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MALARIA PREVENTION.

The Prevention of Malaria. By Major Ronald Ross, C.B., F.R.S. With contributions by Prof. L. O. Howard and others. Pp. xx+669. (London: John Murray, 1910.) Price 21*s.* net.

FEW if any subjects bearing on the prosperity of tropical lands can be of greater importance than the effective control of those tropical diseases which have often proved barriers, sometimes insuperable, to their development. This will readily be admitted with reference to the colonisation of such lands by white men, but it is of at least equal importance for the welfare of the indigenous races the progress of which towards a higher civilisation is most intimately bound up with an increased immunity from disease and a higher standard of hygienic environment.

Of all the diseases prevalent in tropical and sub-tropical countries there is none to compare with malaria, either in point of view of frequency or of disastrous results in respect of the general health of a population. This has been acknowledged to a certain extent from the earliest times, but it has been left for modern science to demonstrate the true magnitude of the problem and to point out scientific and practical measures by which the damage caused by malaria may be controlled.

In this volume, by Major Ronald Ross, we have an admirable account of the whole of the many-sided problem of malaria prevention, stated in clear and eloquent fashion, and developing the subject in so logical a sequence that the reader is carried in complete sympathy with the author towards an acceptance of the preventive measures which he advocates as being the best at present available.

No one has better right to speak with authority on every branch of the subject than the author, whose discovery of the mosquito transmission of the disease laid the foundation for the majority of the preventive measures which have already been of inestimable service to humanity. The discovery of the malarial parasite by Laveran, epoch-making as it was, in itself did little to help in the prevention of the disease, and only a knowledge of the complete life-history of the parasite could teach us where and how to apply measures directed towards the prevention of this scourge of humanity.

Since this knowledge became available, numerous books have appeared, in many tongues, dealing with prevention, but the immense majority of these are either purely technical or purely popular, and there was a distinct place for a volume such as this, which, while avoiding unnecessary technical and medical detail, deals with each branch of the subject in comprehensive fashion and affords such a complete guide as is imperatively needed by all who have to deal with the subject practically, whether from the point of view of the health officer or from that of the civil administrator of a country or district. To obtain success in a malaria campaign it is not enough to be told what to do, one ought to know in addition the "why" of each step.

Throughout the whole of the work the author speaks, as he obviously feels, strongly on the half-hearted manner in which preventive measures have been applied by many bodies in administrative control of various malarious countries. He acknowledges that in many instances the cause of this official indifference is apprehension of excessive expenditure, but he shows clearly that, even from this low point of view, a grudging expenditure is bad finance. Granted that the measures he so ably advocates are carried out with intelligence, and under continuous and proper supervision, few who follow his arguments and examples will differ from him that few items in a colonial budget would have been better expended.

After an interesting historical account of malaria, from the earliest classical allusions to the discovery of the parasites and of the mode of transmission by anopheline mosquitoes, a clear account is given of the fundamental observations and experiments which have led up to our present-day knowledge. Next follows a most interesting chapter on the parasitic invasion of man. This will be read with perhaps the greatest interest by those who have practical knowledge of the disease, since it is replete with information of the most valuable character on such points as the number of parasites which may be introduced by the mosquito, the number which must develop from those introduced before illness is produced in man, the period of incubation, the limitation of the invasion, &c. Even those who are familiar with most of the subject-matter here dealt with will find much to interest them, since there is scarcely a point discussed which has not a direct bearing upon the question of prevention.

Major Ross lays great stress upon the necessity for a more accurate study of the disease by exact quantitative methods, and his arguments and illustrations in connection with this point will find general acceptance. For instance, he advocates a more accurate study of the numbers and local distribution of the particular anopheline mosquitoes which are found to transmit malaria in a given locality, since, without such a foundation, it is not possible to judge with any degree of accuracy as to the effects of the measures which may have been adopted with a view to their destruction. Again, in assessing the value of different preventive measures, such as mosquito destruction, the systematic use of quinine or the protection of individuals by mosquito netting, an accurate measure of the amount of malaria present in a particular population is an essential preliminary. He devotes considerable space to the best means by which such estimations may be carried out, and discusses the relative value of estimates of the actual number of individuals who have parasites in their blood at a given time, the estimation of the number who show signs of present or recent infection by enlargement of the spleen, the constantly-sick-rate, the death-rate, &c. He concludes that the most generally useful of these is the spleen-rate, since an actual microscopical examination of the blood demands too great labour. In this connection a good example of his mathematical reasoning shows that in a quarter of an hour a careful microscopical examination of a sample of blood for

parasites will only have searched one-fiftieth of a cubic millimetre. Now, since this volume is only about 1/150,000,000 of the blood in a man's body, it follows that there is a considerable chance that not a single parasite might be detected, although the individual might have 150 million of them in his circulation at the time!

Major Ross's preference for the determination of the "spleen-rate" appears justifiable on grounds of expediency, but, although he points out most of the more obvious fallacies to be guarded against in making such estimations, he scarcely appears to attach sufficient importance to these. For instance, there is very little experience accumulated as to the length of time which some degree of splenic enlargement may persist after recovery, while the splenic enlargement caused by ankylostomiasis, as has recently been pointed out by Darling, would invalidate the tests in certain localities.

The section dealing with the laws which regulate the number of anophelines in a locality will be fascinating reading to all who have some practical knowledge of these pests, and is full of most suggestive matter, much of which will doubtless be put to the test by those who have opportunity. The problem of attempting the destruction or limitation of mosquito life, under conditions where extensive breeding places abound, and where the usual measures appear at first sight impracticable, are boldly faced, and those who are satisfied with Major Ross's mathematical demonstrations on such points as the variations of mosquito density due to various causes, the random scatter of mosquitoes from a given point, &c., will find it necessary to revise some views which have been and are extensively held on the impossibility of limiting the mosquito population in certain conditions.

The thoroughness with which the earlier portions of the book have dealt with all branches of the subject greatly adds to the value of the chapter dealing with the selection of the preventive measures to be made in a given instance, since one is able to follow the author in his clear exposition of the manner in which one must study the local conditions in every instance before deciding on the plan of campaign. As he is careful to point out, without such close study of these conditions a scheme might be drawn up which was foredoomed to failure, and large sums of money might uselessly be thrown away. The chapter abounds in valuable practical hints for the guidance of those responsible for the organisation of such campaigns, and it may also be studied with the greatest profit by laymen whose only desire is to know how best they, individually, may avoid infection on proceeding to a malarious country.

The second half of the book consists of a series of articles by well-known authorities dealing with experiences of individual malarial campaigns in many countries, and these afford a number of object-lessons in the application of the principles enunciated in the first half. There are altogether twenty-one contributors to this portion, and the majority are recognised authorities on the subject of malaria in the particular country dealt with. For instance, the campaign against malaria in Italy is from the pen of Prof. Celli, while that dealing with the most successful of all malarial campaigns, that in the Isthmus of Panama, has been written by Colonel Gorgas. Dr. Schilling deals with malaria in German possessions; and the measures employed in French territory are described by Dr. Edmond Sergent. The completeness of this portion of the book is indicated by the fact that it concludes with two most interesting articles on the prevention of malaria in troops in war and in peace, the former by Lieut.-Colonel C. H. Melville, and the latter by Major C. E. P. Fowler, who was associated with Major Ross in his campaign in Mauritius, to which so many allusions are made in the systematic portion.

Major Ross and his collaborators may be congratulated on having produced a work which will be of the highest value to all who are concerned with the future progress and welfare of our tropical possessions.

W. B. L.

THE BRITISH MUSEUM COLLECTION OF FOSSIL REPTILES.

(1) *A Descriptive Catalogue of the Marine Reptiles of the Oxford Clay, based on the Leeds Collection in the British Museum (Natural History), London.* Part i. By Dr. C. W. Andrews, F.R.S. Pp. xxiii+205+x plates. (London: Printed by order of the Trustees of the British Museum, 1910. Sold by Longmans and Co., B. Quaritch, and Dulau and Co., Ltd.) Price 25*s*.

(2) *A Guide to the Fossil Reptiles, Amphibians, and Fishes in the Department of Geology and Palaeontology in the British Museum (Natural History).* Ninth edition. Pp. xviii+110. (London: Printed by order of the Trustees of the British Museum, 1910.) Price 9*d*.

(1) THE museum having acquired the unrivalled collection of reptilian remains obtained with much labour and unceasing care by the Messrs. Leeds—more especially Mr. A. N. Leeds—from the brick-pits in the Oxford Clay near Peterborough, it was only fitting that they should be described in a manner worthy of their importance and value. So far as the marine forms are concerned, that is to say, the ichthyosaurs, plesiosaurs and pliosaurs, and crocodiles, the task has been entrusted to Dr. C. W. Andrews, who for several years past has devoted a large portion of his time to the study of these groups. How thoroughly well he has accomplished the work will be apparent to all specialists who study the present volume, which deals with the ichthyosaurs and plesiosaurs.

The work appeals, however, to other than specialists, for it not only serves to make known the remarkably fine state of preservation in which many of the skeletons of these strange reptiles are found, but it also contains a number of interesting observations with regard to their probable mode of life and the conditions in which they existed. So nearly complete, indeed, are many of the skeletons, that not only has it been found possible to mount several for public exhibi-

tion, but, owing to the separation of their constituent elements, the details of the osteology can be studied, except in the case of the skull, which is often badly crushed, as if they belonged to modern reptiles. It should be added that this full acquaintance with the osteology of these saurians is largely due to the extreme care exercised by Mr. Leeds in extracting them from the matrix.

The remains are generally supposed to have been laid down in rather deep water, but the association of the marine forms with terrestrial dinosaurs, and perhaps also the occurrence of masses of lignite, suggests that the deposit was formed near a coast, and not improbably represents the mud-banks in the delta of a mighty river. Here Ophthalmosaurus, the single and most highly specialised representative of the ichthyosaurs, with its powerful caudal fin, pointed head, enormous eye, and porpoise-like body, probably lived in the open sea, where it played the part now assumed by whales and grampuses. Why this particular type should have become practically edentulous, whereas its upper Cretaceous successors were remarkable for their powerful dentition, is somewhat difficult to understand, although, as Dr. Andrews suggests, this feature was probably connected with the nature of its food. Certain features in its organisation suggest that it was capable of "sounding" to considerable depths.

In marked contrast to the movements of this ichthyosaur were those of the contemporary plesiosaurs, which were far more specialised types than their forerunners of the Lias. Instead of being driven through the water by the screw-like action of a powerful tail-fin, these appear to have rowed themselves on or near the surface by means of their strong paddles, of which the hind pair was nearly equal in capacity to those in front, whereas the tail was short, and provided, at most, with a rudimentary fin. Their whole organisation indicates that they haunted the neighbourhood of the coasts, whereas their short-necked and more strongly built relatives the pliosaurs may be assumed to have ventured further out to sea, although they did not possess the truly pelagic habits of the whale-like ophthalmosaur. The littoral habits of the plesiosaurs exposed them to much more varied conditions of life than was the case with the last-named reptile; and it was these diverse conditions which probably led to the differentiation of the group into the numerous types so well described in the volume before us.

To follow the author through his survey of the osteology of the groups forming the subject of this volume would demand much greater space than the editor is disposed to grant. Attention may, however, be directed to the figure on p. 12 illustrating the form and arrangement of the constituent bones of the occipital region of the ophthalmosaurian skull, and more especially to the remarkable position and relations of the opisthotic and stapes. The great length of the parasphenoid element (p. 15) is also noteworthy, while of even greater interest is the author's reference of the ichthyosaurian humerus to its proper side of the body (p. 52). Among the plesiosaurs it must suffice to refer to the determination of the relations and form of the clavicles and interclavicles, and especially the gradual waning of the latter (compare Figs. 61, 62, 70, 88).

Dr. Andrews has a good deal to say as to the phylogeny of the ichthyosaurs, for which readers must refer to the work itself; that of the plesiosaurs and pliosaurs is reserved for the second volume, which we hope to welcome before many months are past.

(2) Passing on to the guide-book to the fossil reptile and fish galleries, the mere fact that a new edition has become necessary after the lapse of only five years from the issue of its predecessor (which was entirely re-written), affords sufficient evidence that the work meets the requirements of the class of visitors for whom it is intended. As we are told in the preface, the new edition is practically a replica of the eighth issue, and therefore demands no special notice in this place. It may be noticed, however, that the price has been raised from sixpence to ninepence, at which figure the work is still a marvel of cheapness. In the next edition it might be well to explain the meaning of "type" specimens (*vide* preface), of which the general public has no conception, and likewise to amend the legend to Fig. 39, which states that the specimen belongs to a small tortoise, whereas it is really something like twenty inches in length.

R. L.

ELECTRO-CARDIOGRAMS.

Das Elektrokardiogramm des gesunden and kranken Menschen. By Prof. Friedrich Kraus and Prof. Georg Nicolai. Pp. xxii+322. (Leipzig: Veit and Co., 1910.) Price 12 marks.

THE electrical phenomena of the living heart has been a fascinating study among physiologists since the early days of electro-physiology; information has been gathered with greater and greater accuracy as apparatus and methods of investigation became more and more refined, and now the registration of the electrical changes in the heart may be, and is, practically employed in the diagnosis of heart affections in the wards of the hospital. A full discussion of the origin and progress of method in this direction is given in this book, which has been produced by authors well acquainted practically with all the details of this branch of physiological and clinical inquiry. The progress of research is strikingly shown in a bibliography at the beginning of the work containing a list of 243 papers on the subject, of which no fewer than 131 have appeared since the beginning of 1900.

It is interesting to notice that investigations into the electrical phenomena of the heart are associated at different periods with the invention of special instruments and methods, such as the galvanometers of Matteucci and du Bois Reymond, the differential rheotome of Bernstein, the capillary electrometer of Lippmann, and, still more recently, the string galvanometer of Einthoven. Matteucci, in 1843, was the earliest observer with the galvanometer; then, in 1849, followed du Bois Reymond with his bussole; Köllker

and Müller worked about 1856, Donders about 1872; and at last there were the elaborate researches of Engelmann from 1873 to 1877. Gotch and Burdon Sanderson studied the phenomena of inhibition in the heart of the tortoise in 1877; Bernstein, du Bois Reymond, Engelmann, Hermann, and Burdon Sanderson used the rheotome between 1868 and1887. Then followed the invention of the capillary electrometer by Lippmann in 1873; it was soon used by Engelmann and Marey, and in 1883 it was employed in research by Burdon Sanderson and Page. Waller, in 1889, was the first to employ the instrument in the investigation of the human heart. The actual oscillations in the tube of the capillary electrometer were photographed on a rapidly moving plate, so as to produce a cardiogram, and with this invention the names of Burch and Burdon Sanderson will be always associated (1890). In more recent times we have the invention of the string galvanometer by Ader in 1897, and perfected by Einthoven, until it must be regarded as by far the most sensitive instrument for the purpose. The instrument, as now constructed, is much more delicate than the original instrument of Ader, while the apparatus had been made complete by the photographic registering apparatus made by various ingenious workers in optics and mechanics.

The accurate interpretation of the electro-cardiogram owes much to Waller, who established important leading principles on which monophasic and diphasic currents can be explained. He also gave a schematic representation of the action currents that can be led off from the living human heart (Fig. 16, p. 45). In the work under notice, there is a full description of the principle and mechanism of the string galvanometer, and an analysis of the curves produced from it (p. 64). The introduction of the quartz fibre has most materially increased the delicacy of the instrument. There can be no doubt that only an expert can use the instrument in a satisfactory manner, as is well illustrated by a study of the diagram of the apparatus in an actual experiment in Fig. 28, p. 89. This method is much more complicated than the simple galvanometer experiments once in vogue in every physiological class-room or laboratory.

Kraus and Nicolai then give a thorough analysis of the electrocardiogram, showing in the diphasic effects groups of electrical oscillations in the curve which are associated with the contractions of the auricle, with those of the ventricle, and with changes occurring also during the diastole of the ventricles and the filling of the auricles. The time relations of all those phenomena can also be accurately determined; indeed, an insight is obtained into the phenomena of the living beating human heart not otherwise possible. They also endeavour to show that those phenomena may be explained or accounted for by our knowledge of the muscular arrangements of the walls of the heart. Without mentioning the old researches of Borelli or the more recent dissections of Pettigrew (to be seen in the museum of the Royal College of Surgeons, Lincoln's Inn Fields), they describe the spiral arrangement of the fibres, the relation of many of the fibres to the papillary muscles, the fibres of Wenckebach (1901) between vena cava and the auricle, and the bundle of His (1893) between auricle and ventricle. Nearly thirty years ago there appeared the classical research of Gaskell (1883) on the heart of the tortoise, which showed the passage of impulses from auricle to ventricle, and was the beginning of much work of great clinical as well as physiological importance. The analysis of many electrocardiograms is given with great care and thoroughness by the authors in chapters vi. to x., and to those the reader must be referred.

The second portion of the work relates to the clinical use of the string galvanometer in the investigation of diseases of the heart and of the circulation. When one considers that the complete apparatus costs from 200*l.* to 250*l.*, and that a special knowledge of electrical appliances is required, it will be evident that the method cannot be expected to come into general use, even in the wards of a well-appointed hospital. Physicians will depend more on mechanical appliances for registering the movements of the various pulses (both venous and arterial) and of the heart itself, a method of sphygmographic investigation that has received a new lease of life by the labours of Mackenzie and others. At the same time it must be admitted that the electrical phenomena give a glimpse of phenomena actually happening in the heart which would escape detection by the mechanical method, as, for example, slight changes in the beat of the auricles, and some phenomena which may account for want of rhthym, as when the auricles and ventricles do not beat in the normal consecutive order. The time relations can also be accurately noted. The authors give many cardiograms well worthy of the study of physicians. These must not be confounded with the tracings that, by other methods, may be obtained of the vibrations of the sounds of the heart. Science must advance, but it is rather disheartening to be obliged to take the view that these elaborate researches have very little to do with the actual treatment of diseases of the heart, and the sufferer whose heart is beating arhthymically will find cold comfort in the certain knowledge that there is some kind of fatty or other degeneration in the fibres of the bundle of His in his cardiac organ.

Since the above was written a valuable paper has appeared in *Heart* by Dr. Thomas Lewis and B. S. and Adele Oppenheimer on "The Site of Origin of the Mammalian Heart Beat; the Pace-maker in the Dog." The researches have been carried out with the string galvanometer, with special reference to the electrical relations of the collection of specialised tissue at the upper caval end of the sulcus terminalis of His. The tissue, or node, as it may be termed, was discovered by Keith and Flack. Dr. Lewis and his co-workers find electrical evidence to show that it is the site of primary activity, that is to say, from it impulses radiate that are the cause of the co-ordinated heart beat. This result, long sought for by other observers, is an important addition to cardiac physiology, while it illustrates the value of the use of the string galvanometer.

JOHN G. MCKENDRICK.

AUSTRALIAN TRIBES.

(1) *The Tribe, and Intertribal Relations in Australia.* By G. C. Wheeler. With a prefatory note by Prof. Edward A. Westermarck. Pp. xii+168. (London: J. Murray, 1910.) Price 3*s*. 6*d*. net.

(2) *Two Representative Tribes of Queensland, with an Inquiry concerning the Origin of the Australian Race.* By J. Mathew. With an introduction by Prof. A. H. Keane. Pp. xxiii+256. (London: T. Fisher Unwin, 1910.) Price 5*s*. net.

ACQUAINTANCE with the interesting political and social organisation of the Australian aborigines has gradually destroyed the tradition of their primæval simplicity, and the information collected and classified by Mr. Wheeler (1), during his work as Martin-White student of sociology in London University, shows that intertribal relationships in Australia are unusually well regulated. Mr. Wheeler declares that "in contrast with the loose ideas generally held war in these tribes cannot be deemed a normal condition," and Prof. Westermarck, in a prefatory note, remarks "among the Australian aborigines the germs of international law" and "something like an anticipation of the Geneva Convention." Instead of the Australian aborigines retaining a primitive communism, territorial ownership is so fully recognised that, according to Mr. Wheeler (p. 161), "War has no other purpose than the seeking of justice or revenge for injuries done." War there, he says, is never for the sake of territorial conquest, as the right of the lawful owners of land is regarded as absolute.

The main purpose of Mr. Wheeler's study is to collect the available information as to the relationships of the Australian tribes. He summarises the evidence as to their confederations, the rights of territorial sovereignty, the regulations which govern tribal intercourse—including barter, asylum, and the safety of envoys, the punishment of offenders belonging to different tribes, and war. The essay is a discussion of second-hand evidence, in the valuation of which the author is perhaps not always successful. Thus, he disparages Howitt's work, since, as that author carefully explained the source of his information, it is obvious how much of it came from others; but Mr. Wheeler is less cautious in regard to some authorities, in whose writings observation and inference are less easily distinguished.

The essential difficulty in the study of intertribal relationships among the Australians is the absence of any trustworthy distinction between tribes and intertribal local groups, and between tribes and "nations." Mr. Wheeler uses the term nation occasionally, but regards it as inappropriate in Australia, as the groups are so indefinite. He admits that there is no firm line to be drawn between nations made up of tribes, and tribes made up of local groups; and he recognises that the relations between local groups of the same tribe do not differ from those of local groups belonging to different tribes. The intertribal regulations, which Mr. Wheeler's study shows are so widely recognised in Australia, therefore deal with the relations of local groups, which have been perhaps only recently and temporarily isolated or combined, and not of tribes separated by racial differences, as in India or Africa, or by traditional feuds, as in North America.

According to Mr. Wheeler, the best test of a tribe (p. 55) is that the intertribal groups do not carry on unregulated warfare, and during warfare do not eat the dead. According to Mr. Mathew, on the other hand, tribal distinctions are based on language.

(2) Mr. Mathew's book may be divided into two distinct sections. Its main value is an account of the Kabi and Wakka tribes, who inhabited the basins of the Mary River and upper Burnett River in southern Queensland. The author had excellent opportunities for the study of the Kabi, as he lived among them from 1866 to 1872, and has re-visited them in 1884 and 1906. He knows their language and appears carefully to have observed their habits and collected their beliefs and folklore. Mr. Mathew's most interesting chapter is upon religion and magic. He concludes that "these tribes possessed the elementary contents of religion" (p. 168), and had some belief in supernatural beings, of whom they spoke with reverence and of whom the "great supernatural" was nameless and was referred to only with bated breath.

The value of Mr. Mathew's book is reduced by his constant re-statement of the theory which he advanced in 1899, in his "Eaglehawk and Crow," and in an earlier paper. He there claimed that the two totemic divisions named after the Eaglehawk and Crow were due to racial differences; he believed that the Australian aborigines have originated from the fusion of a dark "Papuasian" people, who were of the same race as the Tasmanians, with a fairer people who were possibly connected with the Dravidians of India, the Veddas of Ceylon, and the Toalas of Celebes. He re-states this view in an introductory memoir, and repeats it, but without mentioning the strongest objections to it, and still claiming in its support authors, such as Lydekker—who has long since abandoned it. Mr. Mathew admits that some tribes outside Australia are also divided into two exogamous classes, and he appears disposed (p. 140) to extend his racial theory to those cases. Moreover, many Australian tribes are divided into four classes instead of into two, and as Mr. Mathew admits that the fourfold division is not racial, it seems unnecessary to adopt his explanation for the division of the tribes into two classes. Mr. Mathew states that the light-blooded and dark-blooded sections may still be recognised among the Australians; but, in quoting one of these cases he admits (p. 142) that his informants differed as to which section was the light and which the dark. The difference in colour appears to be as slight as the rest of the evidence in favour of Mr. Mathew's theory. The account of the Kabi is, however, a useful contribution to Australian anthropology.

SOME CRITICAL SPECIES OF VERONICA.

Veronica prostrata L., Teucrium L., und austriaca L. nebst einem anhang über deren nächste verwandte. By Dr. Bruno Watzl. (Abh. der K.K. Zool-Botan. Gesellschaft in Wien. Bd. v., Heft 5.) Pp. 94+Tafel xiv. (Jena: Gustav Fischer, 1910.) Price 7 marks.

DR. WATZL has made a detailed study of three closely-allied species in what is generally recognised as a very critical genus. Bentham, when mono-

graphing the family Scrophulariaceæ in De Candolle's Prodromus (1846), grouped these species with a few others as a subdivision Pentasepalæ of the section Chamædrys, characterised and distinguished from other subdivisions, and the majority of the species of the genus, by the five-toothed calyx as contrasted with the usual four-toothed organ. The disappearance, by gradual reduction, of the median sepal is one of the factors in the diminution of the zygomorphy, which is a feature of the Veronica flower when compared with the more strikingly zygomorphic forms typical of the family. These pentasepalous forms are to be regarded as an older type from which the more numerous tetrasepalous have been derived, and Dr. Watzl again directs attention to the fact that the character is a variable one, four-sepalled flowers being of frequent occurrence.

None of the three species which are the subject of the memoir occurs in the British Isles, but they are widely distributed in central and southern Europe. *Veronica prostrata* is the most constant of the three; besides the type only one form and one variety (from Siberia) are recognised. There is, however, a considerable amount of variation in habit, degree of hairiness, and size of parts; and, as shown by plate v., the leaf displays great variety in size and form in specimens from different localities. The other two species are remarkably polymorphic, and are subdivided by the writer into a series of subspecies, varieties, and forms, with, in several cases, a number of transitional forms between the different subspecies. Dr. Watzl has made a careful and exhaustive study of a large series of specimens from central and southern Europe, as well as of the citations in the numerous European floras, and the results of his work will have a special interest for the critical student of the European flora. It is inevitable, however, that the personal element should enter into such a detailed study of a highly variable species occurring over a somewhat extended area, and it is probable that other critical students of the same group would not entirely concur with the limitations of forms and varieties which are adopted by Dr. Watzl. A. B. R.

SCHOOL DRAWING.

(1) *A Course of Drawing for the Standards. Being a Selection of Sheets from "A Complete Course of Free-Arm and Industrial Drawing."* By J. W. T. Vinall. Pp. 24+xxiv charts. (London: Blackie and Son, Ltd., 1910.) Price 6*s.* net.

(2) *Natural and Common Objects in Primary Drawing, with Full Directions as to Their Use. A Handbook for Teachers.* By J. W. T. Vinall. Pp. v+68. (London: Blackie and Son, Ltd., 1910.) Price 3*s.* 6*d.* net.

(1) THE issue of the author's "Complete Course of Free-Arm and Industrial Drawing," in sections is a wise step that will be much appreciated by teachers. The first portion, published as "A Course of Kindergarten Drawing, for Infants and Small Children," has now been followed by a second and more advanced selection under the title given above. It outlines a progressive school course for youths from six years upwards, corresponding to standards I. to VII. and beyond. The first six plates deal with brush work and the principles of colour harmony, with applications to natural objects and ornamental designs. The next six illustrate a well-graded course of free-arm drawing in coloured chalks, based on circular, elliptic, and compound curves. The applications to natural and familiar objects, to ornamental patterns and designs, with reference to the laws of growth, repetition, and radiation, are very numerous and intensely interesting. The remaining charts comprise free-hand drawing in pencil, crayon, and with the pen; further brush work and shading; and model and perspective drawing, with technical and other applications. The plates are accompanied by a very lucid and suggestive description that will prove most valuable to teachers. They are beautifully executed, generally in colours. As a whole, the work forms as admirable a course of school drawing as could be desired, and impresses the reader with the great educational value of training conducted on lines indicated by the author.

(2) This is a new work, intended to be supplementary to the one noticed above, its main object being to assist the teacher in the selection of objects, properly graded and suitable for class instruction in drawing in elementary schools. It is based on the syllabuses of the English and Scottish Boards of Education. The objects are displayed in a number of plates, to which teachers will often be glad to refer. The illustrations include familiar objects in common use, nature forms and specimens, subjects for measured drawings, and specimens of alphabets and printing. The plates are described in the text, and are preceded by a general discussion of the aims and qualifications of the teacher, of the apparatus used, and of the methods of work. The book can be recommended to teachers as affording valuable guidance in their work.

OUR BOOK SHELF.

Iron and Steel Analysis. Vol. i., Ordinary Constituents. By A. Campion. Pp. 80. (Glasgow: Fraser, Asher and Co., Ltd. 1910.)

THIS small handbook gives a detailed account of the methods used in determining the six or seven elements invariably occurring in pig-irons and ordinary steels, and also those employed in the proximate analysis of coal.

With few exceptions, one method only is described for each element, and in every case one which has been in use (with modifications) in steel-works' laboratories for many years. Although, therefore, there is nothing new by way of contribution to the existing literature on the subject, the book is eminently suited to beginners. It is doubtful, however, whether the author's hope that works chemists will find the book useful will be realised, as some of the methods described are by no means quick enough. Rapidity, consistent with accuracy, is a very important consideration in steel-works laboratories, a fact which the author obviously recognises in the preface.

The opening out of grey irons with hydrochloric acid in silicon determinations, as described in this

book, has been largely superseded by the more rapid and trustworthy process of Drown. The gravimetric methods described for manganese and phosphorus are cumbersome. In the case of the former, the importance of neutralising the acid solution of ferric and manganese chlorides at a boiling temperature is wrongly insisted upon, and the washing of the voluminous basic ferric acetate precipitate should have been avoided.

Manganese furnishes one of the cases in which alternative volumetric methods are described, the first of which is undoubtedly more accurate than the gravimetric method as carried out by the author. An alternative process, preferably volumetric, for the determination of phosphorus, would have materially increased the value of the book. The other elements, and particularly the most important one (carbon), are dealt with in a very satisfactory manner. F. I.

The Potter's Craft. A Practical Guide for the Studio and Workshop. By F. Binns. Pp. 171. (London: Constable and Co., Ltd., 1910.) Price 6*s.* net.

THE preface leads to great expectations, for the author says:—"This book is the outcome of an experience extending over a period of thirty-six years. Twenty years ago it would have been impossible for the science of ceramics was not then born." The book itself is, however, very disappointing, and cannot be considered as a serious contribution to ceramic science. It is written apparently for the amateur potter; it certainly would not be of use to anyone else, and there is nothing in it that was not known twenty years and more ago.

Much of the book is taken up with photographs and descriptions of two well-known processes, viz., "mould-making" and "throwing." These could be much better learnt and understood by a visit to a pottery; certainly no one will ever learn to be a craftsman by studying the book. When one knows the time it takes for a professional potter to learn to throw even simple small pieces to a given size, it seems almost ludicrous to write as the author does of an amateur making vases two or three feet high by doing the work in sections. The chapter on glazes and glazing can lead to nothing but disappointment.

It is hard to believe that the author has had great practical experience when we see him trying to deal with "the defects of glazes" in about two pages. For example, practical men know what a difficult problem "the pinholing of glazes" is, and how many and varied are the causes which produce it. Mr. Binns devotes two lines to it!—"Pinholes appear in the glaze when cool. Too rapid cooling is the cause." It is difficult to write with patience of this kind of treatment, particularly when we remember the preface.

Heroes of the Elizabethan Age. Stirring Records of the Intrepid Bravery and Boundless Resource of the Men of Queen Elizabeth's Reign. By E. Gilliat. (London: Seeley and Co., Ltd., 1911.) Price 5*s.*

THE stout-hearted men who sailed the seas in the days of England's awakening were indeed heroes. Their charts were made with the degrees of longitude at different latitudes of equal length; they were inaccurate even as regards the shores of the English Channel, for it is one of the claims to renown of John Davis that he surveyed the Channel coasts in addition to those of the Arctic, of Magellan Straits, and of the Scilly Isles. They dared to cross the Atlantic in ten-ton vessels, for the *Squirrel*, in which Sir Humphrey Gilbert was lost, was of this size; they took five months on the voyage to the Cape of Good Hope, and the chances were that disease alone would kill off a large proportion of the crew of every vessel which went on a protracted voyage.

Englishmen fitted out expedition after expedition; many times for no return, sometimes for a return of hundreds per cent. on their outlay, for the capture of one rich carrack might suffice to pay the cost of a large expedition. In this atmosphere Hawkins began the slave trade, Sir Richard Grenville fought his good fight off the Azores, and Howard and his captains harassed the Armada and made its efforts fruitless. In this spirit Sidney died at Zutphen. These heroic efforts form part of the great struggle for Protestantism which lies at the background of the life-story of the thirteen heroes as depicted in this splendid gift-book by a sometime master at Harrow School. Well illustrated and produced, this book will delight the heart of most boys and many girls, even those of somewhat mature age. B. C. W.

International Language and Science. Considerations on the Introduction of an International Language into Science. By Profs. L. Couturat, O. Jespersen, R. Lorenz, W. Ostwald, and L. Pfaundler. Translated by Prof. F. G. Donnan. Pp. ix+87. (London: Constable and Co., Ltd., 1910.) Price 2*s.* net.

Internaciona Matematikal Lexiko en Ido, Germana Angla, Franca e Italiana. by Dr. Louis Couturat. Pp. 36. (Jena: Gustav Fischer, 1910.) Price 1.50 marks.

THE first of these books is an English edition of a work the German edition of which was reviewed in NATURE for August 19, 1909. The translator is Prof. F. G. Donnan, of Liverpool University. The "Internaciona Matematikal Lexiko," by Dr. Louis Couturat, contains all the technical terms commonly used in mathematics. The language of the International Commission constitutes in many respects a great advance on its predecessors. If there is one feature that possibly calls for improvement, it is that the new language is not based on Latin as much as it might be, in view of the fact that Latin is taught in schools in every civilised country. By adopting the Latin vocabulary free from all unnecessary grammatical technicalities, the need of a new language could have largely been obviated. It is true that a large proportion of the words are taken from Latin, but there are exceptions, such as "lasta" for ultimate, "sam-centra, sam-foka," and so forth, for concentric and confocal, "ringo" for annulus, and "helpanta" for auxiliary.

The Presentation of Reality. By Dr. Helen Wodehouse. Pp. x+163. (Cambridge: University Press, 1910.) Price 3*s.* net.

IN this little book Dr. Wodehouse (who is lecturer in philosophy in the University of Birmingham) attempts a description of knowledge from the point of view of a philosophical psychology. She avoids metaphysics as far as possible, but maintains that in all cognitive experience we come into immediate contact with objective reality, of the existence of which we have in experience an irrefutable witness, and that on all levels of cognition, sensuous or intellectual, this happens in the same way, namely, by the presentation of an object to a subject.

The author's metaphysical inclinations seem to be towards the school of Reid, while among recent writers her affinities are with Dr. James Ward, Dr. G. F. Stout, and Dr. A. Meinong. Bradley on the one hand, and James on the other, come in for acute criticism, Dr. Wodehouse believing strongly—as against the great pragmatist—that reality does not wait for our thinking to make it, though the discovery of reality does; that some discoveries can be made, and that it

is the duty of philosophers to go on trying to make them, with which, no doubt, both pragmatists and absolutists would agree. Indeed, "in spite of everything, this is presumably the real standpoint of all of us."

Lessons on Elementary Hygiene and Sanitation, with Special Reference to the Tropics. By W. T. Prout. Second edition, 1909. Pp. xx+159. (London: J. and A. Churchill, 1908.) Price 2*s.* 6*d.* net.

WE are not surprised that this little book has passed into a second edition. The plan of it is well conceived and the matter excellently written. It tells in the simplest language, with many appropriate comparisons which drive home the meaning, the structure of the body and its functions, how health may be safeguarded, and how disease is propagated. Disease germs, their mode of spread and entrance into the body, are explained, and the salient points with regard to the principal infective diseases are adequately considered. Being avowedly written for residents in the tropics, and in particular for those in Freetown, West Africa, diseases like malaria, cholera, plague, sleeping sickness, leprosy, &c., receive considerable attention, but otherwise the details given are equally applicable to the hygiene of any district.

Chapters on water supply and its purification, the dwelling and sewage removal, respiration and ventilation, diet and clothing are included, and render the book a complete popular exposition of the principles of hygiene. It is also well and sufficiently illustrated. R. T. H.

Aëroplane Patents. By Robt. M. Neilson. Pp. x+91. (London: Constable and Co., Ltd., 1910.) Price 4*s.* 6*d.* net.

THIS is a useful book, which may be recommended to all who are interested in the subject of aëronautics. It begins with thirteen pages of sound advice to inventors, and continues with a list and description of the various patents relating to heavier-than-air flying machines. The list does not profess to be complete or exhaustive, but it contains all the important patents and most of the minor ones are mentioned. The descriptions given are sufficient to explain the objects and claims made in each case.

The period covered by the list extends from 1860 to 1910, and perhaps the most interesting matter which it brings to our notice is the enormous increase in the number of patents relating to aëronautics taken out since 1907. From 1860 to 1906 the average number of patents was about six per year. In 1906 the number was 29; in 1907, 42; in 1908, 115; in 1909, 759; and in 1910 (for eight months), 412.

That but a small percentage of the patents should be of value is only what might be expected, but the total number is evidence of the attention which is being given to the subject.

Stray Leaves on Travel, Sport, Animals, and Kindred Subjects. By J. C. Walter. Pp. xii+295. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1910.) Price 5*s.* net.

THE ten chapters making up this book are for the most part extracts from the author's diaries written among the scenes described, and papers prepared for meetings of a natural history society.

The conversational style adopted makes reading easy, and the persevering reader will incidentally accumulate much useful information about the countries in which the author has travelled, and become acquainted with the habits of many animals which have aroused the author's interest. Mr. Walter's wanderings have by no means been confined to his own country; we have chapters dealing with his excursions in Egypt and Palestine, France, Switzerland, and Italy respectively. On each of his numerous journeys Mr. Walter was an industrious diarist.

1200 *Mining Examination Questions.* Arranged and compiled by G. L. Kerr. Pp. xxvii+111. (London: Crosby Lockwood and Son, 1911.) Price 2*s.* 6*d.* net.

THESE questions have been selected principally from the papers set at the examinations held in the different districts of Britain for managers' and under-managers' certificates. The volume also contains copies of ventilation plans set at these examinations, and suggestions to candidates who desire to qualify for mine managers' certificates.

To some of the questions answers have been given, but to the majority of them this has intentionally not been done. The compiler explains that the correct answer for any given question will vary somewhat according to the formula used, and in mining unfortunately no uniform set of formulæ has yet been accepted.

Chez les Français. Edited by H. Carter. With Exercises, by C. F. Shearson. Pp. vii+171+vii. (London: A. and C. Black, 1910.) Price 2*s.*

THIS well-selected collection of passages in French, from writers of recognised literary merit, dealing with France and French customs, should prove useful in classes where some progress has been made in the study of the language. The book should be particularly serviceable in connection with elementary geographical teaching.

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.*]

A Biological Inquiry into the Nature of Melanism in *Amphidasis betularia*, Linn.

IT is well known to entomologists that dark varieties of several species of moths have recently become increasingly common in many localities within the British Isles, and also that the dark forms are appearing in fresh districts.

It is very desirable and important to know whether the colour of these dark races of moths is protective or whether it has some other significance.

Before, however, any definite explanation of these phenomena can be attempted, it is necessary to have as complete a knowledge as possible of all the circumstances which are likely to have any influence on the species known to exhibit this melanic change. One significant point in connection with my inquiry concerns the resting habits of the moths which are subject to this melanic variation. For example, it is important to know whether the light-coloured moths (*i.e.* the peppered form of *Amphidasis betularia*) generally rest during the day on lichen-covered trunks of trees or any other light-coloured object, and also whether the dark insects (as the form Doubledayaria of *A. betularia*) select black tree trunks or other dark-coloured objects on which to rest.

Information of this nature can, however, be obtained only by the cooperation of very many entomologists, for the chance of obtaining sufficient evidence from the observations of one or two persons is very remote. I should therefore be extremely grateful if entomologists would assist me in collecting information regarding the resting habits of any of the undermentioned species belonging to the Geometræ which may have come under their notice:—

Amphidasis betularia (Peppered Moth).
Amphidasis prodromaria (Oak Beauty).
Odontoptera bidentata (Scalloped Hazel).
Phigalia pilosaria (Pale Brindled Beauty).
Boarmia repandata (Mottled Beauty).
Boarmia abietaria (Satin Carpet).
Boarmia rhomboidaria (Willow Beauty).
Gnophos obscurata (Annulet).
Hybernia progemmaria (Dotted Border).

Scheme of particulars:—

(1) State, if possible, the number of specimens of each variety (light or dark, &c.) of the above species that have been observed at rest, together with particulars as to the object upon which they were found, and also say whether they were conspicuous or well protected by their colour.

(2) State, if possible, whether the species is abundant, fairly common, or rare in the locality to which reference of the observation is made.

(3) If it is not possible to answer the foregoing questions, any other information concerning observations of a general character will be very acceptable.

All help received will be fully acknowledged on publication; and I would like here to express (as it has not yet been possible to publish anything upon the subject) my great indebtedness to those entomologists who have previously sent valuable information concerning the distribution, &c., of the various forms of *A. betularia* in their own particular localities in compliance with a former request.

The University, Manchester. H. S. LEIGH.

Protection from "White Ants" and other Pests.

IN a recent number of NATURE there was a note on the subject of ants in general and white ants in particular (they are not ants, but that does not matter, as they are "so called"), in which it is said that the Admiralty has decided in favour of "blue oil." Blue oil is the residue left in the distillation of mineral oils after the isolation of kerosine (called petroleum in England) and paraffin. I therefore venture to give you my experience in regard to the same and as to some other cognate matters.

Some twenty years ago I bought a cottage at Mittagong, about eighty miles from Sydney; it was furnished, and when I went there for a night I heard a continual rasping sound whilst in bed, and next morning, on examining the place, I found it was infested with white ants. They had eaten the pine lining in two rooms, as well as the uprights of a door.

I was then connected with a kerosine company, and immediately got a quantity of blue oil, which I had sprinkled all round the foundation of the house with a watering-can. The result is that the lining is in the same condition that it was twenty years ago. This is not an isolated instance, because during that time I have had much experience of "white ants," and have always found that they cannot work if they are cut off from connection with the ground, from which they get moisture, which is necessary for them, and they do not seem able to get through ground saturated with blue oil.

There is another matter to which I may refer in this letter. When I bought my present home, in 1882, I found it full of weeds and ants. I have got rid of both by extermination, and with the latter of aphis and almost entirely of scale insects. Of the former I have not seen one for the past fourteen or fifteen years. My first experience was with black aphis, by which the leaves of a nectarine tree were all curled up, whilst ants were continually running up and down the stem. I had read Sir John Lubbock's account of ants carrying the eggs of aphis to their nests, and I therefore shaved off the rough bark and chalked the stem for a foot or so, and the result was that the ants soon ceased to visit the tree, and we had a healthy tree and a fair crop of fruit. I may say that, so far as my observation goes, ants cannot climb up a chalked stem or post, as the chalk comes off with their feet and they fall down. I am not sure that this is the correct interpretation, as I have seen that if a broad chalk line is drawn round a meat-dish standing on a shelf the ants seldom get across it, and if they do it is only by some place being missed in chalking. They seem to leave a trace of formic acid behind them which guides the followers, and, combining with the calcium of the chalk, deprives them of their clue.

As to ants in general, I may say that after trying various ways to get rid of them I have come to an effectual method, that is, to find their nests and pour down each hole two ounces of a solution of cyanide of potassium. Two ounces per gallon is the strength I have used, but it might be weaker. The ants are not all killed by the first dose, for some are out foraging, and one cannot be certain of killing all the queens, but by giving them a dose once a week or a fortnight it is possible to get rid of them.

There is another matter I may mention. Some thirty-nine or forty years ago I observed an old shingle-roofed cottage at Maitland. It had two dormer windows, the sides of which had been painted white with white lead. The whole of the roof was rotten with fungoid growth except below the dormers, where the paint had been washed down by the rain, leaving a white streak, and there the shingles were nearly as good as they were when put on. It was therefore evident that white lead was inimical to fungoid vegetation.

When I came to my present home I had outside venetian blinds, and the "ladders" got quite rotten in three years, evidently by fungoid growths. In getting new ladders I steeped them in a solution of acetate of lead (6 ounces to the gallon), and they lasted for thirteen years, being by that time worn out by friction in moving them up and down. Acetate of lead is soon converted into white lead by atmospheric carbon dioxide. I have used the same process with a sheet surrounding a shower bath which in six months was black with "mould," and now it is in as good condition as it was ten years ago.

WILL. A. DIXON.

97 Pitt Street, Sydney, October 31.

January Meteors.

THE most noteworthy of the January meteor showers is that of the Quadrantids. Owing to the great northerly declination of the radiant, these meteors can be observed at any hour of the night, and being long-pathed they may, if fairly numerous, present quite a striking display. In 1911 the maximum will fall on the night of January 3, computed particulars of which and of other subsequent meteor showers are here summarised.

Epoch January 3, 11h. (G.M.T.), fourteenth order of magnitude. Principal maximum January 3, 12h. 30m.; secondary maximum January 3, 16h. 30m.

Epoch January 4, 13h. 30m., seventeenth order of magnitude. Principal maximum January 3, 12h. 40m.; secondary maximum January 3, 6h. 30m.

Epoch January 6, 22h., approximately sixth order of magnitude. Principal maximum January 5, 14h. 10m.; secondary maximum January 5, 2h. 45m.

Epoch January 6, 2h. 30m., fifteenth order of magnitude. Principal maximum January 7, 9h. 45m.; secondary maximum January 7, 7h.

Epoch January 11, 4h. 40m., eighteenth order of magnitude. Principal maximum January 12, 23h.; secondary maxima January 11, 4h. 40m., and January 12, 13h. 15m.

Epoch January 12, 19h., seventeenth order of magnitude. Principal maximum January 14, 9h. 20m.; secondary maximum January 14, 16h. 30m.

Epoch January 19, 17h., fifth order of magnitude. Principal maximum January 18, 7h. 30m.; secondary maximum January 19, 2h. 15m.

Epoch January 21, 8h. 30m., twelfth order of magnitude. Principal maximum January 22, 23h. 30m.; secondary maximum January 22, 18h. 30m.

The intensity of a meteoric epoch is inversely as its order of magnitude. Thus the heaviest maximum occurs on January 18, as it belongs to an epoch of the fifth order of magnitude, which is the highest of the month. Owing, however, to the times at which its maxima occur, and also to other circumstances, this epoch will not furnish so many meteors as the first two of the month, which have their principal maxima shortly after midnight on January 3.

Dublin. JOHN R. HENRY.

EXCAVATIONS IN CRETE.[1]

SWIMMING in the blue sea of the Gulf of Mirabello (well so named!), on the north coast of Crete, is a solitary isle, the name of which is beautiful in its Greek shape of Pseira, but by no means so lovely when translated into English, for ψείρα means "louse." The polite geographer Kiepert has in his map turned "Pseira" into "Psyra" (which is so much nicer), but Pseira, *Lausinsel*, is its name.

Photo.] [*R. B. Seager.*

FIG. 1.—Pseira, from Kavou i.

Seen from the west it reminds one of the Bass, but from the heights of the bridle-path leading over the cliffs from Kavousi to Tourloti, we see how low and insignificant it really is in comparison with the coast-hills; it looks little more than a long, low shoal. It is barren, and waterless, and no man lives there; only a few goats derive a precarious subsistence from the scrubby herbage which covers a portion of it; the rest is bare rock. Yet this unpromising place was the site, three thousand years ago, of a flourishing settlement of men, in which wealth existed and art was fostered.

Readers of NATURE will remember that some years ago Miss Boyd (the present Mrs. Hawes) excavated for the University of Pennsylvania an ancient Cretan town on the spot which bears the name of *Gournià*, on the mainland not far from Pseira; articles describing her work have appeared more than once in these columns. With her was working a young American archæologist, Mr. Richard B. Seager, who, after the close of the work at Gournià, excavated a settlement at Vasilikí, on the isthmus of Hierapetra, half-way between Gournià and Kavousi, which is opposite Pseira. The results of his work at Vasilikí were reviewed in NATURE of September 6, 1906. His next essay was the exploration of Pseira, where certain indications seemed to promise success in digging. Nor were these expectations disappointed. On the small tongue of land which forms the eastern side of the tiny cove which is the harbour of Pseira (a haven just large enough to hold a couple of caïques), were discovered the remains of an ancient town, with streets of houses descending steeply to the sea. It was a tiny place, though when it was made it was bigger than it seems now, for the land has sunk everywhere along this coast since the old Minoan times, and now the waves wash into the houses. All the ancient Cretan towns of the Bronze age seem to have been small, as was Gournià, judging by our standards, with narrow streets, some five feet broad at most, and cramped houses with tiny rooms.

But their small size was not the result of small ideas or lack of culture. In the ruined houses of these ancient towns have been found treasures of ancient art, of that most ancient art of Greece, the art of the Heroic age, which is older by a thousand years than the "Greek art" of the schools. And waterless, barren little Pseira has yielded objects of art finer than most of those found at Gournià, and hardly inferior to many of those discovered by Dr. Evans at Knossos (though, of course, in much less number). We may instance the relief fresco of the lady or goddess published in plate v., and the vases in Fig. 9 and plate vii., of Mr. Seager's report on his excavations, which lies before us.

Photo.] [*H. R. Hall.*

FIG. 2.—The ancient town of Pseira, showing the excavations.

A cursory glance at these and the other illustrations of the report shows us that at Pseira the best traditions of Knossian art were followed, and it is evident

[1] "Excavations on the Island of Pseira, Crete." By Richard B. Seager. (University of Pennsylvania; the Museum; Anthropological Publications, vol. iii., No. 1.) Pp. 38+19 figures+9 plates. (Philadelphia: The University Museum, 1910.)

that the little island was really wealthier than Gournià, which at the time (about 1700–1400 B.C.) was probably the local provincial capital of the isthmus district. This wealth must have been due to seafaring trade, and probably to a great fishing industry, for agriculture there could be none on Pseira, even if in those days (as seems likely) there were water springs which now have dried up.

Then, about the end of the First Late Minoan Period (about 1500 B.C.), came a catastrophe. The town, which, like other settlements of the Cretan thalassocrats, even on the coast, was undefended by walls and open to attack, was taken, destroyed, and sacked by some unknown enemy. It never recovered, being only occupied for a short time during the Roman period.

To this disaster we owe, as Mr. Seager well points out, the preservation of so many objects of high interest. Gold, siver, and bronze were all looted and carried off; hence the comparative rarity of metal objects. But the fine pottery which is of so great interest to us now as evidence of the culture of its makers was unvalued by sea-robbers, and so, here, as elsewhere in ancient towns which have been destroyed by a catastrophe, we find this pottery and other remains of value to us exactly where it was left by the expelled or destroyed owners, or where the rage of the conqueror cast it forth. "On all sites the period of destruction is the one which leaves the richest harvest for the excavator. As long as a site is in continuous occupation the earlier deposits are only the refuse of breakage and objects which have ceased to be of service to their owners. They are thrown into rubbish-heaps and used as artificial fillings to make even floors over naturally uneven surfaces. Where, as at Pseira, the town was destroyed in the height of its prosperity, with no extensive later settlements to disturb its ruins, the finds are, of course, unusually rich" (p. 10).

I have no space for any critical discussion of technical points of archæology, but may say that Mr. Seager's description of his finds in this summary report is both able and interesting. The publication is well produced, its plates are admirable, and its line illustrations well and accurately drawn. It is a worthy addition to the series of anthropological publications of the Pennsylvania University Museum, of which it forms the first number in the third volume. Soon we hope to see a similar report on Mr. Seager's later and still more interesting discoveries at Mokhlos, another isle, east of Pseira, where tombs have yielded gold treasures like those of Troy, and as old. Mr. Seager is to be congratluated on his admirable contributions to the great work, important and useful alike to science and to art, which is being carried out by the excavators of ancient Crete. H. R. HALL.

THE LEAD GLAZE QUESTION.[1]

THE report referred to below is the outcome of the deliberations of a committee appointed by Lord Gladstone in May, 1908, to consider a question which has engaged the attention of the Home Office and Parliament for several years past, and has already been the subject of inquiry by several departmental committees. It is a matter of common knowledge that persons engaged in the making of earthenware and china are subjected to considerable risk to health from two main cases—dust and lead. The dust arises from the finely-divided silicious matter, mainly ground flint, employed in various stages and processes of ceramic manufacture; this when breathed gives rise to distressing bronchial and lung troubles, and in an aggravated form leads to the malady known as "potter's rot."

The danger arising from dust may be largely obviated by the use of mechanical and other appliances whereby the operative is prevented from inhaling the dust-laden atmosphere. By the more general use of exhaust-fans or other suitable ventilating machinery, and by the employment of respirators, cases of "potter's rot" are less frequent now than formerly. At the same time much remains to be done by a more stringent application of these remedial measures. It was only in 1894 that the Home Office issued the first code of special rules dealing with dusty processes. The evil is patent and notorious; it is, however, not very satisfactory to be told that we must wait for the statistics of 1920–2 before we can estimate the real value of these special rules. If public opinion moved as fast on the dust problem as it has on the lead question, we should not have to wait ten or twelve years before this crying evil was absolutely stamped out, and "potter's rot" become as much a thing of the past as "phossy jaw."

It is, however, mainly to the dangers attendant on the use of lead in pottery manufacture that public sentiment has been roused, and it has been largely in deference to this feeling that the several departmental committees above alluded to have been appointed. It is only by "pegging away" in this manner that such amelioration as has been secured has been reached.

The pottery industry in this country is mainly centred in North Staffordshire. Of the 63,000 workers in the 550 factories scattered throughout the United Kingdom, 48,000 are employed in the 329 "potbanks" in the district known as the "Potteries." Owing to special circumstances, arising largely from local conditions of employment, no systematic attempts to grapple with the evil of lead poisoning have been made by the manufacturers as a body. Individual firms, with intelligent management, have succeeded in minimising the mischief, but the laxity of other firms has at times more than neutralised the benefits which have been secured by the more general adoption of the precautionary measure which common-sense seemed to indicate and experience has shown to be adequate. The manufacturers as a body have, in fact, been content to wait until outside pressure has forced them into action, mainly by rules and regulations issued by the Home Office, and based on the suggestions or recommendations of departmental committees appointed *ad hoc*.

The committee which has now reported has gone over much of the ground already traversed by its predecessors, or which occupied the attention of those engaged in the prolonged arbitration under Lord James, leading up to the special rules of December, 1903. But it cannot be said that any real progress has been made. Although it has been established that a large amount of earthenware can be made without the use of lead in any form, and even in the cases where lead must be used, it has been proved that the lead may be so combined that it is practically innocuous, the manufacturers as a body have hitherto resisted any attempt to prescribe a schedule of articles which should be made with leadless glaze, or to bind themselves to use glazes in which the lead is in an innocuous form. They, in fact, demand unrestricted liberty to use any materials they think necessary for their purposes. The loud cry of "foreign competition" is sufficient to drown the still, small voice of pity raised on behalf of the workers.

[1] Report of the Department Committee appointed to inquire into the Dangers attendant on the use of Lead and the Danger or Injury to Health arising from Dust and other Causes in the Manufacture of Earthenware and China and in the Processes incidental thereto, including the Making of Lithographic Transfers. Presented to both Houses of Parliament by Command of His Majesty. Vol. i. Report. Pp. vii+150. (London: H.M.S.O., 1910.) Price 1s. 5d.

Now it is absolutely certain that under such conditions lead-poisoning in pottery manufacture will continue to occur. The leading manufacturers, through their counsel, in the course of the arbitration proceedings before Lord James of Hereford in 1903, promised the extirpation of lead-poisoning under the rules then proposed, but that promise has not been kept. On the contrary things are as bad as ever. That more might be done under the rules as they stand would seem to follow from the statistical information furnished by the committee. They examined into the record of the 550 potteries which have been placed under these special rules during the period 1904 to 1908, and they find that during these five years :—

5	potteries	have been	responsible for	75 cases
17	,,	,,	,,	119 ,,
151	,,	,,	,,	323 ,,
In all 173	,,	,,	,,	517 ,,

leaving 377 potteries out of the 550 in which no cases have occurred at all. In other words, 32 per cent. have an average of three cases every five years, while 68 per cent. are entirely free from the disease. In the 173 potteries in which the disease has occurred there are 4,800 workers as against some 2,000 in the other potteries. The conclusion would seem to be obvious. It is in certain relatively large works that the cases of lead-poisoning are most frequent, and this can only be due to bad management, imperfect supervision, or inadequate protective appliances.

During the period 1901–9, 865 cases of lead-poisoning in pottery workers were reported. Of these 788 arose from glaze processes, whereas only 51 were due to decorative processes. Lead glaze is therefore the main cause of the evil.

It cannot be said that the conclusions of the committee now reporting have tended in the slightest degree towards a solution of this grave evil. All the conditions to which lead-poisoning in ceramic manufacture is due are perfectly well known, but the committee was apparently unable or unwilling to make any definite suggestions as to remedies. The committee pleads that it was in a difficult position. The members of the committee representing the manufacturers were entirely opposed to any restriction in the use of raw lead; the representatives of the workers, seeing the comparatively harmless character of low-solubility glazes, would be glad to see them generally introduced, "but have to consider the grave risk of loss of employment which any dislocation of the industry due to their introduction might entail." *Might*, not would. Taking the question of glazes as a whole, two facts, says the committee, are beyond dispute :—

"In the first place, the danger to the workers of handling raw lead is very real; in the second, it is evident that however unsuitable leadless and low solubility glazes may be for certain classes of ware, there is a considerable quantity made for which they are quite satisfactory."

But the members of the committee are unable to make up their minds what classes of ware are represented by this "considerable quantity," although the facts were before them. They think, however,

"that every inducement and encouragement should be given to the manufacturers both to persevere with their experiments in search of satisfactory and low-solubility glazes, and to introduce them whenever possible."

Also efforts should be made to arouse the interest of purchasers in the question. The members think "it was established that pottery made with leadless and low-solubility glazes can be obtained of excellent quality," and they "consider that the desirability of insisting on being supplied with such ware should be brought home to the public at large." Lastly, they are of opinion that—

"the observance of the special rules has been far from satisfactory. In the past many of the manufacturers do not appear to have regarded it as incumbent on them personally to insist upon it; they have left the initiative to the factory inspectors, and in future they should be made to realise that they are themselves responsible."

The committee obviously had not the courage of its convictions. It is difficult to imagine any more feeble or inconclusive "conclusions." No constructive action seemed to be possible to it; its only policy was that of *laissez-faire*. The net upshot of the inquiry is that the whole position is not one whit ameliorated; the operatives apparently are still to remain the victims of lax surveillance or of indifference, and of official non-interference.

The matter, however, cannot be allowed to rest in this position. If the manufacturers' claim for unrestricted liberty to use such dangerous materials as they please is to be allowed, they must be made to feel the responsibility they therby incur by far more stringent measures than have hitherto been brought to bear upon them.

THE NEW ENCYCLOPÆDIA OF SPORT.[1]

WHETHER by design or by accident, the new edition of this work has appeared at an opportune time, since the success of the Vienna Exhibition has attracted an even more than ordinary amount of attention to sports and pastimes of all sorts during the year now rapidly coming to a close. Those who

Photo.] [*W. S. Berridge.*

Himalayan Tahr. From "The Encyclopædia of Sport."

possess the first volume of the original edition will find, on comparing it with its successor, a great change in regard to much of the subject-matter, aviation having been practically created since the date of the appearance of the first edition, while during the same period motors have come to the front as a means of communication, and everything in connection

[1] "The Encyclopædia of Sport and Games." Edited by the Earl of Suffolk and Berkshire. New and enlarged edition. Vol. i., A to Cricket. Pp. viii+496. (London : W. Heinemann, 1910.) Price, 10*s.* 6*d.* net at home ; 12*s.* 6*d.* net abroad.

with automobiles has been revolutionised. So far as I am capable of judging, these articles, as well as those devoted to archery, athletics, cricket, &c., are thoroughly up to date, and, like the rest of the volume, admirably illustrated.

On turning, however, to the articles on big game and big game shooting, I notice that there is a considerable amount of repetition and overlapping, while, worse still, one and the same species of animal is in several instances mentioned in different places under different names. In the case of the reindeer or caribou, for example, the scientific name of the species is given on p. 264 as *Rangifer tarandus*, on p. 399 as *C.* (=*Cervus*) *tarandus*, and on p. 401 as *Tarandus rangifer*. Take again the case of the Indian gazelle (*Gazella bennetti*), which is figured, quite unnecessarily, in three different places. The first figure, p. 75, bears the legend "Ravine Deer"—a common sportsman's name—while it is alluded to in the text as the "Chinkara"; on p. 256 the illustration is lettered "Indian Gazelle," while on p. 412 the same figure reappears under the designation "Chickara." Again, the West African dwarf buffalo is designated *Bos caffer nanus* on p. 248, and *Bos pumilus* on p. 319.

These eccentricities in nomenclature are, however, by no means all the defects in the articles under consideration. The chita, or hunting leopard, for example, in addition to being styled *Cynaelurus jubatus* on p. 408, and *Felis jubata* two pages later, is stated on the former to be nearly related to the leopard; and on p. 410, the Indian spotted deer, or chital, is asserted to be a near ally of the fallow deer, despite the fact that the one wears its spotted livery all the year round and the other only in summer. Worse than all, we find on p. 250 a photograph described as that of the western tur (*Capra caucasica*), whereas it is really of the same individual as that depicted on p. 252, under its proper title of tahr (*Hemitragus jemlaicus*).

An error of another kind appears in the first article under the heading bison, which is devoted solely to the American representative of the group, whereas it should have commenced with the European species, which is the bison *par excellence*, the American animal having only a kind of courtesy right to the title.

These and others errors are due, in the first place, to what I regard as the pernicious principle of putting men of different opinions, and in many cases of very different degrees of knowledge, to write on the same subject or branches thereof, and in the second place to the lack of a competent editor to revise and correlate the zoological articles, and thus prevent useless and irritating repetition.

While fully appreciating the value of the work as a whole—which is really a wonderful enterprise—the above and other errors in the big game portion are much to be deplored, more especially as the articles are intended for the use of those who are not professed naturalists.

R. L.

WESTERN CHINA.[1]

MR. ARCHIBALD LITTLE'S work, the result of fifty years spent in western China, forms a valuable contribution to our knowledge of that vast region. The volume before us is invested with special interest, as it is the remnant of the labour to which he devoted the greater part of his life. He was at heart an explorer, although in business as a merchant in Chung-keng, much of his time was spent in difficult and dangerous expeditions, which he carried out so successfully as to establish his fame, not only as an intrepid traveller, but as an authority on the western provinces of the empire. He was an exception to the majority of the foreign merchants one meets in China in his having acquired a

FIG. 1.—The Hua-Hua Lo at Wuchang, opposite Hankow: one of the most beautiful pavilions in China, unfortunately destroyed by fire. From "Gleanings from Fifty Years in China."

[1] "Gleanings from Fifty Years in China." By the late A. Little. Revised by Mrs. A. Little. Pp. xvii+330. (London: Sampson Low, Marston and Co., Ltd., 1910.) Price 7*s*. 6*d*. net.

working knowledge of the language, which proved of service to him in his travels and intercourse with the natives, and in obtaining trustworthy information.

The present volume, unlike its predecessors, is made up of a series of desultory notes or essays written at intervals during his fifty years in Chung-keng, the majority having already appeared in some published form, while the remainder are printed for the first time. Taken together, they form an interesting addition to the author's well-known work, and are published as they were written, no attempt being made to edit or rearrange the material. It is best so, as they are characteristic of the author, who won his way to the hearts of the alien folks among whom he lived and wandered in security for so many years, a people who would fain see the last of the average foreigner, whose aggressive commercialism they do not love.

In his discussion of foreign trade with China the author traverses familiar ground, but he affords some insight into Chinese diplomatic delays in his account of the years spent in fruitless endeavour before

FIG. 2.—A quiet reach on the Upper Yangtse. From "Gleanings from Fifty Years in China."

Chung-keng was thrown open as a treaty port. Mr. Little was the first to take a steamer through the gorges of the Upper Yangtse, a feat so daring and hazardous as to prove what had been foreseen, that the route was impossible for regular steam traffic.

In his historical notes on the provinces from Marco Polo's time, who was the first to describe the region, he states that an interval of some 600 years elapsed before Abbé Huc gave some further account of the country in 1844. He overlooks the claims of Fradelli, Regis, and Bonjour, who, early in the seventeenth century, surveyed and described the western provinces of China, their products, and people.

We can do little more than name some of the other subjects dealt with in the volume—the possible partition of China, China's Christian missions, an essay in which the views expressed may not meet with the approval of those engaged in the work, although he pays a just tribute to the workers as "the promoters of all good in the advance made by China in the past fifty years."

The concluding chapters on the Chinese drama, with examples of native plays, and on Confucianism are new, and sustain the scholarly reputation of the author. A series of excellent photographs add to the attraction of the volume. J. T.

THE CALORIMETRY OF MAN.[1]

A GREAT deal has been said previously as to the general excellence of the methods and apparatus developed in connection with the "respiratory calorimeter" now in use in the Nutrition Laboratory in Boston. That they are original and are carried to a unique degree of perfection, that they have been utilised in the solution of very interesting problems. All this is well known, and will be found frequently dealt with by the authors of the publication referred to below. Gratitude has been freely expressed on these points.

In this recent publication the authors, experienced investigators advantageously equipped for the purpose, have set themselves the task of laying a base line for further calorimetric research. They will receive the thanks of every interested technical observer for the splendid series of data which they have compiled, but they have overhauled them in a manner open to some criticism.

To develop this statement let us take one set of their facts, namely, that the oxygen consumption and heat production of the human being vary during periods of sleep within wide limits when assessed per man, or per kilo of man, or per square metre of the surface of man. Of these three forms of assessment, the last is the most interesting since the loss of heat, and therefore the oxygen consumption and heat production by which it is compensated, is largely conditioned by extent of surface. Now it is of some importance that no surface measurements have been made and that the estimations of surface are really derived from the measurements of weight. The authors refer to this point with some expression of regret, and a promise of contributory data, again of an indirect kind, in future. It would, however, have been of far greater interest had they dealt soundly with their data of height and weight in such a way as to show with unmistakable clearness that no probable corrections in their surface estimations will account for the differences in heat loss observed. A clear statement that they had found variations not accounted for, *and never likely to be accounted for,* by variations in surface would have been of substantial value.

That this end might have been met by an adequate comparison of the measured heights and weights of their "tall lean men, tall men, short fat men, short men," with average anthropometric data, there can be no doubt whatever. Thus let us take the particular instance of the individual giving the minimum heat loss per man, or per kilo, or per square metre of the surface of man, as compared with the seventeen other individuals whose fortunes can be followed through most of the tabulated statements. His height may best be described as the cube root of his

[1] "The Metabolism and Energy Transformations of Healthy Man during Rest." By F. G. Benedict and T. M. Carpenter. Pp. viii+255. (Carnegie Institution of Washington, 1910.)

weight multiplied by 4·5. Armed with a convenient table of cube roots and plenteously available data, it will be found that this man is a departure from the average, but a departure in the opposite direction to that which would promise the concealment of much weight under a partially spherical and disproportionally small surface. In this country at least the average height of the youth from eight years of age to eighteen is 4·3$\sqrt[3]{W}$, whereas the stouter child and adult above and below these ages is liable to possess smaller heights, such as 4·2 to 3·7$\sqrt[3]{W}$.

So far is this man's rate of heat-loss per estimated square metre of surface below the average, and so unlikely is it that direct measurements of his surface will lead to any compensatory change in the statements such as would bring it near to the average, that it might have been of value to direct special attention to his indisputable peculiarity. Had this been done, another peculiarity of his might perhaps have been brought to mind and have been found of interest, namely, that he is a veteran *habitué* of the calorimeter. It may be suggested, indeed, that this is the important fact inasmuch as it enabled him to sleep amidst these peculiar surroundings and modified atmosphere with unusual unconcern. That unconcern is truly a factor of some importance may perhaps be gathered from a consideration of the unexplained greater evaporation of water from the surfaces of the few women bold enough to enter the calorimeter. It might be suggested that there is no mystery in the fact that these ladies perspired unduly.

It is almost certain that this particular case might legitimately be used to illustrate the statement that sleep, like scientific literature, is sometimes profound although often not so. It is indeed a well-known fact that the excitability of the nervous system during sleep is a very variable value, and it is extremely probable that its variations are attended with changes in the "tone" of the skeletal musculature, and therefore with modifications in the quantity of concurrent metabolism. Once take this point of view, which is apparently not dealt with by the authors, who describe all alike as being in profound sleep, and it will, on sound grounds, be found that there is not one of these recorded cases that does not require some consideration in these terms. Thus it will be found that every individual with a metabolism during sleep that is below the average value by more than 5 per cent., awakes to a metabolism increased by from 26 to 63 per cent., whereas every individual with a metabolism in sleep greater than the average by more than 5 per cent. awakes to a smaller increase varying from 10 to 22 per cent. It is necessary to suggest that the one set awake to a relatively much greater increase of metabolism because they awake from a more profound state of slumber. Nor is the suggestion the less necessary when it is discovered that although several not infrequent visitors to the calorimeter are found on either side of the average, yet the initials of the best-known *habitués* are found in the heavy slumber class and those of certain restless probationers in the list of light sleepers. J. S. MACDONALD.

NOTES.

IN a four-column article which appeared in the *Times* of December 22, the outbreak of plague in East Anglia, and particularly the rat-infection in the locality, is dealt with ably and exhaustively. The writer of the article points out that no adequate measures have yet been taken to deal with the situation, and urges that it is one of national importance and for direct Government intervention. It is suggested that a sum of 10,000*l.* at the very least is required to prosecute the necessary inquiries and investigations, and that there is immediate necessity for expert inquiry under Government control and at Government expense. Compared with the issues involved, the expenditure of such a sum, or even one many times larger, need not be considered, and the course of action recommended will commend itself to those who have a real knowledge of plague, and it is to be hoped that the authorities will speedily take in hand an organised scientific inquiry into the outbreak of plague in England and the remedy for its control. Similar views in outline were expressed in the article on "Plague" which appeared in NATURE of the same date (December 22, p. 237).

THE appalling loss of life associated with the terrible colliery disaster at the Yard Mine of the Hulton Colliery Co. at Bolton, Lancashire, has again emphasised the desirability of perfecting, so far as is practicable, the warning of approaching danger. The explosion, which occurred shortly before 8 a.m. on Wednesday, December 21, resulted in the loss of about 350 lives. The *Times* of December 22 says the disaster followed immediately upon a colliery warning, which appeared on Monday in newspapers circulating in various mining districts, and the warning was said to be in continuation of one which had been circulated a week earlier. Such warnings are not, however, issued by the Meteorological Office. With the advance made in recent years in our knowledge of weather changes, it seems desirable to determine the atmospheric conditions under which explosions generally occur, and, if possible, to place the warnings of approaching danger on a scientific basis and to make some public authority responsible for the issue of such warnings. The weather chart for 7 a.m. December 21 issued by the Meteorological Office is of quite a common type, and is representative of many such occurrences in the course of an English winter. A region of low barometer was situated to the south of Iceland, and a region of high barometer was situated over Germany. The barometer at this time was fairly steady at about 29·95 inches over Lancashire. Examining the atmospheric conditions under which fifteen of the greatest colliery disasters of recent years occurred, between the years 1880 and 1910, there is a preponderance of explosions with a high barometer, and about the time that the central area of an anticyclone is situated in the neighbourhood. There are, however, marked exceptions to this, and the disaster near Wigan on August 18, 1909, occurred when an area of low barometer readings was centred close by. Irrespective of the absolute height of the barometer, the instances examined seem to occur about equally with a rising and a falling barometer.

A BILL to make Paris official time coincide with Greenwich time was presented to the French Senate on December 21. The Bill was passed by the Chamber of Deputies several years ago, and has been approved by the senate committee and by the Cabinet, so that in all probability it will become law. Paris time is 9m. 21s. ahead of Greenwich time; and upon the day prescribed by the law, the clocks indicating official time in France will be put back by that amount. By the adoption of the change, France will be brought into the international system of Standard Time reckoning which is now followed in most civilised countries. On this system, the hour of each successive fifteen degrees of longitude, reckoning from the Greenwich meridian, is used for the Standard Time; hence the difference in time in passing from one zone to another is always an exact number of hours.

IT was announced a short time ago that a new zoological garden in course of construction by Mr. Carl Hagenbeck in the grounds of the Villa Borghese, Rome,

would probably be opened on January 1. The grounds, which comprise twenty-eight acres, lie outside the old walls to the northward of the city, and it is stated that more than 40,000*l.* has been already spent on them, while the animals, some 1400 in number, represent another 10,000*l.* As at Stellingen, cages have been to a great extent dispensed with, deep ditches and scarped cliffs serving to confine the animals, which thus appear to be at liberty.

THE Zoological Society of London has elected the following corresponding members:—Mr. Roosevelt, ex-President of the United States; Mr. B. Basu, Calcutta; Mr. J. M. Doctor, Bombay; Dr. R. Dohrn, Naples; Prof. Ludwig von Graff, Graz University; Mr. W. H. Osgood, Washington, U.S.A.; Mr. H. Pam, Caracas; and Mr. R. B. Woosnam, Nairobi. Prof. E. Lönnberg, Stockholm, and Mr. S. H. Scudder, Cambridge, Mass., U.S.A., have been elected foreign members of the society.

WE learn from the *Chemist and Druggist* that the branch laboratories of the Pasteur Institute of Paris, at Garches, near St. Cloud, which are specially used for the preparation of anti-diphtheric and other serums, took fire a few days ago, and damage to the extent of 4000*l.* was done.

THE International Horticultural Exhibition which is to be held in the Chelsea Hospital grounds at the end of May, 1912, promises to have considerable scientific interest. There has only been one show of this nature in Great Britain, namely, that of 1866, which was held at South Kensington. Although the 1866 Exhibition was, in the end, a magnificent success, it very nearly proved disastrous to those responsible for the finances. The ultimate success was obtained by the committee prolonging the period the exhibition was open for public inspection, and the balance which resulted from this policy was devoted partly to the purchase of the Lindley library, at present housed in the Royal Horticultural Society's Hall at Westminster, and partly to making a donation to the funds of the Gardeners' Royal Benevolent Institution. In connection with the exhibition there was held an International Congress, and a valuable report of the proceedings was printed which is still a lasting record of the work and interest that were freely given by the horticulturists of that day. In 1912 a similar congress will take place, and subjects of international importance to the horticultural industry will be discussed in the presence of representatives from most of the European countries, America, and our own colonies. It is expected that the congress will consider the question of the regulation of insect pests and fungus diseases, and the effects of the prohibition of the importation of certain plants to certain countries, for instance, by the Phylloxera laws in the wine-producing countries. Certain other questions suggest themselves as ripe for discussion; for example, the improvements which have been effected in plants in recent years, the different methods by which those improvements have been obtained, and horticultural education, with special reference to the methods of training young horticulturists in this country and on the Continent of Europe and in America. A committee largely composed of scientific men has been appointed specially to promote the congress and a scientific section of the exhibition. The horticultural show itself is expected to be the largest ever held in this or any other country. There are already 431 competitive classes, and many of these are of scientific interest, but we must reserve any further remarks for a future occasion. Copies of the schedule can be obtained from Mr. Edward White, 7 Victoria Street, Westminster.

MR. J. GRAY contributes to the December number of *Knowledge* an article on the measurement of perseveration and its value as an index of mental character. In point of fact, Mr. Gray does not measure perseveration, but the speed at which rapid flashes of colour just succeed in extinguishing flicker in various subjects. He assumes that the individual differences with which he meets are due to differences in the persistence of colour sensations, and that "this persistence . . . is identical, or very closely related, to a quality of mind which the psychologists call Perseveration." The experimental facts which the paper contains are two, viz. that flicker disappears more readily in women than in men, and perhaps more readily in dark-haired than in light-haired persons. The nature of these differences awaits careful psychological investigation.

IN the *Revue générale des Sciences* for October 15 and 30 Prof. Marinesco, of the University of Bucharest, has given an interesting summary of recent investigations upon the anatomical localisation of the human cerebral cortex, and more especially of the distinctive cytological characters of each of the multitude of areas into which the pallium of the brain can now be subdivided. His descriptions are elucidated by a series of twenty-seven drawings exhibiting a wealth of intricate detail. The articles are essentially a digest of the work accomplished by others, and especially of the classical researches of Oskar and Cecilie Vogt and Karl Brodmann. Although Prof. Marinesco's citations of the results and the opinions expressed by other anatomists are not always exact, on the whole his summary will be useful to those who are unable to find time to read the voluminous literature upon which it is based.

THE Journal of the Quekett Microscopical Club for November (ser. 2, vol. xi., No. 67) contains a critical paper on the classification of the Bdelloid Rotifera which should be of great value to students of this difficult group. The same number contains an interesting echo of the British Association's visit to South Africa in 1905 in the description, by Prof. G. S. West, of a remarkable new species of Volvox collected by Mr. Rousselet in Rhodesia. The adult colonies are about 1 mm. in diameter, and may contain more than 50,000 cells. Another paper also deals with the microscopic fresh-water fauna of Africa, being a contribution to the list of Hydrachnidæ found in the East African lakes, by Mr. Charles W. Soar. The material upon which this paper is based was collected during the third Tanganyika expedition conducted by Dr. W. A. Cunnington.

IN the *Centralblatt für Mineralogie, Geologie u. Paläontologie* for 1906, p. 450, Dr. O. Abel founded a new genus and species of bird (*Alabamornis gigantea*) on two bones from the Alabama Eocene, regarded by Dr. Lucas as the pelvis of a Zeuglodon, these bones being described as coracoids of the bird. Dr. Lucas wishes to state that there is no doubt whatever as to the correctness of his original determination, and that the bones in question have been mounted in their proper position in the Zeuglodon skeleton which is now exhibited in the U.S. National Museum. "Alabamornis" must accordingly be deleted from the list of fossil bird genera.

DR. F. A. LUCAS writes to say that the "Open Letter" of the Campfire Club on the fur-seals of the Pribilows, which was referred to in NATURE some months ago, contains several misstatements, more especially the assertion attributed to the authorities that unless 95 per cent. of the males were annually killed the herd could not increase. In the Recommendations of the Advisory Board, of which

Mr. Lucas has enclosed a copy, the statement is "that not more than 95 per cent. of the three-year-old male seals be killed in any one year," which is, of course, a very different matter. Mr. Lucas adds that all male fur-seals over a certain size are not killed, but left to grow up, and that under the rules in force for the last five years the number of adult males has steadily increased, while the females have as steadily decreased, and will doubtless continue to do so if pelagic sealing be not stopped.

In a paper on animals in Glen Garry Forest, published in vol. vi., part iii., of the Transactions of the Edinburgh Field Naturalists' and Microscopical Society, Mr. Symington Grieve states that whereas half a century ago the sea-eagle was far more numerous in Scotland than the golden eagle, at the present time precisely the opposite of this is the case. The golden eagle, owing to the protection afforded to it by landowners, is increasing in numbers throughout the Highlands in suitable districts. On the other hand the sea-eagle, which formerly abounded on the cliffs of the west coast, has nearly disappeared, and in the author's opinion, in default of more efficient protection than it at present receives, will cease to breed in Britain within a few years. Mr. Grieve is also of opinion that the wild cat is on the increase in Scotland, owing to the instructions issued by proprietors and factors for its preservation.

In an article on the spawn and larva of the salamander *Amblystoma jeffersonianum*, published in the *American Naturalist* for December, Prof. W. H. Piersol directs attention to the low vitality of many of the eggs. Although no accurate census has been taken, it is estimated that under natural conditions three-fourths of the eggs do not live to commence gastrulation, and the same proportion of loss occurs in spawn kept in the laboratory. The egg does not die as a whole, but while some cells perish at an early period, others develop to a certain stage, only to die later. These dead eggs imbibe water and become larger than the rest, and in the natural condition become infested with a fungus. Since, however, this fungus does not make its appearance in spawn reared in the laboratory, it is manifest that the mortality is due to some other cause. On the other hand the spawn of the allied *A. punctatum*, both in the natural condition and in the laboratory, suffers practically no loss.

The Live Stock Journal Almanac for 1911 contains the usual amount of valuable information regarding horses and pedigree stock of all kinds for 1910, together with a number of articles on subjects of current interest by various specialists. Sir Walter Gilbey, for instance, discusses the effect of the rapid increase of motor vehicles on the prices of horses, and finds that although fewer horses are required in this country than was the case ten years ago, yet prices in all classes are fully up to their old level. This affords evidence that the supply has fallen *pari passu* with the demand, and this, from a military point of view, is a serious matter. On the other hand, the demand for shire horses is fully maintained. In another article Lord William Cecil directs attention to the value of our mountain and moorland breeds of ponies, on account of their stamina and hardiness, and advocates that Government should take into consideration the advisability of breeding a serviceable class of horse from pony mares. In an article on the connection between the various breeds of British cattle and the nature of the soil on which they are reared, Mr. P. McConnell revives the theory that the red colour of Herefords is connected with the red rocks of their native county. He forgets, however, to add that the Sussex breed is also red. Apparently he also believes that white park cattle are an aboriginally wild stock.

Dr. Guido Sala (*Mem. R. Ist. Lombardo Sc. e Lettere, Classe Sc.*, xxi., fasc. iv.) has published some interesting observations on the cells of the ciliary ganglion. In the human fœtus of six or seven months the cells are comparatively simple; they have few superficial prolongations (each ending in a bulbous enlargement), and a pericellular network is seldom present. At the time of birth the cells and their processes are larger, and six or seven months later loop-like outgrowths of the cell begin to appear, and later become more numerous, larger, and more complex. In adults there is a complex pericellular network of fine deeply staining fibrils, which completely envelops the cell, and there is often a spiral fibril round the axone. In old persons the cells exhibit modifications and assume almost the aspect of embryonic elements, and the protoplasmic processes of the cell are, for the most part, short and thick. In the same memoirs (fasc. iii.) Prof. Livini gives some notes on the development of the trachea in the chick. In embryos of about ninety-four hours' incubation the lower end of the trachea and the origins of the bronchi become narrowed and then occluded, but the lumen is restored before the one hundred and eighteenth hour of incubation. A little later the greater part of the trachea becomes similarly narrowed and temporarily closed.

Among thirty-one forms of lichen collected by Ir. M. Shegolef in the Jugjur chain (Stanovoi), *Umbilicaria caroliniana* and *Usnea cavernosa* are of special interest, as the former has been previously reported only from America and the latter only from America and India (Bulletin of the Imperial Academy of Sciences of St. Petersburg, No. 7, 1910). *U. cavernosa* seems to be widely distributed in eastern Siberia, for it is abundantly represented in Shegolef's collection.

Among ostracoda collected by D. Pedashenko in Issyk-kul is *Herpetocyprella mongolica*, of a new genus which resembles Candona and Eucandona in the absence of swimming bristles to the second pair of antennæ, but is very different in many other respects (*Travaux de la Soc. Imp. des Naturalistes de St. Pétersbourg*, vol. xxix., fasc. 2, part i.). Other new species are *Cypricercus mongolicus* and *Cytheridea pedaschenkoi*.

At the annual meeting of the Lancashire and Cheshire Entomological Society, held in Liverpool on December 19, Mr. R. Newstead, of the Liverpool School of Tropical Medicine, delivered his vice-presidential address on "Some Morphological Characters of the Genus Glossina." He stated that he has made a careful examination of the armature of the males of all the hitherto described species of the genus Glossina, and it has not only revealed some very striking morphological characters, but has led to the discovery of three hitherto undescribed species:—*Glossina submorsitans*, Newst.; *G. brevipalpis*, Newst.; and *G. fuscipes*, Newst.; and the re-establishment of Bigot's *G. grossa*. The scheme of classification adopted is based entirely upon the taxonomic characters of the male armature, which are the true and almost only natural anatomical elements that can at present be found in these insects. Mr. Newstead has found that the species fall into three striking and distinct groups, each being separated by very trenchant characters. The groups are:—(1) The *fusca* group, including the four largest species of the genus: *G. fusca*, Walker; *G. grossa*, Bigot, which have a western distribution; *G. longipennis*, Corti;

and *G. brevipalpis*, Newstead. (2) The *palpalis* group, to which belong the species: *G. palpalis*, Rob.-Desv.; *G. tachinoides*, Westwood; *G. fuscipes*, Newstead; and *G. pallicera*, Bigot. (3) The *morsitans* group, comprising *G. morsitans*, Westwood; *G. submorsitans*, Newstead; and *G. longipalpis*, Wiedemann. In these three groups forms occur which are so widely different as to lead one to assume, without taking the other external features into consideration, that they represent three distinct genera. Certain it is that these insects illustrate one fundamental principle of evolution, namely, that they have attained great development of one set of morphological characters, and have retained others apparently of an ancestral type.

THE difficult question whether acquired characters can be inherited is discussed by Dr. Hugo Fischer in the issue of *Naturwissenschaftliche Wochenschrift* for November 20 and the following number. Examples among unicellular organisms are accepted in the cases of the sporeless races of fission fungi and the colourless variety of *Micrococcus prodigiosus*; also the chromatic modifications of Oscillaria and the physiological varieties of numerous Uredineæ and Ustilagineæ are cited as good instances. Amongst animals, the author notes the experiments of E. Fischer and others, who produced more than transitory changes of colour in butterflies by subjecting the pupæ to abnormally low temperatures, and Kammerer's results with salamanders. In the case of flowering plants, the author holds that the Alpine forms of larch and pine and Wettstein's seasonal forms of Euphrasia and Gentiana are not definite examples, but admits the races of maize produced by Blaringhem and the modified type of Sempervivum raised by Klebs. The essential factor appears to be a disturbance of the metabolism.

A COPY of the annual report for 1909, dealing with technological museums, has been published by the Technical Education Branch of the Department of Public Instruction of New South Wales. The report is an excellent record of steady progress. A considerable number of exhibits were added to the collections during the year. The display of polished marbles and building stones of New South Wales in the museum at Sydney has been largely added to, and the whole now makes a fine exhibit. For comparative purposes, slabs of the principal foreign marbles have been displayed upon the walls in an adjoining court. To increase the available knowledge of the constructive value of the building stones, a special collection was obtained from various parts of the State, and prepared for testing at a 100-ton machine. Fire and water tests upon specially prepared cubes were next undertaken upon the sandstones, trachytes, marbles, and granites. The location of deposits of building and ornamental stones occurring in the area included in the Federal capital site was determined, and specimens of these materials procured. The data obtained, together with a specially constructed map, were published as an appendix to the second edition of the museum's work on the "Building and Ornamental Stones of New South Wales." The public-school teachers of the district take advantage of the facilities offered by the museum in the furtherance of nature studies; 1567 specimens were identified for teachers during the year, not including those brought to the museum by teachers and pupils; 865 specimens were supplied from duplicate collections to assist the teachers in the formation of school museums. Specimens were identified and classified for a large number of schools throughout New South Wales.

MRS. M. OGILVIE-GORDON continues her studies of the Triassic masses above the Grödental, in Tyrol, in the *Verhandlungen der k.k. geol. Reichsanstalt* for 1910 (pp. 219 and 290). In 1908 she visited the Boégipfel region with Prof. Rothpletz and Herr von Klebelsberg, and verified the overthrust of Raibl beds on Dachstein dolomite. Neocomian strata were found resting on Jurassic north and south of the Eisseespitze; these lie below the overthrust. The sections of the Boé and Jägerschart masses show remarkable discordances due to thrusting, even among the Jurassic strata, and the Upper Triassic beds climb up boldly on the crests. Similar overthrusting has been studied by the author in the Sella and Langkofel area (Trans. Edinburgh Geological Society, 1909–10). In the second paper in the *Verhandlungen* the discovery of fossiliferous Cassian beds is recorded from under the Burgstall, a part of the Schlern mass where a dolomitic and contemporary facies was believed to exist. The dolomite on this level farther west is attributed by the author to the occurrence of an overthrust, whereby the Cassian horizon is brought above a wedge of the Schlern dolomite, which properly should overlie it, as it is seen to do on the Gamsteig and the Burgstall.

THE *Geologische Rundschau* (Leipzig: Engelmann), which was recently started as a journal of general geology, continues on the broad lines laid down by its originating society. Prof. Steinmann, for instance, describes and illustrates in parts ii. and iii. the structure of the Cordillera of South America. M. Semper summarises seventy papers on the "Klimaproblem der Vorzeit," a labour that will surely rejoice his fellow-members. P. Wagner furnishes a list of 127 German works and papers bearing on geological teaching in schools and on the treatment of geology so as to promote interest and observation. His introductory essay of sixteen pages reminds us that the main object of the *Rundschau* is to bring the geological features of Germany and Austria to the front in public education. It is clear from his review that there is already a healthy movement to draw even scholastic mineralogy out of the old grooves of dry description. In part iii. W. Meigen reviews recent work on the origin of dolomite, and J. J. Sederholm discusses twenty-three papers on the pre-Cambrian rocks of Fennoscandia. E. Dacqué deals with the Jurassic strata formed by transgression on the "Lemurian continent," that is, in the region between New Zealand, East Africa, and India. In part v. J. Koenigsberger discusses the earth's age, and F. Pockels the bearing of earthquake research on the nature of the earth's interior. It is clear that these reviews of geological progress, written by specialists, make the *Geologische Rundschau* a very welcome addition in all libraries of a scientific character, as well as in many private homes.

THE Geographical Pictures published by Messrs. A. and C. Black for use in schools furnish selected views of typical land features for study. Twelve of these, illustrating various forms of valleys, have just been issued in Series x. as half-tone prints of selected photographs, about 16×12 cm. Notes accompany them suggesting various problems for study. A reference to the contoured map-sheet on which the feature is represented would further enhance their educative value.

COPIES of the Tide Tables issued by the Canadian Government for the Pacific and the eastern coasts of Canada for the year 1911 have been received. For the former, tide tables are given for six stations, and from these the tides at numerous stations can be determined. The results given are largely based on the observations of 1909, when twenty recording gauges were in simultaneous operation

throughout British Columbia; besides these, however, observations for six years are available at Sand Heads station, and for shorter periods at the others. On the eastern coast longer periods are available, and the tables for Quebec are based upon observations extending over thirteen years. It is claimed that the tables for Quebec, Father Point, Halifax, and St. John are now superior to those of any other harbour on the Atlantic coast of North America.

WE have just received Water Supply Papers Nos. 245, 247, 250, 251, and 237, 239, published by the United States Geological Survey, in addition to the papers of the same series referred to elsewhere (p. 283). The first four papers deal with the surface waters of the Missouri and Lower Mississippi Basin, the Great Basin, and California, and record the gauge readings and discharge measurements made in 1907–8. Covering as they do a large area where rainfall is slight, the results are interesting, though, of course, they extend over a short period only, and are intended to be a preliminary investigation. River velocities are determined by the Price current-meter, which is almost exclusively employed by the Survey, and in this way results of much value are obtained rapidly and from a very wide area. The other two papers treat of the quality of the surface waters of Illinois and California, especially with regard to their potability and their suitability for industrial purposes.

IN the last number of the Proceedings of the Royal Society (vol. lxxxiv., A, No. 572) is an important memoir by Sir George Darwin on the tidal observations made during Sir Ernest Shackleton's Antarctic expedition of 1907. The observations are shown by Sir George Darwin to demonstrate a tidal seiche in the Ross Sea, and from its period Darwin concludes that the sea extends far beneath the Great Ice Barrier into the Antarctic continent, passing to the east of the Pole and for at least 10° of latitude beyond it. He remarks that if this arm of the sea extends across Antarctica to the Weddell Sea the seiche would be much as the tidal observations indicate. It was remarked in a note in NATURE of May 12, on the expedition by Lieut. Filchner, whose plan is based on the assumption that Antarctica is divided into two parts by a sound connecting the Ross Sea with the Weddell Sea, that if the theory be correct some evidence in its favour should have been forthcoming from the tidal observations. Sir George Darwin's memoir shows that the tides offer striking evidence in favour of the direct connection between the Weddell and Ross Seas.

AMONG several useful papers in the Journal of the Scottish Meteorological Society for 1909 (recently published) there is one of especial interest by Dr. G. A. Carse and Mr. D. MacOwan giving a brief *résumé* of the more important facts connected with atmospheric electricity. Descriptions are given of some of the earlier methods of detecting the phenomena, and of Lord Kelvin's water-dropping apparatus, which is most widely used for measuring the atmospheric potential. Observations show that, in general, this factor varies with the time (there being in most places a diurnal and annual variation), and that, generally speaking, it increases in proportion to the distance from an extended horizontal surface if the distance between the points is not too great. It has, however, been found by balloon ascents that in fine weather it diminishes with height above ground, thus indicating that electrification is largely confined to the lower levels of the atmosphere. The annual variation has a maximum about mid-winter and a minimum in summer, but the periods of the diurnal variation are much more complex. Another factor of importance is the ionisation of the atmosphere, and this is now being investigated more thoroughly. A few of the more interesting of the various theories accounting for the phenomena of atmospheric electricity are briefly sketched, but, so far as known, none has yet been promulgated which sufficiently explains all the observed facts.

TO the *Rendiconti R. Accad. Lincei* of October 2 Dr. Eredia communicates an interesting paper on the cold period of June in Italy. This cold period has already been shown to exist over a large part of Europe, and to be due to the mean distribution of pressure at that period. But as Italy possesses a valuable series of observations available for the purpose, the author has taken advantage of them to show that this cold period in Italy constitutes a real climatological factor. His tables show differences of the ten-day means of temperature from each other between the third decade of May and the first decade of July, for 120 stations, for the period 1866–1906. He also gives a map showing by various shadings the difference of temperature between the first and second decades of June for different regions. These clearly show that generally there is a considerable fall of temperature in the second decade of June, that it is much more marked in Upper than in Lower Italy, and is considerably influenced by geographical configuration.

AN interesting article by Dr. J. Mascart on actinometry and on meteorology at Teneriffe is published in the *Revue générale des Sciences* of November 15. The author points out that in the determination of the solar constant a difficulty arises at the outset; according to the definition, the receiving surface should be theoretically *black for all radiations*, having the properties of an integral radiator. Strictly speaking, this preliminary problem has not yet been solved. He described the so-called "absolute" instruments in use, which may be divided into two groups:—(1) calorimetric actinometers, which contain a liquid of known specific heat, of which that by Pouillet is the oldest; (2) those in which the electric energy necessary to produce the same effect as the solar radiation is measured; to this class belong the actinometers of Ångström and Féry. The Solar Committee has adopted as a type Ångström's compensation pyrheliometer. This decision is excellent as regards uniformity of observations, but might be harmful if it diminished the number of measurements with other apparatus. Reference is made to the observations made by the late Dr. W. Marcet and others on the extreme dryness at times of the Peak of Teneriffe, and on the electric phenomena there which seem to be connected with the former. The author considers the peak to be particularly favourable for observations on atmospheric phenomena and their connection with actinometry; also for observations of terrestrial magnetism. He thinks that more attention should be given to observations of zodiacal light, crepuscular rays, and atmospheric polarisation; these subjects are generally omitted from meteorological text-books because they are supposed to have no immediate connection with meteorology, but with this view he does not agree.

IN a communication made to the Illuminating Engineering Society on December 9th Prof. G. W. O. Howe showed that the darkening of the glass bulbs of Osram lamps sometimes noticed is due to the use of a slight amount of copper in the leading-in wires. This copper appears to be projected from the point at which the filament is joined to the negative leading-in wire, and forms on the inner surface of the bulb a distinct shadowgraph of

the glass stem and wire supports of the filament. It is obvious that the use of copper, even in small quantities, in the leading-in wires of these lamps must be avoided.

THE device of doubling a wire on itself before winding it into a resistance coil reduces the inductance of the coil to a very small quantity, but unfortunately introduces a considerable capacity, which is equally undesirable if the coil is to be used in alternating-current measurements. Chaperon's method of winding the coil in sections, in each of which successive layers are wound in opposite directions and the magnetic area of each layer made the same, reduces the capacity considerably, but the more recent suggestion to balance residual inductance and capacity has been taken up by Dr. E. Orlich, of the Reichsanstalt, with marked success. He winds one layer of wire on a slate slab 5 by 12 centimetres and 3 or 4 millimetres thick with rounded edges, then places bridges over the edges and winds the second layer over the bridges. The distance between the two layers of wire is calculated so as to make the capacity and inductance equal for frequencies not very high. The results of the calculations are tabulated for resistance coils exceeding 3000 ohms, below which the method is not applicable.

WE have received from Messrs. J. J. Griffin and Sons, Ltd., a new edition of "Scientific Handicraft." The volume, which contains more than one thousand pages, forms a very comprehensive catalogue of physical apparatus. Messrs. Griffin, in addition to supplying all that is most recent for advanced work in the physical laboratory, include in their list apparatus which is suitable for many technical industries. The catalogue is also issued separately in three parts, the first part dealing with laboratory fittings and apparatus for general physics, the second part with heat, light, and sound, and the third part with electricity and magnetism. The book is well illustrated, and is furnished at the end with tables of physical constants. It will no doubt find a place in all physical laboratories as a book of reference.

IN a paper on the winning of coastal lands in Holland, read by Mr. A. E. Carey before the Institution of Civil Engineers on December 20, some interesting facts were given with reference to the gradual reclamation of the Dutch lowlands from the sea. The principal reclamations, which have so largely altered the map of Holland, were described, particularly that of the Lake of Haarlem, the first reclamation of which was carried out between the years 1540 and 1648. The so-called lake consisted of a vast swamp. The final works of reclamation were carried out by the State in 1840. Several of the breaches in the sand dunes on the North Sea coast appear to represent former embouchures of the River Rhine. The level of Amsterdam Peil, worked to by the Dutch engineers, differs only by about 1 foot from the level of the Ordnance datum. Some interesting facts ascertained in connection with the borings for the water supply of the City of Amsterdam were cited to show the delicate balance in water pressure which exists in the substrata of the Dutch fenlands. The gradual weakening of the natural protection afforded by the sand dunes was referred to, and some interesting evidence was brought forward to show how great the alterations in the position and magnitude of the dunes have been. Changes in location of the sand dunes are arrested by the planting of grasses on the faces of the dunes, and the protection of them on the land side by the planting of various kinds of trees. The controversy proceeding in Holland as to the best procedure in carrying out the project for the reclamation of the Zuyder-Zee, which involves the reclamation of 1,500,000 acres, was mentioned. Briefly, the alternative schemes are:—(1) to close the inland sea by a reclamation dam running from Wieringen to the coast of Friesland, near Piaam, thus shutting out the North Sea from the area to the south, the reclamation works being effected at leisure in the lake which would then be formed behind the dam; (2) to carry out the series of smaller reclamations before the closing of the entire sea.

THE report of the Clifton College Scientific Society for the year 1909–10 has been received. We are glad to find that useful practical work continues to be done in the various sections into which the society is divided. An interesting series of notes on the birds of the Clifton neighbourhood, arranged chronologically, is published with the report.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF THE AMERICA NEBULA.—In a paper published in the *Sitzungsberichte der Heidelberger Akademie der Wissenschaften* (1910, No. 27) Dr. Max Wolf discusses spectrograms of the America nebula taken during October. The spectra were photographed with the Zeiss spectrograph, having two U.-V. prisms, attached to the Heidelberg reflector.

Referring the emission lines of the nebula spectrum to several Fraunhofer lines occurring in the stellar spectra shown on the same plate, Dr. Wolf finds for the former the following wave-lengths:—434, 412, 406, 389, 383, 373, and 343. Of these the chief lines occur at 410·2 (412), 383·7, 372·7, and 344·8 $\mu\mu$, the line at λ 373 being by far the brightest.

THE MOVEMENTS OF CERTAIN STARS, IN SPACE, COMPARED WITH THAT OF THE SUN.—As an extract from the November *Bulletin Astronomique* we have received a paper in which Dr. P. Stroobant shows that the sun is probably a unit in a stream of stars moving through space in the same direction with a common velocity. As a primary index he takes those stars of which the movements, relative to the sun, are small, and then reduces their movements to a common plane.

The result is certainly striking, for Dr. Stroobant shows that the seven stars α Cassiopeiæ, β Persei, α Persei, α Scorpionis, γ Cygni, ϵ Pegasi, and α Pegasi are all travelling towards a polar area of only 14° radius, with velocities ranging between 11 and 22 km.; towards the centre of this area the sun is moving at a rate of 19·4 km. The probability that of the 105 stars brighter than magnitude 2·5 seven should, accidentally, shows this common motion, is very small, but it must be borne in mind that the data on which the result is based are, especially, in the case of parallax, open to corrections.

Dr. Stroobant suggests that, with the accumulation of further, more trustworthy, data, other stars may be found to belong to the same stream, and he cites γ Pegasi, γ Persei, ζ Geminorum, α Hydræ, ϵ Leonis, η Leonis, ψ Ursæ Majoris, η Virginis, γ Aquilæ, α Pavonis, and η Pegasi as stars having small proper motions, and of which the radial velocities relative to the sun are also small.

THE ITALIAN OBSERVATORIES.—In the *Rivista di Astronomia* (Turin) a series of articles is appearing describing in detail the various Italian observatories. In No. 10 Signor C. H. Loviselmi gives an excellent description of the observatory of the Roman College. The account gives the history of the observatory, describes the buildings and instruments, and gives short accounts of the various observers; it is illustrated with photographs of the buildings and portraits of Vico, Secchi, Ferrari, and Tacchini.

ASTRONOMY AT THE BRUSSELS EXHIBITION.—An interesting account of the astronomical exhibits at the Brussels Exhibition is given by Dr. Stroobant in the *Bulletin de la Société astronomique de France*, and now published as

a separate brochure. Photographs of the exhibits from Harvard, Mount Wilson, Heidelberg, and other observatories show that astronomy was fairly well represented at the exhibition.

TRACING THE SOLAR CORONA IN LUNAR OBSERVATIONS.—In the December number of the *Bulletin de la Société astronomique de France* M. Em. Touchet makes the interesting suggestion that observers may be able to trace the radiations of the solar corona in observations of the moon. The note was submitted to the Académie des Sciences in 1906, but did not appear in the *Comptes rendus*, and even now M. Deslandres considers the difficulties of realisation are about equal to those surrounding the photography of the corona in full sunlight.

The suggestion is that when the sun rises on the moon, the lunar surface, owing to the absence of atmosphere, would first be illuminated by fairly strong coronal light, then by the chromospheric radiations, and lastly by the photosphere. With the observer's spectroscope slit delicately adjusted on the position of lunar strip lighted by the corona, one might possibly find, in addition to the ordinary lunar spectrum, a narrow spectrum composed of that of the earth-light and the corona. M. Touchet realises that the difficulties are enormous, but suggests that, with a clear atmosphere, large dispersion, and the large apertures now available at Mount Wilson, for example, they might not prove insuperable.

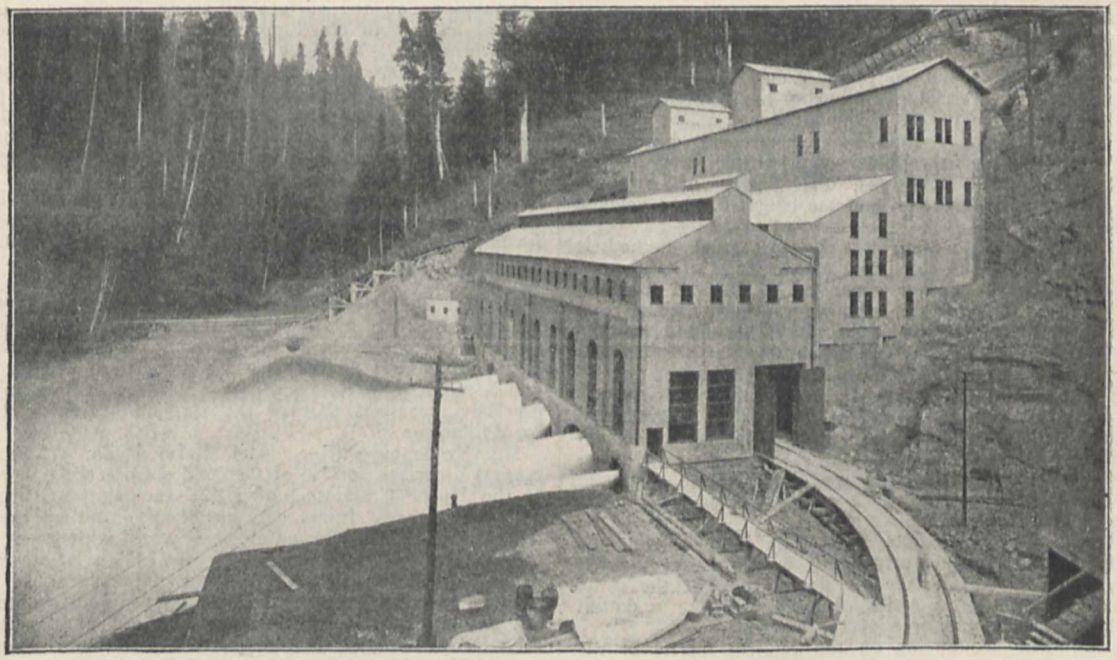
ANNUAL PUBLICATIONS.—The "Companion to the Observatory," published by Messrs. Taylor and Francis at 1*s.* 6*d.*, contains the usual features, and should be secured by every astronomical student actually engaged in making observations. The increase in the number of variable stars makes the publication of the complete list impossible. As the compilers of the "Annuaire du Bureau des Longitudes" have discontinued the computation of the variable-star ephemerides, the editors of the "Companion" can no longer rely upon that source of information.

M. Flammarion's "Annuaire Astronomique" also follows its usual form, and is a most useful work of reference to all interested in the popularisation of astronomy. Its review of the past year's astronomy and meteorology is also useful, while the special articles therein comprised are very interesting; among them we might mention notices on Halley's comet and the Paris floods of 1910.

AMERICAN HYDROGRAPHY.[1]

THE first impression which one gains in turning over the pages of these seven reports is that, if genius be, as Dr. Johnson asserted, an infinite capacity for taking pains, then the compilers of these statistical records possess that attribute in a very high degree. One turns over page after page of systematically prepared data, unquestionably the outcome of innumerable observations which have been carefully and religiously made through long periods of time, and one cannot but admire the patient, painstaking zeal of these scientific workers who have concentrated their energies on this special field of enterprise, in the service of their country, for the development of its resources and the expansion of its commerce.

The work is carried on under the auspices of the Geological Survey of the United States, and this relationship of hydrography to geology calls to mind the proud reply of the "Scarabee" to the Poet at the Breakfast Table:—"I am often spoken of as a Coleopterist," he said, "but I have no right to so comprehensive a name. The genus Scarabæus is what I have chiefly confined myself to, and ought to have studied exclusively. The beetles proper are quite enough for the labour of one man's life. Call me a Scarabeeist if you will: if I can prove myself worthy of that name, my highest ambition will be more than satisfied."



Hydro-electric Plant (developing 26,600 horse-power) on Puyallup River, near Electron, Washington.

This is the true scientific spirit: the concentration of thought and energy on one special branch of study to the exclusion of even cognate interests; the patient accumulation of facts and data, and their careful analysis and tabulation, within a purview sufficiently restricted for the capacity of the individual investigator—by these means alone is the practical knowledge of the world increased and its avenues of progress extended.

In order to appreciate the full utility of these records it is essential to recall the fact that the development of water-power in every civilised country is rapidly becoming an economic necessity. With the steady depletion of coal, lumber, oil, and natural supplies of fuel there arises a corresponding need for the exploitation of other sources

[1] Surface Water Supply of the United States, 1907–8. Bulletins prepared under the general direction of M. O. Leighton, viz., Paper No. 241, North Atlantic Coast; No. 243, Ohio River Basin; No. 244, St. Lawrence River Basin; No. 245, Upper Mississippi and Hudson Bay Basins; No. 248, Western Gulf of Mexico; No. 249, Colorado River Basin; No. 252, North Pacific Coast. (Washington: U.S. Geological Survey, 1910.)

of energy available for and adaptable to manufacturing purposes. Among these water-power stands pre-eminent, especially since the introduction of electricity, which has provided an easy and convenient means for the transmission of its energy. Then, in regard to flood prevention, domestic water supply, irrigation, and land reclamation there are obvious grounds for regarding the study of periodic flow in rivers and streams as a consideration of the highest importance. The damage arising from floods in the United States exceeds a hundred million dollars annually, and more than 70 million acres of the richest land are rendered practically worthless by reason of prevailing conditions of overflow and swamp. Amelioration of these natural defects can only be brought about by the collection of trustworthy data and a careful and thorough study of all the circumstances attending the phenomena in question.

Records of stream flow necessarily call for frequent and prolonged observation. They must embrace all stages and cover, if possible, the absolute maximum and the absolute minimum of discharge. This involves, in most cases, a period of at least five or ten years, and in some instances twenty years or more. It is regrettable that the compilers of these volumes have had to avow that a number of their records are of insufficient duration, owing to unforeseen reduction in grants and the consequent abandonment of certain gauging stations. The national exchequer is surely not so impoverished as to be under the necessity of exercising retrenchment in regard to so important a branch of the public service.

Three methods of stream-flow measurement have been adopted by the Hydrographical Department, according to the local physical conditions, the degree of accuracy desired, the funds available, and the length of time devoted to observation.

The first, most theoretical, and least used method is that of measuring the slope and cross-section of a stream, and then using the Kutter expansion of Chezy's formula. Owing to the difficulty of obtaining accurate data, and more particularly to the uncertainty attaching to the coefficients in the formula, results obtained by this method can only be regarded as approximately correct.

The second method is that of measuring the discharges over dams and weirs. Here the problem is complicated by variations in profile and crest, by leakages through the dams, backwater at high stages, log and ice obstructions, and local diversions of water for power purposes. On this account comparatively few stations are maintained at weirs and dams.

The system chiefly employed is that of measuring the velocity of the current, principally by the Price current meter, rarely by means of free floats, and, at the same time, determining by a series of ordinates from a datum line the cross-sectional area of the stream.

The following comments on the relative merits of the systems are interesting.

"Practically all discharge measurements made under fair conditions are well within 5 per cent. of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favourably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail."

Then there is, of course, the human element and the personal factor which enters into all experimental work. It is interesting to know that, "with relatively few exceptions, the observers perform their work honestly." Yet even honesty of purpose cannot eliminate every element of error, though the effect of numerous readings is obviously to minimise any inadvertent inexactitudes. Individualism counts for something, too, but, on the whole, errors arising from these and other causes become self-compensating and virtually negligible.

Merely to enumerate all the river basins comprised within the purview of the Hydrographical Survey would involve more space than can be spared for the purpose. From the noble Mississippi, with its drainage area of 1,240,000 square miles, including wholly, or in part, thirty States, besides a small portion of the Dominion of Canada, down to the modest Siletz, with its length of 50 miles and its basin of 320 square miles, there are measured and described all sorts and conditions of streams with names as musical as Menonimee and Wapsipinicon, as dissonant as Umpqua and Puyallup, prosaic as Muddy and fantastic as Devil's. The whole area of the country is to be covered by a dozen bulletins, of which the present seven form part. B. C.

PALAEONTOLOGICAL PAPERS.

THE troublesome question of fucoids has exercised Mr. Otto M. Reis ("Zur Fucoidenfrage," *Jahrb. k.k. geol. Reichsanstalt*, Bd. lix., published 1910, p. 615), an author well known for his researches on ruin-marble and cone-in-cone. He accepts an organic origin for the fucoids collected by him in the northern Apennines and the Alps, and points out that the clay, which might be regarded as a mere infilling of a worm-tube, is in some cases so arranged as to form a true wall to the tube. The granulations on the surface of many fucoids may be regarded as due to clay-lumps used in the construction of the worm-tube. *Terebella figulus* is cited (p. 628) as an example of a worm that kneads up fine clay into bricks, as it were, which it places from its mouth on to the growing margin of its tube. The author expects criticism, since he sets aside the algal theory of the origin of fucoids in the Flysch, and ascribes the structures to boring and tubicolous worms.

Mr. E. W. Vredenburg (Records, Geol. Survey of India, vol. xxxvi., 1908, p. 241) has described certain "pseudo-fucoids" of eastern Baluchistan as casts of worm-burrows and tracks of marine organisms, here following the work of Nathorst.

Mr. M. D. Zalessky records (*Bull. Acad. imp. Sci. St. Pétersbourg*, No. 6, 1910) in a brief English paper the discovery of coal-balls in the Carboniferous of the Donetz basin, containing well-preserved plants, from the study of which much may be expected. Their mode of occurrence precisely resembles that of the English examples studied by Williamson.

Mr. Vredenburg (Rec. Geol. Surv. India, vol. xxxvi., p. 171) describes species of Orbitoides from the upper part of the Upper Cretaceous of India, including megaspheric and microspheric forms. As usual, this author interestingly connects his palæontological work with zonal considerations and with questions of Indian stratigraphy, which here occupy twenty-five pages of the paper.

The important manuscript work on dendroid graptolites, left by Dr. R. Gurley, has been revised and issued by Mr. R. S. Bassler (Bull. 65, U.S. National Museum, 1909). The forms described, including many species of Dictyonema, are from the Niagaran (Middle Gotlandian) Dolomites of Hamilton, Ontario. With one or two exceptions, like the Inocaulis on p. 48, the figures of these difficult fossils are limited to the forms of the rhabdosomes.

Proceeding to molluscs, Dr. A. Schmidt has examined the Anthracosiidæ of the Upper Carboniferous beds of Mährisch-Ostrau (*Jahrb. k.k. geol. Reichsanstalt*, Bd. lix., published in 1910, p. 733). The forms illustrated have naturally an interest for English geologists, and the paper both supports and supplements the work of Dr. Wheelton Hind. Dr. Schmidt points out the general tendency towards a uniform type of shell among the later members of this fresh-water group, while the animals very probably remained quite distinct. The reduction of hinge-teeth seems related to prolonged fresh-water conditions. The author doubts if the fresh-water shells of the Mesozoic era had fresh-water Palæozoic ancestors, since the Permian forms had already proceeded far towards uniformity of type, and probably altogether passed away. However, a mollusc described by Mr. L. J. Wills in a paper on the Keuper of Worcestershire, to be quoted later, seems possibly a survival of Naiadites. In the same volume of this *Jahrbuch* (p. 407, published in 1909) Dr. A. Till continues his work on the jaws of fossil cephalopods. In the absence of any guide to their correlation, these objects are

classed under the genus Hadrocheilus, and are distinguished by numerous specific names.

Mr. G. C. Crick describes a new genus and species of dibranchiate cephalopod, *Belemnocamax boweri*, from the Lower Chalk (Totternhoe Stone) of Lincolnshire (Proc. Geol. Assoc., vol. xxi., 1910, p. 360). Belemnocamax resembles Actinocamax generally, but has a broad ventral furrow, and fine longitudinal striæ near the point of the guard.

Dr. A. Till (*Verhandl. k.k. geol. Reichsanstalt*, 1909, p. 194) establishes a new genus, Villania, for an ammonite allied to Perisphinctes, found in an Oxfordian horizon at Villány, in Hungary.

Mr. T. D. A. Cockerell continues his studies of Tertiary insects (*Am. Journ. Sci.*, vol. xxvii., 1909, p. 381), introducing three new genera, and Mr. H. F. Wickham (*ibid.*, vol. xxix., 1910, p. 47) compliments him by describing *Calosoma cockerelli*, among other fossil Coleoptera from the Florissant (Oligocene) deposits of Colorado.

Mr. L. J. Wills (Proc. Geol. Assoc., vol. xxi., 1910, p. 302), in a paper on the fossiliferous Lower Keuper rocks of Worcestershire, describes in considerable detail three species of Mesophonus, a new scorpion, fragmental remains of which occur abundantly at Bromsgrove. Numerous photographs of these remains are given, as well as of the plants from the same strata.

Mr. Bashford Dean's studies on fossil fishes (sharks, chimæroids, and arthrodires) forms part v. of the ninth volume of the Memoirs of the American Museum of Natural History (1909). The memoir is finely illustrated, and deals mainly with the cladoselachians of the Devonian period, which are viewed, in agreement with the opinion of Dr. A. S. Woodward, as primitive sharks. The author regards them as nearer the earliest fish-type than are the acanthodians of the Upper Silurian epoch (p. 247). Photographs and descriptions of mounted skulls of Dinichthys and Titanichthys are also given.

The distribution of the Deinosauria in time and through geographical areas is the subject of a memoir by Mr. R. S. Lull (*Am. Journ. Sci.*, vol. xxix., 1910, p. 1). As the result of a wide range of reading, the author has drawn up distributional tables, and maps illustrating the probable routes of migration. The maps furnished by De Lapparent for various Mesozoic periods are found to supply the necessary bridges between existing lands in which deinosaurian remains have been found. Incidentally, several suggestive remarks are made. On p. 5 bipedal movement is associated with the necessity for rapidly traversing lands increasing in aridity. The bipedal lizards of the present day occur in semi-arid areas. The carnivorous and bipedal deinosaurs, the Theropoda, are the most widely distributed, and appear to have followed any other forms that furnished them with food. The armoured and herbivorous Orthopoda are regarded as originating with Scelidosaurus of the English Lias, and as having become sluggish and quadrupedal in the course of time, when their heavy armour rendered them impregnable (p. 11). At this period, including the epochs when Polacanthus and Triceratops flourished, vegetation and water seem to have been abundant. The mystery of the extinction of the deinosaurs is not lightened by the passing reference to geographical conditions on p. 37.

Mr. Harold Brodrick (Proc. Liverpool Geol. Soc., vol. x., part v., 1909, p. 327) describes and figures footprints, doubtless deinosaurian, found by him in the Inferior Oolite at Saltwick, south of Whitby. It would be very interesting to know if the zone also contains marine fossils, in view of Mr. Lull's comparison of aquatic deinosaurs and hippopotamuses, the latter having been seen to move from estuary to estuary through sea-water.

Mr. A. Zdarsky contributes a memoir on the Miocene Mammalia of Leoben, in Styria, to the *Jahrbuch der k.k. geologischen Reichsanstalt*, Bd. lix., 1909, p. 245. These occur in a terrestrial sandstone above clay and brown coal, the last-named stratum resting on Palæozoic slates. Various rhinoceroses and Suidæ occur. Among the latter, the author places a new genus and species, *Xenochoerus leobensis* (p. 264), represented by part of a mandible and a row of teeth from the upper jaw. Mastodon and Deinotherium are both present, and the deposit appears (p. 287) to be of Middle Miocene age.

Mr. Franz Toula, in the same journal (Bd. lix., 1910, p. 575), records the results of an investigation of a preglacial or interglacial bone-deposit near Kronstadt, in Transylvania. The mammalian remains collected from this in recent years have become somewhat scattered; but the author has examined most of them, and especially describes the teeth of a new form, *Rhinoceros kronstadtensis* (p. 580). Among the bones of Cervus there is a phalange that suggests the presence of the giant deer of Ireland.

The *Sitzungsberichte vom naturhistorischen Verein der preussischen Rheinlande und Westfalens* for 1908 (published in 1909) contains numerous abstracts of papers read before its component societies. Dr. Elbert described at Münster (Section C, p. 51) his expedition to Java in search of the predecessors of the human race. It may be well to recall that he found traces of hearths in deposits that showed the existence of man side by side with Stegodon. He believes that primæval man entered Java with the Siwalik fauna at the close of Cainozoic times, and that Pithecanthropus was entombed during a cold "diluvial" epoch, when floods were caused by the action of lavas on the snows. The evidence for this colder epoch is furnished by the fossil plants of the Kendeng beds, which represent species that now live at much higher elevations. Dr. Elbert considers that Pithecanthropus was forced to retreat before primæval man, while a land-connection was still open with Celebes, and that various pigmy races may have descended from this genus.

Without entering seriously on the literature of primitive man as a branch of palæontology, we may perhaps direct attention to the spirited description by the late Commandant Molard of the prehistoric drawings of animals in the cave of Niaux, in Ariège (*Spelunca*, tome vii., p. 3), and to Dr. Florentino Ameghino's illustrated account, previously promised, of stone implements found near Mar del Plata. The latter paper (*Anales del Museo Nacional de Buenos Aires*, tomo xx., April 22, p. 189) maintains that the pebbles with chipped ends are in some ways more primitive than eoliths, and attributes them to *Homo pampaeus* of the Tertiary era. G. A. J. C.

A MONOGRAPH OF THE JELLYFISHES.[1]

ANY attempt to arrange the Medusæ of the world in a natural and convenient zoological system is beset with so many exceptional difficulties that the author of this very fine monograph must at least be congratulated on the courage he has shown and the patience he has exhibited in preparing and publishing his work.

Since Haeckel wrote his famous "System der Medusen" in 1879 there has been no other standard monograph on the group for systematic zoologists to consult, and the need for a comprehensive revision of his classification has been acutely felt. In many cases the forms which Haeckel described as distinct genera have proved, in the light of more modern research, to be but stages in the development of one genus; many new genera and species have been described, and our knowledge of the life-history, anatomy, and physiology of many of the old species has been very widely extended. To bring together the results of all these investigations into one great monograph, to criticise, and to rearrange the genera, is the task which Mr. Mayer has attempted, and, it may be said, with no small measure of success.

The principal difficulty in the systematic arrangement and nomenclature of the Medusæ arises from the fact that in some cases, but not in all, the free-swimming, bell-like and sexually mature organism represents only a stage in the life-history of an individual, or the detached sexual organ of an individual which has an altogether different form, and there are many examples of the sedentary or hydroid stage of a species being known by one generic name and the free-swimming or medusoid stage by another. It may have been an ideal of the earlier writers, which they themselves could not hope to attain, that ultimately the sum total of the life-history of a single species would be united under one generic and one specific name. But this ideal appears to be in these days not only

[1] "Medusæ of the World." By Alfred Goldsborough Mayer. 3 Vols. Vol. i., pp. iv+250+xv; Vol. ii., pp. iv+231-468+xv; Vol. iii., pp. iv+499-735. (Carnegie Institution of Washington, 1910.)

more remote, but even impossible to reach. As the author points out, such dissimilar hydroids as Syncoryne and Stauridium give rise to similar medusæ of the genus Sarsia, and on the other hand the dissimilar medusæ

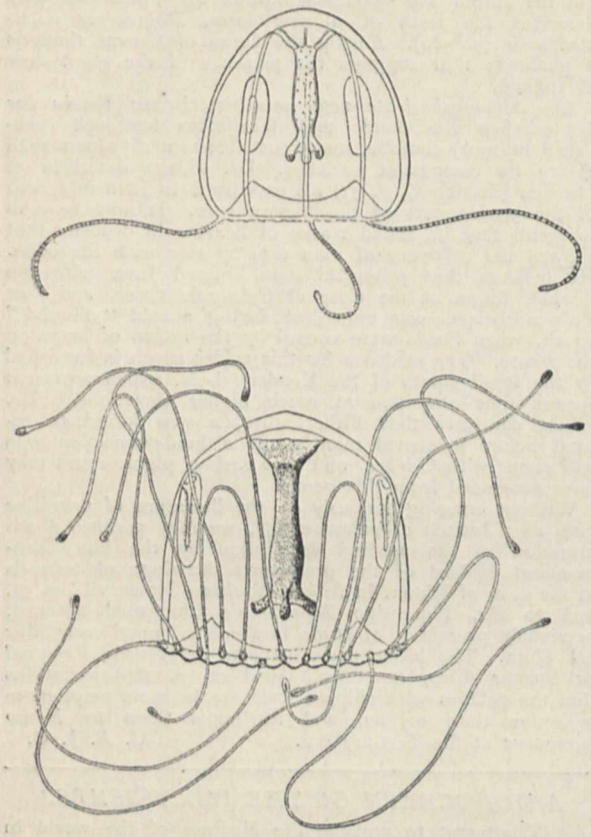


FIG. 1.—*Persa incolorata*, one of the Trachymedusæ.

Bougainvillia (formerly known as Hippocrene or Margelis) and Nemopsis are produced by gemmation from closely related species of the hydroid genus Bougainvillia. An attempt, therefore, to construct a system under which the sent exists. For the present, then, we may agree with the author that the nomenclature of the medusæ and the nomenclature of the hydroids must be, in the majority of cases, kept distinct, but at the same time regret may be expressed that he has not set forth his views of the classification of these Cœlenterates in some tabular form with the families of the hydroids and medusoids arranged in parallel columns. Such a table would necessarily be incomplete and subject to several exceptions in detail, but it would be extremely useful to those who are interested in the Hydromedusæ as a whole and of great assistance to naturalists who are endeavouring to work out their life-histories. Such a table has recently been drawn up by Stechow in a work on the Hydroids of Japan, which was published, unfortunately, too late to be reviewed in Mayer's memoir. A comparison of a table by Mayer, had he constructed one, from the medusoid point of view with that of Stechow from the hydroid point of view, would have given us a very instructive review of the classification of the Hydromedusæ as a whole.

But it seems somewhat ungracious to begin a notice of work that is characterised by so many excellent features by complaining about an omission.

The first point that will strike the ordinary zoologist, who is not a specialist in any one group, as a very welcome and important novelty in monographs on systematic zoology, is the inclusion in the text of a statement concerning all the important contributions to our knowledge of embryology, cytology, and physiology of the subject group. This is not a work that can be set aside as a systematic treatise, of value only when it is required for the identification of a species, but it is one that can and should be consulted by all those who are interested in the morphology of the group. Special attention may be directed to the excellent accounts, given in various places in the text, of the physiology of the rhythmic contractions of the bell, and the lucid statement concerning the recent researches by Stschelkanowzeff on the extraordinary developmental process in Cunina described by Metschnikoff as "sporogony"; but there are many others to relieve the tedium that is inseparable from a series of purely systematic descriptions.

In dealing with the two genera Ctenaria of Haeckel and Hydroctena of Dawydoff, which have been supposed to connect the true Cœlenterates with the Ctenophora, the author takes the perfectly sound position that the resemblances relied upon indicate no true genetic relationships between the two classes, but he incidentally directs attention to an interesting observation of Woltereck's that in the larva of Solmundella and in the actinula larva of

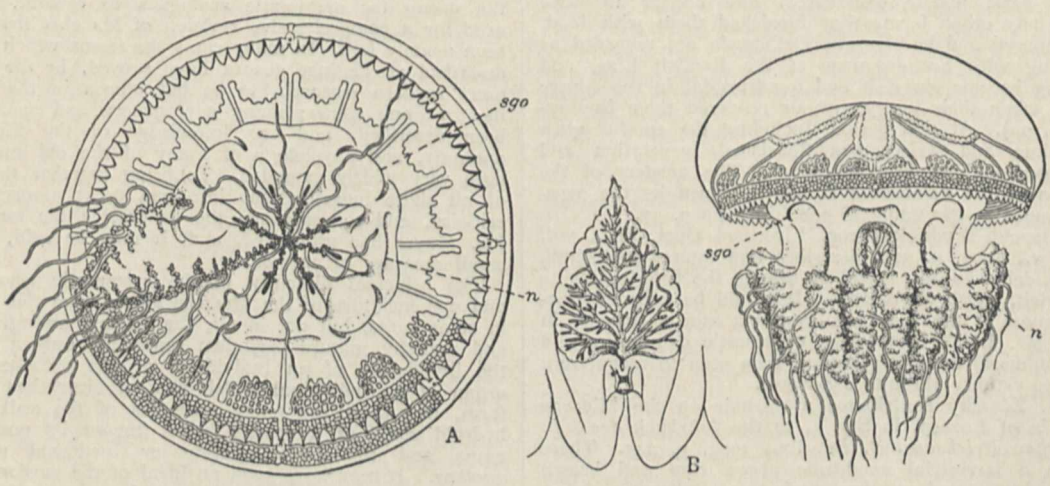


FIG. 2.—*Lychnorhiza bartschi*, one of the Rhizostome Scyphomedusæ. A, Oral view. B, Sense-organ seen from exumbrella side.

name of the hydroid stage would supersede the name of the medusa stage, or *vice versâ*, even if it were confined to those species of which the life-history is known, would lead to a state of confusion even worse than that which at pre-

Tubularia there is an apical pole-plate of ciliated ectodermal cells. This does not constitute an aboral sense-organ on such an elaborate scale as that described in Hydroctena, but it indicates, at least, that this organ is

not necessarily a sign of Ctenophore affinities. As in other divisions of the Cœlenterata, the determination of true or natural specific distinctions in Medusæ from false or accidental differences is extremely difficult. A great many species have been described from the more or less distorted and contracted specimens that are sent to systematic zoologists by the collectors, and it is very probable that many of the folds and wrinkles, and even the warts and tubercles, that are relied upon for separating species are due to post-mortem changes. Mr. Mayer deals with this problem with sound judgment. The work of previous authors is carefully considered and tabulated, so that the reader may form his own judgment in each case if he wishes to do so; but his own opinion, based on a wide experience of living and preserved material, is clearly expressed. Thus, of the genus Pelagia, no fewer than fourteen species have been described, of which six are from the Atlantic Ocean. "All of the Atlantic species," he says, "are closely related one to another, and future researches may demonstrate that they are only geographical races."

It would be difficult to express adequately our admiration of the seventy-six coloured plates with which this monograph is illustrated. As regards delicacy of treatment and accuracy in detail, they may be regarded as the best series of zoological plates that have been published for many years. In addition to the plates, there are more than four hundred text illustrations in black and white. The majority of these are copied from the works of other authors, but there are several, such as the two specimens we reproduce, that have not been previously published.

Important changes in well-known generic names are not so common as in some other recent memoirs, but there are some which many students of the group will notice with regret. Thus the familiar genus Lizzia becomes merged in Rathkea; Corynitis becomes Linvillea. The generic name Turris, having been used by Humphrey in 1797 for a mollusc, is regarded as preoccupied, and this genus of Medusæ becomes Clavula. As examples of changes in spelling, we may refer to the genus Irene, which becomes Eirene, and Aurelia, which becomes Aurellia. But the most deplorable proposal in this respect is that the name Craspedacusta should be used in place of Limnocodium. It is clear from the text that the author has made this change with regret, since he realises the great inconvenience that must be caused by the substitution of a name that has been used only once, and in a preliminary note, for a name that has been used consistently by all authors, including the writer of the preliminary note, ever since. That the change has been made is due to the mandate of the International Commission on Zoological Nomenclature, who stated that the usage of the name Limnocodium would be "in contravention of the provisions of the Code." No better example could be found to show the pressing need of some revision of the Code. We cannot close this notice without again expressing our thanks to Mr. Mayer for his most magnificent and serviceable memoir. It is really a great work, and will mark a great step of progress in the literature of the subject.

MEASURES OF SOLAR PARALLAX.[1]

THE particular value of solar parallax derived from the discussion of any one set of measures is of smaller consequence than the manner in which the result has been achieved. The interest in the problem has shifted. In its present position, the knowledge of the distance of the sun from the earth is less important than the examination and elimination of the causes that affect the accuracy of the measured coordinates obtained from a series of plates. Viewed in this light, Prof. Perrine's paper is of great value, for it puts us in possession of an independent discussion of material that has already been submitted to the most careful scrutiny.

We have presented to our examination a numerical estimate of the different constructions that expert knowledge can place upon the same measures. Mr. Hinks, in his elaborate discussion of the solar parallax from photographic observations of Eros, pointed out some discrepancies in the Lick results, which he thought required further examination. Among others, he suggested that some of the comparison stars were too distant from the axis of collimation. Apparently this criticism was justified, and Prof. Perrine has employed in his reductions only those star images which were accurately circular. A second suggestion, that an error was introduced by the eccentric position of Eros with reference to the stars of comparison, is not accepted. This want of symmetry arose from the plan of choosing the same stars for the morning and evening observations, a scheme which possesses obvious advantages; but in a plate taken with Eros always in the centre, the motion of the planet will carry it nearer to, or away from, the more outlying members of the group of stars selected for measurement. The motion of Eros in the interval was about 8′–10′, and in a field the available diameter of which is small the distortion of the image might outweigh the evident theoretical advantages.

To test this point Prof. Perrine has made two solutions, according to the stars selected, and can find no evidence of systematic error. Another attempt to explain the observed discrepancy, more of the nature of a suggestion than a criticism, was made to depend upon the generally small magnitude of the comparison stars. With a large aperture and the necessity of restricting the field, there will be a tendency to use fainter stars than in other observatories employing the ordinary photo-refracting telescope. As a rule, the stars selected at Lick have been fainter than the planet. Prof. Perrine does not specifically discuss the effect of magnitude, and there is the less necessity, since the value of the solar parallax he obtains does not show any anomalous deviation from the final value adopted by Mr. Hinks.

The difference of computational results is a point of great interest. The final value of solar parallax derived from the total mass of measures at the command of Mr. Hinks is 8·807″, while the same authority obtained from the Lick measures alone 8·815″. From the same data Prof. Perrine derives from his own measures 8·8067″, or identically Mr. Hinks's result. The problem for solution has therefore moved from finding an explanation of the difference of Lick results from the general average to tracing the cause of the disagreement between the Cambridge and the Californian computations. The computed probable errors also differ. That attached by Prof. Perrine in his final equation for π is $\pm 0{\cdot}0025''$, and by Mr. Hinks $\pm 0{\cdot}0046''$. It is a matter for congratulation that such small differences should attract attention and call for explanation. The minuteness of the discrepancy seems to indicate that in modern processes such a degree of refinement has been reached that the disagreement must be attributed to purely arithmetical operations, and has no physical significance.

[1] "Determination of the Solar Parallax," from Photographs of Eros, made with the Crossley Reflector of the Lick Observatory, University of California. By Charles D. Perrine, and others. Pp. v+98. (Carnegie Institution of Washington, 1910.)

AMERICAN VERTEBRATE PALÆONTOLOGY.

THE phylogeny of the Felidæ forms the subject of an article, by Dr. W. D. Matthew, published in vol. xxviii. (pp. 289–316) of the Bulletin of the American Museum of Natural History. According to the author, the great majority of the extinct members of the family, including all the oldest species, are characterised by a more or less pronounced development of the upper canines into long, flat-sided tusks. These are the so-called sabre-tooths, or machærodonts, which date from the Lower Oligocene, typical cats with relatively short upper canines being unknown before the Pliocene. The early sabre-tooths are, however, divisible into two series, one characterised by the extreme length and slenderness of the tusks and the large size of the protecting flange on the lower jaw, and the other by the shorter tusks and smaller flange. Hoplophoneus and Dinictis respectively represent the two series in America. While the derivation of the large Pliocene and Pleistocene sabre-tooths from Hoplophoneus has been accepted, the relations of the modern cats to Dinictis have been overlooked. "The evidence appears, however, to indicate that the Dinictis phylum led

directly into the modern Felidæ, the canines having reverted from the almost unique machærodont specialisation to the normal type of carnivorous mammals. The series Dinictis—Nimravus—Pseudælurus—Felis are in direct succession, structurally and geologically."

In the opinion of Dr. Matthew the origin of the cat family cannot be carried back further than the Oligocene sabre-tooth, their supposed derivation through the so-called Ælurotherium—which is based on the milk-dentition of a species of the same group—from the Eocene creodont Palæonictis being inadmissible.

Mr. R. O. Peterson has, however, just described, under the name of Daphænodon, in the Memoirs of the Carnegie Museum at Pittsburg (vol. iv., No. 5), the skeleton of a dog-like carnivore of the size of a large leopard from the Miocene of Nebraska, which, together with the allied but older Daphænus, he regards as in a considerable degree intermediate between dogs and cats, although the skull and teeth are essentially dog-like. In many respects Daphænus, of which the whole skeleton is known, is very cat-like, especially in the long leopard-like tail, which may, however, have been bushy. A cat-like feature is the partially retractile structure of the claws. In concluding his description, Mr. Peterson observes that the model "is instructive, as it furnishes at least a conception of a primitive form ancestral to cats and dogs." Whether later discoveries in earlier strata will reveal a community of origin for the two groups remains to be seen.

Reverting to the first article, Dr. Matthew replies near the end to critics who have doubted his theory that the sabre-tooths attacked by dropping the lower jaw into a nearly vertical position and stabbing with the upper tusks. After supporting the theory by additional anatomical evidence, he remarks that most of the early large ungulates were of the "pachyderm" type, which were specially suitable to this method of attack, while they would succumb to the mode practised by lions and tigers.

"With the rise and dominance of the large light-limbed ruminants and horses some of the early sabre-tooths were correlatively adapted into the modern type of felines, while other sabre-tooths, as the surviving pachyderm phyla became larger, thicker skinned, and more powerful, became progressively larger, more powerful, and developed heavier weapons to cope with and destroy them. The final extinction of the machærodont phylum was probably largely conditioned by the growing scarcity and limited geographic range of the great pachyderms."

Finally, he protests against the idea that these later sabre-tooths died out as the result of over-specialisation.

Recent conflicting opinions as to the pose of the sauropod dinosaurs are discussed by Dr. Matthew in the September number of the *American Naturalist* (vol. xliv., p. 547). That these reptiles walked, instead of crawling, the author considers fully proved, their limb-structure, as was previously pointed out by Dr. Abel, displaying a remarkable parallelism to that of proboscideans. This "rectigrade" type, in which the whole limb is pillar-like, with the foot short, rounded, and heavily padded, and the toes reduced or rudimentary, is correlated with gigantic bodily size, the movements being mainly restricted to the upper joints, and the foot serving chiefly as a cushion to minimise the shock. A structure of this kind will obviously occur only among animals which habitually rest their weight on the limbs alone.

A limit is, however, soon reached in regard to the weight which even the most powerful limbs are capable of supporting in the case of a purely terrestrial animal, and this limit appears to have been attained among the elephants. But if this be so, we are confronted by the question why the sauropod dinosaurs, with their less perfectly formed limbs, vastly exceed the largest elephants in bulk and stature. The answer, in Dr. Matthew's opinion, is that these reptiles were aquatic, and adapted to wading. "A wading animal has the greater part of its weight buoyed up by the water, and might attain a much larger size without transcending its mechanical limitations, just as the whales and some true fishes attain a much larger size than any land animal."

In 1908 Mr. Lambe described a new genus of crocodile (Leidyosuchus) on the evidence of imperfect remains from the Judith River beds of Alberta, Canada. An unusually well-preserved crocodilian skull from the Ceratops beds of Wyoming, recently acquired by the U.S. National Museum, is referred by Mr. C. W. Gilmore (Proc. U.S. Nat. Mus., vol. xxxviii.), in spite of its later geological horizon, to a second species of the same genus, under the name of *L. sternbergii*. A second skull of the same species, from the Hell Creek beds of Montana, which came under the author's notice after the original paper was written, is also described and figured.

Leidyosuchus may now be characterised as a short and relatively broad-skulled crocodile, with the nasals apparently not reaching the nares, the posterior nostrils wholly enclosed by the pterygoids (instead of being behind them, as in Crocodilus), the mandibular symphyses short and formed in part by the splenial, the upper teeth more numerous than the lower, the first lower tooth received into a pit, and the third and fourth—which are about equal in size—into notches in the skull. The vertebræ have the cup in front; and there was armour on the lower as well as on the upper surface of the body. Many of these characters connect the genus with Crocodilus on one hand and Alligator (including Caiman) on the other, although their preponderance is with the first-named genus. There are also indications of affinity with the Tertiary Diplocynodon. The position of the posterior nostrils—intermediate between those of modern and Jurassic crocodiles—is just what might have been expected from the geological horizon of the genus.

Since its original description by Sir R. Owen in 1873 the imperfect skull of the saw-billed bird (*Odontopteryx toliapica*) from the London Clay of Sheppey, preserved in the British Museum, has remained the sole evidence of its genus and species. When complete the specimen probably measured something like 6 inches in length. The discovery is now announced by Mr. B. Spalski, in the second number of the new journal published at Leipzig under the title of *Der Geolog*, of the skull of a much larger species of the same genus in Tertiary strata in Brazil, the total skull-length being no fewer than 53 centimetres. The name *O. longirostris* is proposed for the Brazilian species.

THE INFLUENCE OF RIVER SYSTEMS IN THE EAST.

GLOBUS for September 1, Bd. xcviii., contains an article of some interest on the subject of the influence of river systems in the East, by Herr Ewald Banse. The author deals with the area between 17° and 36° N. lat. and 17° W. and 74° E. long. (which he terms the Orient), where the average annual rainfall is less than 200 mm. (8 inches); this is bordered in the southern Sahara and in the northern part of south-western Asia by a broad zone with an annual precipitation of 600 mm. (23½ inches). In summer this area is the hottest part of the earth's surface. It tends to prevent the intermingling of various flora, fauna, and human races; the Arabian peoples, the one-humped camel, and the date-palm are mainly confined to it. The map accompanying the article shows three main areas, which are drained by no rivers—the Saharan, the Arabo-Syrian, and the Irano-Armenian, the undrained regions amounting to 77 per cent. of the Orient.

The central regions, with their entire lack of hydrographic connection with the ocean, differ essentially from peripheral countries with sea-connection. The formation of level plains is one marked tendency of countries devoid of rivers; wind, which forms the sole connection with the ocean, plays a very important *rôle* there. These flats are to be regarded as phenomena of disease in the earth's surface, and the fact that three-quarters of the Orient is devoid of river systems will account for its low population and helps to explain its cultural backwardness. It is the watered areas—23 per cent. of the whole—which have produced the cultures of the Orient, *e.g.* the Sumerian within the Anatolian-Kurdic belt. Higher cultures concentrate where there is flowing water all the year.

Four regions are passed in review, the Atlas countries, the Sahara region, south-west Asia, and western Asia. For each a table is drawn up giving the total area, proportions of permanently river-drained, periodically river-drained, and entirely undrained land, and the density of the population—the last, it may be noted, is in inverse

ratio to the extent of riverless country. These statistical data are summed up in a fifth table. The Sahara region is most intensively characterised by lack of river-systems; no rivers rise there, and those which flow through lose rather than gain during the transit. Eighty-eight per cent. of this region is without off-flow. This huge desert area Herr Banse regards as "the surest bulwark of Islam in Africa."

RECENT PROGRESS IN ELECTRIC LIGHTING.[1]

Incandescent Lamps.

THE most remarkable development within recent times is the production of an incandescent lamp with an efficiency approximating to 1 candle-power per watt. The best known of these lamps are of two kinds, one made with tantalum as the material for the filament, and the other with tungsten. There are a great number of lamps under a great variety of different names using tungsten, and the difference between the lamps is largely due to the differences in the processes of manufacture adopted. The most recent development in the construction of tungsten lamps is in the use of wire-drawn filaments (L. Gaster, Cantor Lecture, 1909).

In order to test a statement that has been frequently made as to the bad effect of switching off and on, a series of tests is being carried out in the Electrical Engineering Laboratories at Liverpool in which the lamps are switched off for ten seconds and then switched on again, the process being repeated at intervals of one minute. Although these tests are not complete, the results, so far as they go, have been interesting. In all, twenty lamps, which have been supplied by several makers, are being subjected to this test. The lamps were divided into two groups, and each one was adjusted to have an initial efficiency approximating to 1·4 watts per candle-power; this adjustment was effected by introducing resistance into the circuit of each individual lamp. One set of ten lamps was connected in circuit with an automatic switch driven by a small fan motor at such a speed that a cam switched on the light for fifty seconds and switched it off for ten seconds. The reason for this choice of time was that it appeared that ten seconds was enough to allow the filament to become practically cold, and thus to give the maximum contraction and expansion of the thread. So far as the experiments have gone, the effect of switching does not appear to be serious; the lamps that have been burning continuously have given out to the same extent as those that have been subjected to the continuous switching off and on.

The effective life of these lamps is found by them to be roughly proportional to the 3·65th power of the initial watts per candle-power, a law which corresponds with that found for carbon filament lamps.

We may sum up the position, so far as metallic filament lamps are concerned, by saying that at present there is no difficulty in obtaining a 230-volt metal filament lamp of about 25 candle-power which will give one horizontal candle-power for 1·2 watts, and will burn near this efficiency for more than 1000 hours, probably for a much longer period under ordinary conditions.

Before leaving the subject of incandescent lamps, it may be of interest to make some remarks on the character of the light that is emitted from them. The spectrum obtained corresponds with the spectrum given by an incandescent body, *i.e.* it is a simple band spectrum. So far as my own observations have gone, there is no evidence of selective emission, and the increase in efficiency of metal filament lamps may be said to be entirely due to the higher temperature at which the lamp filament runs. The wave-length of maximum emission intensity corresponds fairly closely with Wien's law for the radiation emitted by a black body. (It may be of interest to note here how nearly the temperature of maximum emission intensity for the yellow line, D, or centre of the visible spectrum about 6200° C., corresponds with the estimated temperature of the sun.)

The nearer we can approach the temperature of the sun with artificial sources of light, the more nearly will an illumination be obtained which corresponds in all regards with sunlight.

Arc Lamps.

The most notable advance in arc lighting within recent years is the flame arc, but these lamps have been used so extensively for a number of years that the flame arc itself is far from being a recent development.

It is my intention in this paper to lay stress on only two points:—(1) the improvements made in the distribution of light so as to give more uniform illumination over a large area; (2) the actual efficiency or flux of light emitted per watt consumed in a modern lamp.

The attempt to obtain more uniform illumination on the surface has been made in two ways, first by using vertical carbons instead of **V** carbons, as in the earlier form of flame lamps. As has been pointed out by many people, the candle-power curve required to give uniform horizontal illumination is much more closely approached by the polar curve of light distribution given by a vertical carbon lamp than by any other form.

The second method which has been adopted with the view of improving the light radiation from **V** carbon lamps is by the use of special globes. The most notable example of this is the use of the dioptric globe.

(2) Actual efficiency of modern arc lamps as measured by the influx of light per watt consumed (see subjoined Table).

Type of lamp	Volts	Current	M.^{H}S.C.P.	C.-P. per watt
Enclosed flame lamp (clear globe)	58	8·45	2200	4·5
(opal globe)	57·8	8·5	1430	3·0
Open flame arc (slightly obscured globe) ...	40	7·0	1040	3·72
Singly enclosed arc ordinary carbon ...	86	8·5	1150	1·6
Midget singly enclosed arc lamp	77	3·2	245	1·0

Vapour Lamps.

The production of light from an incandescent vapour is a method of lighting which has long been familiar, though the only practical examples of it are the mercury vapour lamp and the Moore tube. The two forms of mercury vapour lamp which are being manufactured at present are the quartzlite lamp and the silica lamp.

The main characteristic of this lamp is that it produces a large amount of ultra-violet light, to which quartz is transparent, and which is screened off from the exterior by a heavy lead glass clover. If the lamp is left burning without this cover for a few minutes the smell of ozone produced is very strong. It is a matter for discussion whether mercury vapour lamps containing these very strong lines only in the spectrum will not ultimately prove injurious to the sight of those who are obliged to work in it. *A priori*, it would seem to be bound to produce a fatigue of those parts of the retina which respond to the impulses given by the particular rays which the lamp emits.

A lamp of this type has recently undergone test in my laboratory, with the result that the efficiency worked out at 1·73 candle-power (mean hemispherical) per watt. The lamp consumed 688 watts at 230 volts, and gave a mean hemispherical candle-power of 1190.

The mixing of the mercury vapour light with that of the light from tungsten lamps has been tried at Liverpool with quite satisfactory results, the ratio between the amount of light required to produce complete mixing being very easily found by the aid of the globe photometer and two pieces of milk glass, one piece illuminated by a beam of daylight from the outside and the other by the light diffused on the surface of the globe by the two sources of light inside the globe. This method is, of course, not so exact as the colorimeter of Ives, but gives quite satisfactory results.

[1] From a paper read before the Illuminating Engineering Society on December 9 by Prof. E. W. Marchant.

SMOKE AND ITS PREVENTION.[1]

UNDOUBTEDLY the most important question of the day from the sanitary and artistic point of view is how best to combat the smoke nuisance, which, like a cumulative poison, is slowly but surely saturating our lives and homes with its filthy dregs, and is at the same time like a cancer depleting and destroying our natural strength by the waste of our already rapidly diminishing fuel supplies.

When, in the thirteenth century, bituminous coal was first used for fuel purposes, the smoke to which it gave rise roused such indignation amongst the public that a decree was passed in 1306 forbidding its use; but fuel had to be found, and the supply of timber proving insufficient, once more attempts were made to introduce it, but again public opinion led to its banishment in the reign of Queen Elizabeth. The third attempt, however, to bring it into use proved successful, and slowly the consumption increased, until the last century saw coal firmly established, not only as a fuel for domestic consumption, but also as our great source of power, and it was the possession of great stores of the fuel that gave England her commercial supremacy.

The smoke from the few chimneys where coal was used by our forefathers, and which so shocked the sense of the observers of that day as to lead to its use being banned, was an absolutely negligible quantity as compared with the smoke belched forth into the air in any of the large cities of to-day, and the effect upon our climate, our health, and our buildings has so steadily risen with the increase in consumption that it is no exaggeration to speak of it as a cumulative poison.

It was only in the latter half of the last century that the cumulative effect of smoke began to make itself appreciable, and the 'eighties and 'nineties were marked by a diminution in the hours of sunshine in our big cities and by fogs of remarkable density and lasting power; but such legislation as was enacted and the efforts of those interested in smoke abatement have apparently had some slight influence in a reduction of the plague, and certainly during the past ten years the fogs have not been of the same density or so frequent as in the preceding twenty or thirty years, but how far this has been due to efforts at smoke abatement and how far to meteorological conditions I, at any rate, am unable to say. It is an absolute fact that even if a certain amount of work has been done, so much still remains to do that the subject is as important now as it was ten years ago, and my desire this evening is to attack the subject of smoke from the more chemical and physical side of its production, and to review those methods which are practically possible for its prevention.

It must be borne in mind that the smoke question not only affects the well-being of the country, but also implies a waste of fuel so great that with the problem of failing coal supplies looming on the horizon it behoves us to make a national matter of it, not only from a hygienic, but also from an economic point of view. Indeed, the whole question of fuel economy is so closely allied to the problem of smoke prevention that it is impossible to consider the one without the other, and if only rational methods of heat production were adopted, both economy of fuel and cleansing of the atmosphere would follow.

The principal source of the cloud which hangs over our big towns, cutting off the direct rays of the sun and ruining health, varies with the locality. In the south of England it is the domestic grate using bituminous fuel which is responsible for the major portion of this pollution of the atmosphere, whilst further north, in the great manufacturing centres, it is the factory shafts which emit the pall of black smoke that aids in shortening life and killing vegetation, and which begrimes and finally helps to destroy our public buildings.

Many estimates of the relative amount of pollution due to manufactories and to the domestic grate have been made, but as the question of what is the ratio of smoke production from the various sources varies enormously with the locality, no very satisfactory conclusion has been arrived at.

[1] A lecture delivered at the London Institution on December 8 by Prof. Vivian B. Lewes.

With regard to London, Dr. Shaw's estimate that 70 per cent. of the smoke is due to the domestic fire would probably be about correct, but in Sheffield or Birmingham the figures would most likely be reversed. But it is a certain fact that domestic smoke is produced throughout the whole length and breadth of the land, whereas the factory chimney concentrates its attention on the more limited area of the manufacturing districts.

Although it is difficult to gain any idea of the ratio of blame to be given to the two greatest sources of smoke production at any one spot, yet it is easy to obtain an insight as to the relative total amount of smoke so produced from the uses to which our coal is put, and the Royal Commission on Coal Supplies arrived at the conclusion that, of the 167 million tons of coal burnt in this country in 1903, 36 millions were used for domestic heating, whilst, after deducting the coal used for gas making, it would probably be near the truth to say that the domestic use of bituminous coal is responsible for one quarter of the smoke pollution of the country, the responsibility for the remainder being split up amongst the various manufactures and railways.

Practically all the advances of late years have been in fuel consumption on the large scale, and the improvements brought about by stoking machinery and attention to air supply have been great, whilst some of the largest manufactures have demonstrated, not only the ease of obtaining smokeless factory shafts, but also the economy that accompanies them.

Little, however, has been done to improve the conditions of fuel consumption in the household, and in spite of the fact that the use of bituminous fuel in the domestic grate has been condemned for the part it has played in the pollution of the atmosphere from the earliest years of the fourteenth century to the present day, the ideas that exist as to its composition and method of production are still very vague, and it is this side of the question with which I now desire to deal. In an ordinary open fire radiant heat given by the incandescent fuel and heated grate warms the room, and although it is undoubtedly a wasteful method, owing to the largest proportion of the heat escaping up the chimney with the products of complete and incomplete combustion, yet it is so superior from the hygienic point of view, and so much more comfortable than any other method of heating, that it still holds the premier position in spite of the economic advantages of central heating systems or slow combustion stoves.

The production of smoke from the ordinary open grate using bituminous coal means a waste of fuel, but although this loss assumes grave proportions when the number of fires is taken into consideration, it is small as compared with the other losses due to actions taking place in the fire itself and the loss of heat escaping up the chimney. When bituminous coal is fed on to the burning fire, the action which takes place on the newly added portion closely follow the lines of action occurring during the distillation of coal, and it is during this period that a very large proportion of the heat units in the coal are lost, owing to the amount taken up in decomposing the coal and converting the volatile portions into vapours and gases. During this period the coal, heated by the fire from below and comparatively cool above, distils off tar vapours, coal gas, and steam in proportions which vary with the temperature. In the early stages, the surface of the fuel being too cool to lead to their ignition, they escape as vapours up the chimney, mingled with an amount of air which is dependent upon the draught of the chimney, and ranges from eight to thirty thousand cubic feet per hour. In an ordinary flue the composition of the escaping products may be taken as approaching to the following analysis:—

	Per cent.
Carbon dioxide	0·70
Methane	0·36
Hydrogen	0·29
Carbon monoxide	0·01
Oxygen	19·85
Nitrogen	79·79

and these gases, together with water vapour, escape up the chimney.

During this period of smoke production no soot is formed, and the physical properties of the cloud of vapour are an interesting study, as it explains one of the secrets of the lasting power of smoke and the way in which it acts. A most beautiful and instructive experiment is one devised by Mr. F. Hovenden, which shows to perfection the structure of smoke as it escapes from a burning object. A puff of smoke blown through a small glass cell illuminated from below by an oxyhydrogen or arc light, and examined under a low-power microscope, reveals the fact that it consists of excessively minute vesicles which are in a marvellous condition of motion, and which, owing to the gas within them being lighter than air, remain floating in the stream of air or gas until impact with a solid surface causes a bursting of the little liquid envelope, forming a microscopic drop of tar on the solid against which it has struck, and liberating the contained gases.

The wonderful movement of these vesicles is the most beautiful realisation that I know of our conception of molecular motion, and the marvellous way in which they keep up a continuous bombardment would be a perfect lecture illustration of kinetic energy if only it could be projected on the screen.

Given proper conditions, most condensing vapours seem to assume this form, and the small vesicular masses seem to retain the molecular activity of the particles that build them up, and there is little doubt that in fog or cloud it is this formation that gives the floating power, as the water vapour contained by the vesicle is only a little more than half the weight of air, and also explains the formation of rain by gun-fire and the dispersion of fog by electrical discharges, the bursting of the vesicle in each case leading to precipitation.

The tar vapour which escapes during the distillation of coal, either in the gas-maker's retorts or upon an open fire, consists of a mass of vesicles of this character, and this period is the one in which the most serious waste takes place, as not only is the greatest amount of heat being rendered latent by the distillation from the coal of these products, but they also escape unburnt up the chimney. After a while sufficient heat finds its way through the coal to the top of the fuel to ignite some of the escaping vapours, and the bright luminous flame then makes its appearance above the fire. This flame radiates a considerable amount of heat owing to the incandescent particles within it, and the waste of heat diminishes; but it will be seen that a large amount of vapour is still escaping unburnt, owing to the dilution of the hydrocarbon gases by steam and the cold air sucked in over the surface of the fire, which lowers their temperature below the point of ignition.

The appearance of the flame itself is worthy of notice, as the chemical changes taking place within it make it red and lurid towards the top, and the particles of oily carbon which form the soot escape from it.

Flame is caused by the combustion of gaseous matter, and when the air supporting the combustion is supplied externally to the combustible gas, the resulting flame is always hollow, consisting of at least two parts, an outer zone in which combustion is taking place, and an inner zone in which, there being no oxygen to carry on the combustion, no such action can take place. The ordinary luminous flame, such as is employed for illuminating purposes, is divided into four parts, but for present purposes our fire flame may be looked upon as consisting of only three, the inner zone being an area in which no combustion is taking place, but in which the gases are subjected to the baking action of the heated envelope that surrounds it, and undergo many decompositions, the most important chemical change being the conversion of any hydrocarbons into acetylene. In the outer zone combustion takes place in contact with air, giving the hottest part of the flame, and as the result carbon dioxide, carbon monoxide, and water vapour are formed; whilst between the inner and outer zones is a brilliantly luminous sheath giving the major portion of the cheerful firelight, whilst higher up in the flame, if combustion is not complete, this luminous portion becomes dull red and gives out far less light, and above this again smoke begins to appear in considerable quantities. These gradations in appearance are due to the acetylene and kindred bodies formed by the baking action of the outer zone on the hydrocarbons in the gases and vapours passing through the dark inner zone, entering the heated zone of combustion, when the acetylene suddenly splits up under the influence of heat into carbon and hydrogen, the latter of which burns and adds to the general heat of the flame, whilst the carbon raised to incandescence partly by the heat generated during its own formation from the endothermic acetylene and partly by heat from the flame, as well as by its own combustion, gives out the light. If the combustion were completed no smoke would be formed, but the diluting influence of the nitrogen and other products from the fire beneath and the cooling influence of the chimney draught so check and hamper the completion of the combustion of the products from the decomposed acetylene that the top of the flame is cooled to a dull red, and the flame is finally extinguished before all the carbon particles can be consumed, this producing the sooty smoke which passes up the chimney. The smoke does not consist merely of the liberated carbon particles, but contains tar vapour, water vapour, products of combustion, and excess of air, together with the residual nitrogen from that portion of the air that has been used in the combustion, as well as particles of ash sucked up by the draught of the chimney.

In time the fire burns clearly, the amount of flame becoming extremely small, and consisting mainly of carbon monoxide, and practically smokeless combustion is attained. No further pollution of the atmosphere takes place until more coal is fed on to the fire, whilst the incandescent fuel is radiating out the heat given by the combustion of the carbon, and is doing more heating work than at any other period.

Such details of chemical and physical action as I have attempted to bring before you seem absolutely superfluous to the lay mind, but until they are recognised it is practically impossible to arrive at any true solution of the difficulty.

Take an iron flask, half fill it with pieces of bituminous coal the size of peas, and heat it up to the highest temperature you can obtain with an atmospheric burner, and you will find that, as the heat penetrates the mass of coal, first white and then brown vapours distil from the mouth of the flask. Ignite these brown vapours, and you will see the same phenomena that are shown by the luminous flame above the fire; stop the flame for a moment by closing the mouth of the flask by a damp plug, and, having extinguished the flame, pass the brown vapours through a condenser, and you find that black liquid tar condenses and a clear, colourless coal gas escapes, which when ignited gives a luminous flame with little or no formation of carbon. Moreover, if, having ascertained this fact, you remove the condenser and re-ignite the mixture of gas and tar vapour, you find it gives a flame which steadily becomes less and less luminous, and finally assumes the character of a yellowish flame incapable of forming smoke, and from which no tar can be condensed.

This flame gradually dies away, and if the residue in the flask be examined, it is found to be ordinary gas coke, which when burnt in air gives no smoke or soot, and only such flame as is due to the formation of carbon monoxide by the passage of air through the incandescent carbon, and which, escaping from the mass, meets more air and burns with a small non-luminous flame.

From the fact I have brought before you several points are clear:—

(1) That the smoke-forming portion of bituminous coal is the hydrocarbons, which on destructive distillation form the tar.

(2) That the true coal gas contains but little of these, and can easily be burnt with smokeless combustion.

(3) That the residue left after the destructive distillation of the coal, *i.e.* coke, burns without the formation of smoke.

(4) That tar vapour and white smoke escape in the form of minute vesicles, which will float in air until burst by violent contact with some surface, on which they then deposit as tar.

(5) That what we speak of as smoke consists of a mixture of (*a*) tar vapour; (*b*) water vapour; (*c*) tarry carbon particles; (*d*) products of combustion other than water vapour; (*e*) fine particles of ash.

Amongst the gaseous products of combustion also are

to be found sulphur compounds, such as sulphuretted hydrogen and sulphur dioxide, the first formed during the distilling period when coal has just been fed on to the fire, and the latter during the combustion. Both these compounds are due to the sulphur always present in the coal, and whilst the former blackens white-lead paint and tarnishes silver, the sulphur dioxide, dissolving in water, oxidises to sulphuric acid, which is far more actively injurious, corroding and destroying metal work, retarding the growth of vegetation, and finally killing it.

Smoke thus formed finds its way from the chimney into the atmosphere, and is rapidly diffused through the air by means of the air currents, and it is manifest that if there were no means of removing it the air would soon become perfectly opaque from its accumulation in large quantities. When, however, rain falls, it rapidly washes the air free from such suspended solid and liquid impurities which constitute the visible portion of smoke. Snow is even more efficacious than rain in doing this; where the snow has fallen on the glass roof of a greenhouse it will be noticed that when it melts it leaves behind a black deposit consisting of the solid matter which it has collected during its passage through the air. An analysis of a deposit of this character formed on the glass roofs of some orchid houses at Chelsea gives a very good idea of the constituents of these solid impurities :—

	Per cent.
Carbon	39·00
Hydrocarbons	12·30
Organic bases	1·20
Sulphuric acid	4·33
Ammonia	1·37
Metallic iron and magnetic oxide	2·63
Other mineral matter, chiefly silica and ferric oxide	31·24

Water not determined.

In cases where long drought prevents the rapid clearance of the air by this means, the heavier of the solid particles settle by gravity, whilst the particles of carbon and carbonaceous organic matter are slowly oxidised by the oxygen and ozone into carbon dioxide, in which form vegetation removes them from the air.

The solid particles suspended in air are, however, by no means confined to the products of our improper use of bituminous fuel, and mineral matter from the dust of our roadways and organic matter from animal and vegetable life all play their part in rendering town air deleterious to health; but it is the smoke "dirt" that is the most injurious factor.

The smoke from our grates is naturally discharged at a lower level than that from the factory shafts, with the result that it probably has a greater effect on our general health and buildings than the higher layers of smoke, which travel for miles with the wind and which act more by darkening the sky and cutting off the sun's rays; and it is also clear that the low-level smoke will not extend so far from the point at which it is formed, as contact with buildings and vegetation rapidly rob it of the tar vapours, with the result that in a smoky town like Leeds it has been shown that at one mile out the solid impurities have fallen to one half, and at 2½ miles out to one-sixth.

Injurious as are the direct effects of smoke on health and property, they are small as compared with those brought about by dense fog, which may to a great extent be attributed to smoke, which acts partly by helping its formation and partly by retarding its dispersion.

Fog, whether it be in the form of white mist which is found in the country, or the yellow abomination which we know so well in London, is formed by the condensation of water vapour from the air, and this is brought about by any cause which rapidly cools a large volume of moist air. If, instead of the surface of the ground and the objects on it only being cooled the air for a considerable height above it is also lowered in temperature, then the moisture which is deposited from it, instead of forming dew, condenses in the air, forming minute vesicles that remain suspended and floating in the air, and constitute fog or mist. In pure air the mist so formed consists of little else than these minute bubbles of water, and has no irritating effect on the eyes or lungs. In a large town like London, however, the air is charged with an enormous number of minute particles, the heaviest of which settle on a horizontal or roughened surface in the form of dust, whilst the lighter particles continue floating in the air. These particles consist of a heterogeneous collection of all kinds of matter, amongst which "smoke" particles bulk largely, constituting more than one half. All these floating solids cool with great rapidity on account of the smallness of their size, and in doing so cause the rapidly cooling air to deposit moisture upon them, and so aid in the formation of the town fog, which appears long before the country mist.

The air of towns in which much coal is used also contains the volatile tarry matter distilled off during the imperfect combustion, and this, condensing with the moisture, coats it on the outside with a thin film, which does much to prolong the existence of the fog, as when the temperature of the air again rises the clean mist again evaporates into the atmosphere, but the tar-coated yellow fog has its power of evaporation retarded to an enormous extent. Experiments made by Sir E. Frankland show that the evaporation of water in dry air is reduced nearly 80 per cent. by blowing some smoke from burning coal on to its surface.

The statements made as to the enormous waste of fuel in the escaping smoke are, I think, often much exaggerated. In point of fact, the carbon wasted as soot is extremely small, and varies in smoke with the state of the fuel which is fed on to the fire. Under the ordinary conditions experienced in an open fire grate, in which the fire has just been made up with bituminous coal, the heavy smoke escaping will contain, on an average, 1½ per cent. of the total weight of fuel consumed, and as the temperature of the mass gradually increases this falls to less than ½ per cent.

A greater waste of the thermal value of the fuel takes place in the formation of the smoke, *i.e.* in the heat rendered latent in bringing about the decomposition of the coal, and the volatilisation and escape unburnt of the tar vapours formed.

Having gained an idea of the causes which give rise to smoke from the domestic hearth, we can now review the proposals which have from time to time been made for its prevention, and which may be classified under the headings :—

(1) The use of bituminous fuel in special grates.
(2) The use of solid smokeless fuel.
(3) The use of gaseous fuel.
(4) The combined use of gas and coke.
(5) Central heating by steam, water, or hot air.

In considering the claims of these various methods we must remember that the English open fire is undoubtedly the most comfortable and wasteful method of heating that could be adopted; but although by far the largest proportion of the heat escapes up the chimney, we must clearly bear in mind that this very factor makes it a most important engine of ventilation, and that at this time, when the ventilation of our middle-class houses is chiefly left to the jerry builder and the open fireplace, it is an important factor of health. Moreover, it heats the room in the only healthy way, that is, the radiant heat from it does not directly raise the temperature of the air, but is radiated to the floor, walls, and furniture in the room, which again part with their heat slowly to the air in contact with them and to the inhabitants, so that the walls and other solid matters in the room are at a higher temperature than the air.

Apart from its being more healthy to breathe cool than hot air, there is another important point to consider. The normal temperature of the body is 98° F., or 36·8° C., and this temperature is maintained by the slow combustion processes going on in the body. By the laws of radiation a heated surface parts with its heat more or less rapidly according to the temperature of the surrounding bodies, so that if a person be sitting in a room filled with warm air, but near a wall colder than the air, his body will rapidly part with heat by radiation to the wall, and a sensation of chill is the result; but with the open fire this is never the case, as the radiant heat from the fire heats the walls of the room to a temperature higher than that of the air. But when a room is heated by means of hot-water pipes or warmed air, the walls not being heated

in the same proportion, although the air may feel warm the walls will remain cold, so that the heat of the body would pass by radiation to the walls and give rise to a chill.

If, therefore, one can retain the chief characteristic of the open-fire heating by radiation, and eliminate the smoke production and excessive waste of heat up the chimney, we should have the ideal conditions for house-warming.

Enormous improvements have been made in the domestic grate during the last fifteen years both from the artistic and economic point of view, and whilst with the older forms it was not unusual to find a coal consumption of 7 to 8 lb. of coal per hour, this quantity has been reduced in the more modern forms to about one half, and this in itself has been an important step in smoke reduction; but grates have long lives, and the capital outlay of putting in new ones results in the modern forms being chiefly found in new houses. There have been many attempts made to construct grates for the smokeless consumption of coal, but it is found in practice that when once the heavy carbonaceous smoke is produced it is very difficult again to burn the carbon particles completely, as the dilution caused by the large volumes of nitrogen present prevents their easy combination with the oxygen of the air; and there is no doubt that the best methods of preventing smoke from bituminous coal is to feed on the fresh coal only in very small quanties, and to supply the top of the fire with a sharp draught of hot air. Under these conditions complete combustion of escaping hydrocarbons is ensured, and very little carbon is allowed to be liberated in the solid form. In order to do this, however, the stove has to be to a certain extent closed in, which is a drawback, and it is also found that no grate for bituminous coal is absolutely smokeless.

Stoves have been constructed in which the coal should be supplied to the bottom of the fire, so as to keep the top bright and clear, all the smoke having to pass through the clear fire above, where it is decomposed. Such grates are by no means novel, as one of the best was the "Arnott," and must be more than sixty years old; but for some reason they have never been popular with stove manufacturers, with the result that they have never reached the public, otherwise they are efficient and economical.

The great factor in making special forms of grate an ineffective solution of the smoke problem is that it involves large capital outlay on the part of the consumer, and my own experience is that unless the consumer can become a reformer without expense or extra trouble, the majority will talk but never act, and it is for this reason that the use of solid smokeless fuel, which can be used in all existing grates, appears the most likely solution of the great question.

Smokeless solid fuels may be classified as:—

(1) Coal which has been carbonised at a high temperature, so as to drive out practically all the volatile matter, and this class is represented by gas coke and Coalexld.

(2) Coal which has been partially carbonised so as to distil out the smoke-forming constituents, but to leave enough volatile matter to give a non-luminous flame and easy ignition, as seen in coalite and carbo.

(3) Non-bituminous coal, such as anthracite.

Coke, the solid product of high-temperature distillation, has never found favour with the middle and upper classes as a domestic fuel, owing to prejudice against it because of its being somewhat difficult to ignite and not burning freely, and its chief market has been for steam-raising and other manufacturing purposes, very little finding its way into the householder's grate. The result is that, had not carburetted water gas offered a convenient and economical way of using it in the gas works, many companies would have found great difficulty in keeping up the price during the years that coal was cheap.

It must be remembered, however, that during the past three years the great gas industry has been in a transition stage, and England is slowly following the lead of the Continent in recognising the fact that great economies are to be found in carbonising coal for gas-making in larger charges than have ever before been attempted, and the introduction of vertical and oven retorts is undoubtedly a step in the direction of making a coke which shall be more fitted for a domestic fuel than the overheated product made in the horizontal retorts of late years.

The large amount of attention centred upon the production of a smokeless fuel during the past three years has led to the introduction of several processes for improving the coke during gas manufacture, which, although leading to little or no improvement, have enabled the product to be sold under a fancy name, and have done a certain amount of good by inducing consumers to try under another name the coke which prejudice would have damned untried.

The second class of smokeless fuel, and the one which many scientific men look upon as the most promising solution to the smoke problem, owes its inception to Colonel Scott Moncrieff, who many years ago suggested the use of a half-coked coal as a fuel supply, and tried to make a commercial article by carbonising coal at the ordinary gas-retort temperature, drawing the charge when half the usual volume of gas had been distilled out from it. Two factors, however, led to failure, the one being that the time was not ripe, and the second that the means by which he proposed to carry out his entirely admirable idea, being dependent upon the ordinary gas-works practice, had to be carried out under certain conditions which led to a want of uniformity in the fuel, and to certain difficulties which those who tried to make it failed to overcome.

The idea, however, of a semi-carbonised coke which should still contain enough volatile matter to give easy ignition and a cheerful flame without any smoke, was independently revived under the name of "Coalite."

This differs from the fuel proposed by Colonel Scott Moncrieff in that, instead of shortening the period of carbonisation at a high temperature, the temperature is reduced to one half the ordinary, and is continued in suitable retorts until a uniform coke, containing 12 to 15 per cent. of volatile matter, is formed. In both processes there is the fatal defect—from a gas manufacturer's point of view—that less than one half the volume of gas is obtained per ton of coal, and as the all-conquering career of the incandescent mantle has rendered a high candle-power gas unnecessary, the rich gas yielded is not looked upon as an equivalent attraction.

The coalite process has the great advantages over the older process that the fuel is of greater uniformity, and that the yield of tar is doubled instead of being decreased, and is greatly enhanced in value.

Coalite has created so much interest that, as was only natural, the Moncrieff process was revived, and the product is well known under the name of "Carbo."

Coalite appears at present to be labouring under difficulties, but I am convinced now, as I was when I first examined the process, that when its manufacture is properly handled coalite will be the ideal fuel, and will not only solve the smoke problem in the easiest possible way, but will also be an important economic advance in our treatment of coal.

The use of a non-bituminous coal like anthracite would result in smokeless and very hot combustion, but here again the objection is that stoves with a special draught would have to be used, and the initial cost would prevent its use ever being adopted, besides which any great demand for this kind of fuel would at once send up the price to a prohibitive figure.

If the consumer can be induced to take the trouble, a very good semi-smokeless fuel can be made by using a mixture of two-thirds coke to one-third coal, and instead of piling up the grate with cold fuel when the fire burns low, to add the fresh fuel frequently in small quantities, so as to prevent the deadening of the top heat of the fire; but this is diminishing, not killing, the evil.

Leaving the smokeless solid fuels, which I believe will in the future play a very big part in the cleansing of town air, we now come to the gaseous fuels, and here at once we have ready to hand a solution of the difficulty in the use of coal gas. Gas fires, gas cookers, gas water-heaters, gas engines, have all been developed to a point which leaves no valid excuse for overlooking their claims, and ever since Bunsen in the early 'fifties gave us the atmospheric burner, in which non-luminous combustion is obtained and smoke rendered impossible, coal gas has

steadily progressed in favour for heat and power as well as light, until at the present time nearly as much is used for the one as for the other.

What, then, stands in the way of its universal adoption? First and foremost, initial cost crops up, as although much has been done by the companies in popularising gas stoves by letting them out on hire, by easy payment systems, and by looking after their maintenance, the consumers must pay something, and that is sufficient to damp their ardour as smoke reformers. Secondly, gas is a little more expensive for continuous heating than coal, although when used for short periods, as for fires in bedrooms, &c., the fact that you turn it on when you want the fire and turn it off when it is done with brings the fuel cost to nearly the same as coal, whilst in such places as Widnes and Sheffield, where the price has been reduced to a minimum for heat and power, the gas engine and gas fire well hold their own.

The chief sentimental objections to the gas fire—its non-pokerbility and one's not being able to throw cigar stumps and ash into it—are disposed of by a suggestion made first, I believe, by Sir W. Siemens some thirty years ago, and that is to decompose bituminous coal into coke, tar, and gas in our gas works, and to reunite the true heat producers, coke and gas, in our fire grates sans the smoke-producing tar—to do, in fact, with coal what was done by Chevreul a century ago with tallow, when he converted the tallow dip into the composite candle.

All the initial outlay needed for this is to fit the atmospheric burner arrangements of the gas stove to any ordinary fire grate, so arranging them that they can be made to swing back clear of the fire when they have done their work of bringing to bright combustion the gas coke used as fuel in the grate. This has always seemed to me to be the best economic method of using the products of gas manufacture, because it would be impossible to use either gas or coke alone to entirely supplant the use of bituminous coal; a market must be made for the by-products if prices are to be kept down and, as we hope, still further reduced, but if the use of gas and coke could both be increased, the gas manager could afford a diminution in the price of tar from over-production, as he has already ruined the tar market by overheating his retorts, and so loading the tar with free carbon and naphthalene as to make it nearly worthless.

As I have before pointed out, to my mind the best solution of the dual question of the most economical use of coal and the cleansing of our atmosphere is to be found in low-temperature carbonisation and the production of such fuels as coalite, because every constituent of the coal is utilised in the best way; but when we see how little expense and personal trouble is needed to attain smokeless combustion in other ways, it becomes evident that the mere provision of means to bring about the desired end is entirely insufficient. How can the societies interested in smoke abatement influence the hundreds of thousands of small consumers whose chimneys make the morning cloud; they may make their doctrines felt in the West End, but will they ever touch the seething population of the workers' quarters of the town?

One is gravely told that legislation should be passed dealing with the question, and that the use of bituminous coal should be forbidden; but I think this is scarcely feasible, and unless we revert to the conditions of 1306, when a citizen of London was executed for using bituminous coal, I doubt its being effective; but I do believe that if a future Chancellor of the Exchequer would put a 5*s.* tax on bituminous coal, exempting that used for gas-making, smokeless fuel manufacture, and for use by those burning it in smoke-preventing forms of grate or furnace, the question would quickly be solved, coal economised, and smoke abolished.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR T. CARLAW MARTIN, editor of the *Dundee Advertiser*, has been appointed by the Lords of the Committee of Privy Council on Education in Scotland, director of the Royal Scottish Museum, Edinburgh.

PROF. G. R. THOMPSON, professor of mining, University of Leeds, has been appointed professor of mining at the South African School of Mines and Technology, Johannesburg, and principal of the college.

THE Department of Agriculture and Technical Instruction for Ireland has issued in pamphlet form an illustrated account of technical instruction in Londonderry, by Mr. G. E. Armstrong, principal of the Londonderry Municipal Technical School, which was published recently in the Department's Journal (vol. xi., No. 1).

THE report of a higher education subcommittee of the London County Council Education Committee, recently prepared, provides interesting information as to the allocation of grants to secondary schools aided by the Council. The income of aided secondary schools is derived from four main sources:—endowment, Board of Education grant, fees, and grants from the Council. The actual receipts for the school year 1909–10 under the four headings in order were 45,132*l.*, 52,326*l.*, 101,256*l.*, and 37,398*l.*, making a total of 236,112*l.* The estimated receipts for 1910–11—for the aided schools, which number forty-two—are, under the same headings, 46,589*l.*, 52,653*l.*, 97,181*l.*, and 38,203*l.*, amounting to 234,626*l.* The amounts mentioned under fees include the fees of London County Council's scholars, which in the forty-two schools mentioned were in 1909–10 37,938*l.*, and are estimated for 1910–11 at 37,144*l.* It will thus be seen that the total Council grant to aided secondary schools in London was in 1909–10 75,334*l.*, and will be in 1910–11 75,347*l.*

A COPY of the annual report of the 114th session of the Glasgow and West of Scotland Technical College, which was adopted by the governors last September, has been received. The progress of the college in regard to the number of students, as well as standard of work, continues to be satisfactory. While the number of individual evening students has increased in five years by 30 per cent., class enrolments and "student hours" have increased by more than 45 per cent. The fourth and last section of the new buildings has now been completed, and provides accommodation for the department of textile manufacture. The new school of navigation, to which the Glasgow City Educational Endowments Board has undertaken to make an annual subsidy of 500*l.*, has now been organised and opened. In their report the governors acknowledge the receipt of additional grants, amounting to 26,866*l.*, from the Scotch Education Department towards the building and equipment fund, and a grant of 3000*l.* from the trustees of the late Mr. Alexander Fleming.

THE eighteenth annual distribution of prizes and certificates was held at the Borough Polytechnic on Monday, December 19. Mr. J. Leonard Spicer (chairman of governors) presided, and in the course of his opening remarks referred to the great progress made by the institute during the year, the record number of class entries being more than 5000, showing an increase of more than 500. That the work was appreciated was shown by the numerous visits paid by persons from all parts of the world interested in education, and as a result of one of these visits a request had been received from the High Commissioner to the Australian Commonwealth for a set of specimens of metal work executed by the boys of the day school, and the Japanese Commissioner, on behalf of his Government, applied for the metal work of the boys' day school, the specimens from the printing classes, and the work of the oils, colours, and varnish department, that had been displayed at the Japan-British Exhibition. The principal, Mr. C. T. Millis, reported the satisfactory examination results, and stated that thirteen medals had been gained in examinations conducted by the City and Guilds of London Institute, the Royal Society of Arts, and other public bodies. Lord Lytton urged the students of the polytechnic to do their utmost to realise the ideals which the founders of that institution had in mind when the polytechnic was first established. Was there ever a more pathetic sight, he asked, than to see a man who had suffered all through his life from lack of opportunity, and he thought the polytechnics were established with the object of equalising opportunities for all in the competition in life. The polytechnics should in addition stimulate among the students a sense of the duties and responsibilities of citizenship.

JUDGING from a speech by Mr. Beeby, the Minister of Public Instruction at Milthorpe, on November 3, a report of which has reached us, education in all its grades is likely to receive generous treatment from the new Labour Government in New South Wales. Among other developments in education which it is proposed to foster is the inauguration of continuation and trade schools, and a large extension of technical schools, with the view of keeping boys and girls who leave school at an early age to enter "blind-alley" employments under observations and under the influence of active and interested minds much older than their own. New regulations as to the high schools are under consideration also. Their main object is to establish a well-defined course of secondary education in certain selected schools, and in that way to abolish the present unsatisfactory position of superior public schools in which children get a smattering of education without any definite result. These regulations provide for the establishment of high schools, the abolition of tuition fees—the periods and character of instruction in high schools and superior public schools differentiating the two types—the institution of certificates of attainments, and the localisation of scholarships within districts, to secure their distribution throughout the States. The Government believes also that reforms in the constitution of the university are necessary before any serious increase in State subsidies is considered, and this matter is under consideration. As regards the question of compulsory attendance at continuation and trade schools, the Government proposes to face an alteration of industrial laws to provide for the shortening of the working hours of boys and girls up to the age of eighteen, and their attendance at school for a certain number of hours each week. It is satisfactory to find that the new Government of New South Wales believes that the people of this State will support cheerfully any proposal for a large increase in the education vote so long as the money is spent wisely, and will make every effort to carry out the reforms indicated.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, December 13.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—E. S. **Goodrich**: The segmentation of the occipital region of the head in the batrachia Urodela. This paper was based upon the author's studies of the development of the head region of the Axolotl (*Amblystoma tigrinum*). The head of the Axolotl contained three segments behind the auditory capsule. Three metaotic somites were developed in these segments, of which the first soon disappeared, and the second and third contributed to the formation of the temporal muscle. To the first segment belonged the glossopharyngeal nerve, to the next two the vagus. The occipital condyles were developed between the third and fourth somites. The two hypoglossal roots corresponded to the fourth and fifth metaotic segments, and passed out in front of the first and second vertebræ. In the Amniota all these segments were included in the head. The skull of an amphibian was thus shorter than that of a mammal, yet the condyles were homologous in the two animals. The shifting backwards or forwards of the condyles was brought about, not by the inter- or ex-calation of segments, but by a transposition from one segment to another. The shifting of the condyles was comparable to the transposition of the limbs on the trunk-segments.—Oldfield **Thomas**: The mammals of the tenth edition of Linnæus: an attempt to fix the types of the genera and the exact bases and localities of the species. It was shown that by the use of tautonymy the types of nearly all the Linnæan genera could be definitely fixed, the conclusions arrived at by this means agreeing in most cases with common usage. The type of Simia, however, would not be *S. satyrus*, but *S. sylvana*, and of *Dasypus D. novemcinctus* instead of *D. sexcinctus*, the consequences of which changes were pointed out. Pygathrix, as represented by the two species *nemaeus* and *nigripes*, was shown to be generically distinct from Presbytis, so that the latter name still remained available for the ordinary Langurs. Changes in specific names, due to a complete examination, were shown to be less numerous than might have been expected, while the stability of mammalian nomenclature was much increased by avoiding the danger of what such an examination might lead to. Type localities, derived from the original authors quoted by Linnæus, were defined for a considerable number of the species.—Dr. W. E. **Hoyle**: Report of the International Commission on Zoological Nomenclature. A discussion of the report followed on the portion relating to the formation of an official list of most frequently used zoological names. The feeling of the meeting was very strongly in favour of the International Congress giving its authority to the formation of a list of zoological names, the significance of which should not be altered by application of the rules of the international code. It was unanimously agreed to accept the action of the Congress if it would adopt this course.

Royal Meteorological Society, December 21.—Mr. H. Mellish, president, in the chair.—Captain C. H. **Ley**: Report on balloon experiments carried out at Blackpool in the early part of the year. The proposal was to employ balanced pilot balloons, which, floating in a current with no upward or downward hydrogen velocity, would represent the motion of a particle travelling in that current. Difficulties, however, arose which prevented the scheme being carried out as originally planned. Ultimately, a hydrogen balloon, or twin-system of hydrogen balloon and heavy satellite, was so valved as to have a large lift at first, but to continuously lose gas under the action of a leak until a certain point is reached, when the valve closes, when in accordance with previous adjustment it is nearly in equilibrium. The vertical motion of a fresh wind blowing over a flat country is very slight as a whole, but subject to marked variation on special occasions. In the lowest stratum in the late afternoon there is frequently a large descending current. The apparent effect of a river is to check the wind velocity and cause a downward movement of air over the whole area of the river valley.—Captain C. H. **Ley**: The meteorological significance of small wind and pressure variations. In this paper the author compared the "yawings" of the wind at Blackpool with the small variations of atmospheric pressure as recorded by the microbarograph.—Dr. Wilhelm **Schmidt**: Atmospheric waves of short period.

Institution of Mining and Metallurgy, December 21.—Mr. Edgar Taylor, president, in the chair.—F. **Gillman**: Malaga magnetites. In a previous paper the author suggested that the magnetites of Malaga, Spain, were originated by segregation from the peridotite magma, and the present paper was written to confirm this suggestion after a detailed examination of one characteristic deposit at Estepona. This deposit is intimately related to the serpentinised peridotite which constitutes the entire mass of the adjacent mountains, and is about half a mile distant from the nearest metamorphic or sedimentary rocks, and the results of work executed on the ore body serve to show that the deposit consists of serpentine, which is sterile above a certain line, and more or less ore-bearing below.—R. W. **Hannam**: A method of raising bore-casings from a pontoon. This brief note describes a simple method of withdrawing bore-casings from a river bed by means of the surplus buoyancy of native pontoons. A crowd of natives was employed to weigh down the pontoon, and the bore-casing was secured to it when thus depressed. At a given moment the natives sprang overboard, and the buoyancy of the pontoon was sufficient to withdraw the bore-casing.—H. C. **Bayldon**: Notes on Chilian mills in Russia. The author provides a useful and instructive treatise on the slow-running Chilian or "edge-runner" mill invariably used in Russia for crushing gold ores as a preliminary to amalgamation, &c. After a brief historical summary the paper deals with a description of the standard type of Chilian mills now in use, and of the milling methods adopted in Russia, and this is followed by notes on an improved type of Chilian mill and milling plant recently introduced. The descriptions are suitably illustrated, and there are ample statistics relating to mills and their efficiency. The author is of opinion that, if the same amount of thought and attention were devoted to the development of this type of mill as has been given to the heavy stamp-tube mill combination in South Africa, it would prove a serious rival and give a product nearer to the ideal aimed at on that goldfield.

MANCHESTER.

Literary and Philosophical Society, November 15.—Mr. Francis Jones, president, in the chair.—Dr. W. **Makower** and Dr. S. **Russ**: Note on scattering during radio-active recoil. During experiments on the recoil of radium B from radium A, not only did a surface directly exposed to the recoil stream become active, but surfaces situated outside the direct stream also received active deposit. It was thought that these effects were due to scattering from the surfaces upon which the recoil atoms fell, and experiments were made to test this. These were carried out in a high vacuum, and a plate was mounted in such a way that it was outside the recoil stream coming from an active wire coated with radium A, but so that recoil atoms scattered from a copper reflector could reach it. When the plate was examined it was found to be active, and by measuring its rate of decay with an α-ray electroscope, more than half of the active matter proved to be radium C, and not radium B. This result can be explained if, when the radium B impinges on the reflector, a small portion of it is scattered on to the plate, but the greater part remains on the reflector and subsequently gives rise to radium C, a small fraction of which is then directly projected on to the plate.—D. M. S. **Watson**: Upper Liassic Reptilia. Part iii.: Microcleidus and on the genus Colymbosaurus.

November 29.—Mr. Francis Jones, president, in the chair.—Prof. A. **Schwartz** and Philip **Kemp**: Some physical properties of rubber. Pure rubber strip which has not previously been extended has a large coefficient of linear expansion when tested under loads just sufficient to keep the strip straight. The behaviour of rubber when heated under tension was found to be more complex than had previously been supposed. The previous history of the rubber as to whether it has been previously extended or not largely affects the result. The modulus of elasticity of the rubber probably changes with load and temperature. Considerable change takes place in pure rubber when rested in air for some time at normal temperatures, the strips, which were originally translucent and flexible, becoming opaque and hard. An opaque, hard, and comparatively inextensible condition can be obtained by slightly warming a pure rubber strip and rapidly extending it as far as possible by hand. On keeping it extended thus for a few seconds and then removing the tension it will be found that the rubber remains extended in an opaque condition, but can be brought back to its original dimensions and condition by the application of slight heat. The mechanical hysteresis of rubber has been studied and applied to the testing of rubber. The hysteresis machine was described. A test-piece of rubber, subjected to a series of complete cycles of extension and retraction, was shown to increase in length, according to a logarithmic law, with respect to the numbers of the cycles. The slow stretch of rubber under a constant load also follows a logarithmic law with respect to time. The work done in extension, in retraction, and in the rubber itself, was shown to be proportional to the cross-sectional areas of the specimens.

DUBLIN.

Royal Irish Academy, December 12.—Dr. F. A. Tarleton president, in the chair.—G. H. **Pethybridge** and Paul A. **Murphy**: A bacterial disease of the potato plant in Ireland, and the organism causing it. The authors describe a bacterial disease of the potato plant of frequent occurrence in Ireland, and give an account of the organism which they isolated from diseased plants, and with which successful inoculations were carried out on healthy plants and tubers. It is a multiflagellate peritrichous bacillus, liquefying gelatine and producing decay in the living tissues of a variety of plants in addition to the potato. It resembles in many respects other organisms which have been found causing similar diseases in potatoes both in the Old and New Worlds, but does not appear to be identical with any of them. The name *Bacillus melanogenus* is proposed for it.—A. W. **Stelfox** and Robert **Welch**: A list of the land and fresh-water Mollusca of Ireland. In the introduction the authors give a short *résumé* of the work which has been done in this branch of natural history in Ireland from the time of Captain Thomas Brown to the present day. This includes a list of species added to the Irish molluscan fauna since the publication of Dr. Scharff's valuable work in 1892. The paper is divided into three parts; first comes the list proper, which includes only *bona fide* records, *i.e.* records which are backed up by specimens; secondly, a list of doubtful and erroneous records; and, lastly, a complete list of all species which are known to have been introduced into Ireland in recent years. These are mainly confined to greenhouses and nursery gardens. In the list proper the authors give notes on the principal variation of many of the species, especially that variation which tends to be of interest to those who study the geographical distribution of plants and animals. A full bibliography accompanies the paper.—H. Wallis **Kew**: A synopsis of the false scorpions of Britain and Ireland. The arachnidan order Pseudoscorpiones is represented in the British Islands by twenty-two species, one of which, unknown in Britain, is confined in Ireland to the extreme south-west.

DIARY OF SOCIETIES.

MONDAY, JANUARY 2.

ARISTOTELIAN SOCIETY, at 8.—The Standpoint of Psychology: Benjamin Dumville.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Determination of Sucrose (Cane Sugar) in Sugar Factory Products by Clerget's Process using Invertase as Hydrolyst: J. P. Ogilvie.—The Testing of Incandescent Mantles: J. H. Coste and W. E. F. Powney.—Radiation Errors in Flow Calorimeters: J. H. Coste and B. R. James.

THURSDAY, JANUARY 5.

RÖNTGEN SOCIETY, at 8.15.—The Radioactivity of Thorium: Prof. Rutherford.

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