined lecture-room and laboratory, a junior laboratory, a separate lecture-room with preparation store, and balance rooms; the lower for physical science, and containing a senior and junior laboratory, two lecture-rooms, and a school museum. Provision is also made for a master's room, a photographic dark-room, and a small workshop. The building is being erected from the plans of the school architect, Mr. C. E. Barry. In his speech in the great hall Lord Rayleigh contrasted the old and present position of science in schools. He pointed out that scientific spirit and method should be the aim of the teaching. In the present-day provision of elaborate apparatus and fittings things were in danger of being made too mechanical. He mentioned the simple apparatus used by Maxwell, and by Hughes for the microphone, who carried simplicity almost to an absurdity. The charms of accurate measurement were briefly touched upon. He thought there was also a tendency to try and cover too much ground in science teaching at schools; less, more thoroughly done, would be better. His own classical education was not literary enough; he was taught no English composition. Modern languages would be better than Greek for very many boys.

THE London Inter-collegiate Scholarships Board was constituted in 1904 with the approval of the governing bodies of University College, King's College, and the East London College, for the purpose of holding a combined annual examination for entrance scholarships and exhibitions tenable at those colleges. One examination has been held already, and with satisfactory results. The next examination will take place in London on May 15 and following days. The competition is limited to those who have not previously been students at any one of the colleges, except where the contrary is stated. No candidate will be admitted to the examination unless he has passed the matriculation examination of the London University, or any examination accepted by the University in lieu thereof, or is the holder of a school leaving certificate, or is able to furnish some evidence of having had a sound general education which is satisfactory to the Board. Application should be made to the secretary of the Board, University College, London, Gower Street, W.C., for forms of entry, which must be returned not later than May 1. Any scheme tending to diminish the number of examinations to which pupils in secondary schools are subjected is to be welcomed, and we trust that the schoolmasters of London will appreciate the efforts of this Board. The insistence upon the possession of a good general secondary education by the holders of scholarships at the group of colleges concerned is a step in the right direction, and it is to be hoped this example will be copied by similar institutions throughout the country.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 2, 1905.—"On the Electr Resistance to the Motion of a Charged Conducting Sphere in Free Space or in a Field of Force." By G. W. **Walker.** Communicated by Prof. A. E. H. Love, F.R.S.

November 16, 1905.—"First Photographs of the Canals of Mars." By Prof. Percival **Lowell,** Flagstaff Observatory, Arizona. Communicated by Sir Norman Lockyer, K.C.B., F.R.S.

With this paper the author communicates a number of photographs which undeniably prove the objective reality of the Martian canals. From a large number of photographs obtained by Mr. Lampland during May and June, 1905, five have been selected for publication, and when these are studied with the contemporaneous, yet quite independent, drawings made by Prof. Lowell, the more prominent canaliform features on the Martian disc are plainly seen.

The photographs show, so far as the grain of the photographic plate permits, that the canals are narrow and direct lines following arcs of great circles or curving in a systematic manner. There is evidence, although for the present the author does not care to assert it definitely, that both a *double* canal and a *double* oasis have been photographed.

One remarkable result that has accrued from Mr. Lampland's researches is the increased efficiency to be obtained by diaphragming down the objective, so that its effective aperture becomes equal to, or less than, the length of the atmospheric waves obtaining at the moment of observation. If the aperture is so large that more than one such wave is in front of the objective at the moment of exposure, poor definition results, caused by the consequent quiver in the rays from the planet; but if only one wave be included, the atmospheric displacement of all the rays is homogeneous, and good definition results.

In obtaining the photographs a colour screen and Cramer isochromatic plates were employed, and the camera was made movable so that numerous successive photographs might be obtained on the same plate, thereby greatly increasing the chance of obtaining at least one well defined photograph at each observation. About 700 images of the planet were secured in this way during the short time that it was favourably placed for such work during the opposition of 1905.

December 7, 1905.—"On Mathematical Concepts of the Material World." By Dr. A. N. **Whitehead**, F.R.S.

January 25.—"Galvanic Cells produced by the Action of Light.—The Chemical Statics and Dynamics of Reversible and Irreversible Systems under the Influence of Light." (Second Communication.) By Dr. Meyer **Wilderman**. Communicated by Dr. Ludwig Mond, F.R.S.

February 15.—"The Chemical Constitution of Protoplasm as shown by the Rate of Tissue Disintegration." By Dr. H. M. **Vernon**.

If a kidney be perfused with saline solution for five to eight days, it is found that from 28 per cent. to 60 per cent. of the tissues pass into solution. These constituents consist of proteid and proteid disintegration products, and contain a good deal of the peptone-splitting ferment erepsin. Sometimes the passage of the kidney tissue from life to death is quite gradual, with no accompanying disintegration. At other times it takes place suddenly, and the proteid and ferment washed out of the kidney may very quickly increase four- to twenty-fold, and then dwindle away again. Sudden and very marked disintegration is invariably produced by adding ether or chloroform to the perfusion liquid. Sudden death produced by perfusion with NaF does not lead to any sudden disintegration. The rate of disintegration is extremely responsive to changes in the perfusion liquid, *e.g.* substitution of 1 per cent. saline for 4 per cent. saline caused a thirty- to sixty-fold increase in the disintegration both of ferment and proteid groups. On the other hand, if already perfused saline were sent through the kidney a second time, the proteid disintegration might be *diminished* to a seventh its previous value, but the ferment disintegration *increased* even twenty-fold.

After the first few hours' perfusion, a roughly constant amount of nitrogen continues to break away from the tissues in a non-proteid form, though the proteid breaking away at the time may vary as 1 to 1300. It is produced by autolysis. Almost the whole of the nitrogen is present in the tissues as potential proteid, and may be made to break off as actual proteid; but if the kidney be perfused with saline containing 0·1 per cent. of lactic acid—which has no action on ordinary proteid—more than half the unstable potential proteid of the tissues is split up.

These results seem to indicate that the difference between living and dead tissues is one of degree rather than of kind, for the dead tissues show great lability, and their self-decomposition is greatly augmented by stimuli.

Anthropological Institute, February 13.—Prof. W Gowland, president, in the chair.—Two clay images used by the A-Kikuyu of British East Africa in harvest ceremonies, and a slide showing four remarkable dance armlets used by the natives on these occasions: **Secretary**. The images were about 9 inches in height, and were very rude representations of the human figure; they appear to be greatly venerated by the natives; the two specimens shown were, so far as is known, the only ones that have reached Europe.—Selection of slides showing rude stone monuments in Glamorganshire: A. L. **Lewis**. The author described the monuments at Tinkinswood, near Cardiff, the fine cromlech at St. Lythian's which bears close resemblance to that at Kit's Coty House. At Pontypridd there is a curious group of stones consisting of a rocking stone, surrounded by two circles and two small curved avenues forming the head and tail of a serpent. This group has been considered by many to be ancient, and ingenious theories have been woven round it, but Mr. Lewis was able to prove conclusively that the stones had not been in position for very much longer than fifty years. Mr. Lewis also showed slides of the dolmen at Lanyon Quoit.—Notes on Deluge legends, tracing their distribution: N. W. **Thomas**.

Linnean Society, February 15.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—A lantern demonstration of the developmental changes in Zoogloœa: Dr. H. C. **Bastian**. Masses of Zoogloœa in their early stage were first shown, in which the constituent bacteria were plainly recognisable. The growth of the masses, their alteration in appearance and in reaction to staining fluids, together with the progressive segmentation which they undergo, were revealed by other specimens. Segmentation was shown to progress until minute spherical or ovoidal units were produced. During the first three to five days, while these changes are occurring, the masses remain colourless and the ultimate segmentation units develop into flagellate Monads, or, more rarely, into equally minute Amœbæ—myriads of one or of the other of these forms appearing (all of about the same size) where a few hours before they were absent. Later, from fifth to tenth day, the ultimate segmentation units of other masses appear as aggregates of brown fungus-germs. Often the masses as a whole become brown before segmentation has much advanced, and the different stages were shown by which the bacterial aggregates are completely converted into masses of brown fungus-germs, together with the development of hyphæ therefrom. All the stages in the complete conversion of the Zoogloœa masses into Monads or Amœbæ in the one case, or into brown fungus-germs in the other, are clearly recognisable, though it is impossible to say from the appearance of the masses in their early stages which of these three interchangeable forms of life will ultimately be produced.—The structure of *Isis hippuris* (Linnæus): J. J. **Simpson**. The species in question is the only one remaining in the genus, the other eighteen formerly included having at various times been removed to other genera of Alcyonaria. It is widely distributed, being found in Iceland, the Mediterranean, Indian and Pacific Oceans, though no specimen was found in the *Challenger* collections. The investigation was conducted on a series of specimens obtained by the Indian survey ship *Investigator*, from the surf-line and from 20 fathoms in the Andaman Sea.—Note on the distribution of the genus Shortia (Torr. and Gray): B. Daydon **Jackson**. By the aid of lantern-slides, the distribution of the genus was indicated, and various species described, with their distinguishing characters shown.

Zoological Society, February 20.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—A new drawing of the skeleton of the Triassic rhynchocephalian, *Rhynchosaurus articeps*, from the Keuper Sandstone of Shropshire: Dr. A. Smith **Woodward**.—Breeding experiments with Lepidoptera: L. **Doncaster** and the Rev. G. H. **Raynor**. The species used were *Angerona prunaria* and its var. *sordiata*, and *Abraxas grossulariata* and its var. *lacticolor*. In *A. prunaria* the banding of the var. *sordiata* was dominant over its absence in the type, but the speckling characteristic of the type appeared in the heterozygote, so that the latter was both banded and speckled. The characters appeared to segregate in the typical Mendelian manner, but in several families there was an excess of *prunaria* over *sordiata*. In *A. grossulariata* the var. *lacticolor* was a Mendelian recessive, but was normally found only in the female. By pairing a heterozygous male with a *lacticolor* female, *lacticolor* males and females were obtained. *Lacticolor* male × female gave only *lacticolor*; *lacticolor* males by heterozygote females had given all males of the type, all females *lacticolor*.—Tracheophone Passeres: W. P. **Pycraft**. The author proposed to make the Tracheophone Passeres one of four great divisions of the passerine stem. The most primitive of the divisions would contain the Eurylæmidæ, Cotingidæ, and Philepitta. The second would be represented by the Tracheophonæ, the third by the Tyrannidæ and Pittidæ, and the fourth by the rest of the Passeres.—A collection of mammals made by Mr. C. H. B. Grant at Knysna, and presented to the National Museum by Mr. C. D. Rudd: O. **Thomas** and H. **Schwann**. The collection consisted of about 150 specimens, belonging to 31 species or subspecies, of which the most noticeable was Mrs. Rudd's golden mole (*Amblysomus corriae*), the description of which had already been laid before the society. A new generic name, Nototragus, was applied to the grysbok, which differed from the other

members of Raphicerus by its possession of supplementary hoofs.—Habits of the Australian lung-fish (*Ceratodus forsteri*) as observed in the society's menagerie: Prof. B. **Dean.**

Royal Meteorological Society, February 21.—Mr. Richard Bentley, president, in the chair.—Report on the phenological observations for 1905: E. **Mawley.** As affecting vegetation, the weather of the phenological year ending November, 1905, was chiefly remarkable for the dryness and mildness of the winter months, the drought and frosts in May, the long spell of hot and dry weather in July, and an exceptionally cold period in October.—Brief discussion of the general features of the pressure and wind conditions over the trades-monsoon area: W. L. **Dallas.**—The dispersal or prevention of fogs: Dr. W. B. **Newton.**

CAMBRIDGE.

Philosophical Society, January 29.—Prof. Thomson, vice-president, in the chair.—The expansion of a gas into a vacuum and the determination of the specific heat at constant pressure for gases: G. F. C. **Searle.** If gas, which is initially stored in a receiver at a high pressure, be allowed to expand into an exhausted vessel, and if the temperature of the whole mass of gas be allowed again to become uniform, without any gain or loss of heat, the final temperature (t') will differ from the initial temperature (t) unless U, the energy of a gram of gas, is independent of the volume. For a gas obeying Van der Waals's equation $(p+a/v^2)(v-b)=Rt$, it is shown that, when the volume of one gram increases from v to v', the change of temperature is given by $t-t'=a/C_v(1/v-1/v')$. Regnault's method of determining the specific heat of gases at constant pressure is shown to be an extreme case of the Thomson-Joule porous plug experiment.—The action of radium and other salts on gelatin: W. A. D. **Rudge.** The author has shown that barium salts produce the same effect upon gelatin as is the case with radium salt, and concludes from his experiments that radium has no specific action upon gelatin, any result obtained being due to the action of the barium in the radium salt upon the sulphur compounds present in the gelatin.—A novel instrument for illustrating the magnetic properties of iron: A. H. **Peake.** In this instrument a strong magnetic field is produced by sixteen bar magnets; this field, which is normally horizontal, may be slightly inclined at will by rotating a turn-table, to which the permanent magnets are attached, through a few degrees. The specimen of iron under test is very thin in proportion to its length; it is supported in a freely pivoted cradle to which a control weight and a long pointer are attached; the axis of the cradle is in the same straight line with that of the turn-table.—The susceptibility of iron in colloidal solution: E. F. **Burton** and P. **Phillips.** The paper is an account of experiments made to determine the susceptibility of a colloidal solution of iron in methyl alcohol. The susceptibility found indicates that iron in colloidal solution has much stronger magnetic properties than it would have if it existed merely as a ferric (or ferrous) salt in the solution; on the other hand, the magnetic properties are weaker than those of pure iron. The results seem to point to the conclusion that each particle in the colloidal solution consists of a core of pure iron surrounded by a layer of some compound of iron, *e.g.* the hydroxide.

MANCHESTER.

Literary and Philosophical Society, January 16.—Sir William H. Bailey, president, in the chair.—Behaviour of liquid films formed from a solution of saponin in water: H. **Stansfield.** Although saponin films have very little mobility, they are capable of becoming extremely thin. The limiting thickness of a black saponin film is comparable with that of the thinnest soap film. In the process of thinning, the saponin films exhibit a grey stage; and there are two characteristic abrupt changes in thickness, the first from the white of the first order to the grey, and the second from the grey to the black.—Battack printing in Java: J. **Allan.** The process of battacking is more akin to dyeing than to printing. The white cotton is first freed from the starchy and saline matter of the "finish" by frequent washings and exposure in the wet condition to the sun. When thoroughly dried and cut into sarong lengths it is ready to be printed. The whole fabric is immersed in a dye bath, the parts not intended to be coloured being protected by previously overlaying them with a coating of wax, placed on in such a way as to form a design. In the coarsest cloths the design is drawn in with a thick brush by the women; in those of finer quality it is stamped with a metal die by the men.—Remarks on the germinal layers of vertebrates and on the significance of germinal layers in general: J. W. **Jenkinson.**

January 30.—Mr. Francis Nicholson in the chair.—The origin of the salt in the sea: R. L. **Taylor.** The paper was a contribution to the controversy which began more than thirty years ago between Dr. Sterry Hunt and David Forbes. Hunt (whose views Mr. Taylor endorsed) contended that on the original cooling of the globe, and before the condensation of the water, the alkali metals, sodium and potassium, existed in the crust of the earth entirely as silicates, the primitive atmosphere containing the chlorine as hydrochloric acid, and also probably sulphuric acid. When the water condensed these acids dissolved in it, and the primitive ocean was thus really dilute acid. This acid, however, soon became neutralised as it vigorously attacked the silicates of which the crust of the earth was composed. The calcium and magnesium, dissolved out of the primitive rock at the same time as the alkalies, have been gradually replaced by sodium carried down as carbonate by rivers.

February 13.—Sir William H. Bailey, president, in the chair.—Report on the recent Foraminifera from the coast of the island of Delos, part iii., Lageninæ: H. **Sidebottom.** The writer directed attention to the points of difference that occur in the same species, and stated that some of the species found have not previously been reported from the Mediterranean. Drawings of the most interesting forms obtained were exhibited and described.

PARIS.

Academy of Sciences, February 26.—M. H. Poincaré in the chair.—Researches on some metals and minerals found in the excavations at Susa, in Persia: M. **Berthelot** and G. **André.** The objects examined come from the earliest Elamite period, earlier than 750 B.C., and analyses are given of articles of silver, copper, bronze, lead, and lead silicate.—The propagation of a movement round a centre in an elastic homogeneous and isotropic medium: study of the wave correlative to the variations in density: J. **Boussinesq.**—Some difficulties presented by the estimation of carbon monoxide in gaseous mixtures: Armand **Gautier** and M. **Clausmann.** Synthetical mixtures of carbon monoxide with hydrogen and air were analysed by absorption with cuprous chloride and explosion with oxygen. It was found that the absorption by cuprous chloride, even in two successive treatments, was never complete, and that measurable amounts of carbon monoxide escaped oxidation by explosion.—An important inequality in the study of quasi-waves of shock: P. **Duhem.**—The addition of hydrochloric acid to isobutylene oxide, $(CH_3)_2.C\overset{O}{\diagdown\!\diagup}CH_2$: Louis **Henry.** Isobutylene oxide reacts with concentrated hydrochloric acid, a new chlorhydrin, $(CH_3)_2.CCl.CH_2(.OH)$, being formed. The starting point for the preparation of the isobutylene oxide was the isomeric chlorhydrin, $(CH_3)_2.C(OH).CH_2Cl$, prepared from monochloracetone by Grignard's reaction. The physical and chemical properties of these closely related isomers are compared.—M. Heim was elected a correspondant for the section of mineralogy in the place of M. de Richthofen.—The perpetual secretary announced the death of M. A. F. A. Bienaymé, correspondant for the section of geography and navigation.—Observations of the Brooks comet (1906*a*) made with the large equatorial of the University of Bordeaux: E. **Esclangon.**—The indeterminateness of a function of a variable in the neighbourhood of a transcendental singularity: Pierre **Boutroux.**—Fourier's series: Léopold **Fejér.**—The integrals of a differential equation in the neighbourhood of a di-critical point: H. **Dulac.**—The application of the analysis of Dirichlet to quadratic forms with coefficients: P. **Fatou.**—The theory of spectra: Ivar **Fredholm.**—The vibrations of an elastic body the surface

of which is at rest: A. **Korn.**—A particular case of the problem of *n*-bodies: Thadée **Banachiewitz.**—The exact significance of Carnot's principle: Louis **Fredoy.**—Lævorotatory lactic acid: E. **Jungfleisch** and M. **Godchot.** *l*-Lactic acid is much more easily transformable than the *d*-acid into the (*d*+*l*) acid, and increased care in working is in consequence necessary. The crystallised lævo-acid melts at 27° C., at approximately the same temperature as the dextro-acid.—The cysts of Glœosporium and their *rôle* in the origin of yeasts: P. **Viala** and P. **Pacottet.**—*Stellosphaera mirabilis*, a new larva probably belonging to an abyssal form: R. **Kœhler** and C. **Vaney.**—The recuperative effects of raw meat after fasting: Charles **Richet.** Experiments on dogs comparing the recuperative effect after fasting of cooked meat, broth, and raw meat showed that the latter food is the most efficacious.—Study of the variations in the toxicity of the contents of the small intestine: modifications of the blood: MM. **Charrin** and **Le Play.**—The tectonic of the massif of the Dent Blanche: Émile **Argand.**—The geology of Ifèrouane: R. **Chudeau.**

NEW SOUTH WALES.

Royal Society, December 6, 1905.—Mr. H. A. Lenehan, president, in the chair.—A method of separating the clay and sand in clay soils and those rich in organic matter: L. **Cohen.**—Latitude of the Sydney Observatory; appendix to a paper on the provisional determination of astronomical refraction, from observations made with the meridian circle instrument of the Sydney Observatory: C. J. **Merfield.** An alteration in the accepted value ($\phi_0 = -33° 51' 41''{\cdot}55$) is regarded as unwise until the question is more completely discussed.—Sociology of some Australian tribes: R. H. **Mathews.** The author stated his opinion that among the social institutions of a primitive people there is none of greater interest and value to the anthropologist than the study of these social systems. He also expressed his conviction that neither "sexual promiscuity" nor "group marriage" has ever existed among the Australian aborigines.—An undescribed species of Leptospermum and its essential oil: R. T. **Baker** and H. G. **Smith.** "The lemon-scented Leptospermum," the species described in this paper, occurs in the north coast district of New South Wales and the southern coast district of Queensland. It is a shrub attaining a height from 6 feet to 12 feet, with erect branches and small, lanceolate, ovate leaves, the flowers occurring in the axils of the leaves on the upper branchlets. The fruits measure about two to three lines in diameter. Its differentiation from described species is based on both morphological and chemical characters, although the former are alone sufficiently marked to warrant its specific rank.

DIARY OF SOCIETIES.

THURSDAY, MARCH 8.

ROYAL SOCIETY, at 4.30.—The Microscopic Changes in the Nervous System in a Case of Chronic Dourine or "Mal de Coit," and Comparison of the Same with Those found in Sleeping Sickness: Dr. F. W. Mott, F.R.S.—On the Relationship between Hæmolysis and Phagocytosis of Red Blood Cells: Dr. R. D. Keith.—Upon the Properties of an Anti-typhoid Serum obtained from the Goat: Dr. A. Macfadyen.

ROYAL INSTITUTION, at 5.—The Physiology of Plants: F. Darwin, For. Sec. R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—A New Single-Phase Commutator Motor: V. A. Fynn.

MATHEMATICAL SOCIETY, at 5.30.—On Function Sum Theorems connected with the Series $\sum_1^\infty x^n/n^2$: Prof. L. J. Rogers.—On Sommerfeld's Diffraction Problem and on Reflection by a Parabolic Mirror: Prof. H. Lamb.—On Series of Zonal Harmonics: Prof. T. J. I'A. Bromwich.

FRIDAY, MARCH 9.

ROYAL INSTITUTION, at 9.—Some Dietetic Problems: Dr. R. Hutchison.

PHYSICAL SOCIETY, at 8.—The Velocities of the Ions of Alkali Salt Vapours at High Temperatures: Prof. H. A. Wilson.—Some Experiments on Earth Currents at Kew Observatory: Dr. Harker.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Preliminary Account of Flash Spectra taken August 30, 1905: Dr. S. A. Mitchell.—Note on Certain Anomalies observed in Radial Velocity Curves: Dr. Alex. W. Roberts.—The Total Solar Eclipse of January 3, 1908: Dr. A. M. W. Downing.—On the Variable Star 38, 1905, RX Andromedæ: A. Stanley Williams.—(1) Discussion of Greenwich Observations of the Sun, 1864-1900: (2) Discussion of Greenwich Observations of Venus, 1869-1900: P. H. Cowell.

MALACOLOGICAL SOCIETY, at 8.—Descriptions of twenty-seven Marine Gastropoda, and one Scaphopod, from the Persian Gulf and Gulf of Oman: J. C. Melvill.—Note on *Capulus lissus*, Smith: J. C. Melvill.—Mollusca from a Rainwash, 150 ft. O.D. at Harlton: Rev. R. Ashington Bullen.—Report on a Small Collection of Land and Freshwater Shells from Uganda, with Descriptions of two New Species of Limicolaria and one of Martensia: H. B. Preston.—On New Species of Polyplacophora from South Australia: W. T. Bednall and E. H. V. Matthews.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Design of a Two-hinged Spandrel-Braced Steel Arch: R. Freeman.

SATURDAY, MARCH 10.

ROYAL INSTITUTION, at 3.—The Corpuscular Theory of Matter: Prof. J. J Thomson, F.R.S.

MONDAY, MARCH 12.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Recent Journeys in the Rhodope Balkans: Colonel F. R. Maunsell, C.M.G.

SOCIETY OF ARTS, at 8.—Fire, Fire Risks, and Fire Extinction: Prof. Vivian B. Lewes.

TUESDAY, MARCH 13.

ROYAL INSTITUTION, at 5.—Food and Nutrition: Prof. W. Stirling.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Widnes and Runcorn Transporter Bridge: J. J. Webster.

THURSDAY, MARCH 15.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* A Discussion of Atmospheric Electric Potential Results at Kew from Selected Days during the Seven Years 1898 to 1904: Dr. C. Chree, F.R.S.—On the Specific Heat of, Heat Flow from, and other Phenomena of, the Working Fluid in the Cylinder of the Internal Combustion Engine: Dugald Clerk.

CHEMICAL SOCIETY, at 8.30.—The Interaction of well dried Mixtures of Hydrocarbons and Oxygen: W. A. Bone and G. W. Andrew.—The Explosive Combustion of Hydrocarbons: W. A. Bone and J. Drugman.—The Occurrence of Marsh Gas amongst the Decomposition Products of Certain Nitrogenous Bases as a Source of Error in the Determination of Nitrogen by the Absolute Method: P. Haas.—Studies on Comparative Cryoscopy. Part IV. The Hydrocarbons and their Halogen Derivatives in Phenol Solution: P. W. Robertson.—The Displacement of Acid Radicles. I. Displacement of the Chloride and Nitrate Radicles: A. F. Joseph.

ROYAL INSTITUTION, at 5.—The Physiology of Plants: Francis Darwin, For. Sec. R.S.

LINNEAN SOCIETY, at 8.—Discussion on the Origin of Gymnosperms: Opened by Prof. F. W. Oliver, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Languages of India and the Linguistic Survey: Dr. George A. Grierson.

FRIDAY, MARCH 16.

ROYAL INSTITUTION, at 9.—How to Improve Telephony: W. Duddell.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Continued Discussion:* Large Locomotive Boilers. G. J. Churchward.—*Probable Paper:* Petroleum Fuel in Locomotives on the Tehuantepec National Railroad of Mexico: L. Greaven.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—Evolution in Relation to Disease: Dr. J. T. C. Nash.

CONTENTS.