THURSDAY, JUNE 15, 1899.

THE ANTHROPOLOGY OF BADEN.

Zur Anthropologie der Badener; Bericht über die von anthropologischen Kommission des Karlsruher Alertumsvereins an Wehrpflichtigen und Mittelschülern vorgenommenen Untersuchungen. By Otto Ammon. Pp. xvi + 707. Maps 15. (Jena: Gustav Fischer, 1899.)

FOR many years the distinguished worker, Dr. Ammon, has been conducting an anthropological survey of the Grand-duchy of Baden in such an exhaustive and detailed manner as cannot fail to excite the admiration of all interested in this branch of science. A considerable proportion of his investigations has been already published and incorporated in anthropological text-books; but the present bulky volume gives the whole of his work in collected form, and embodies such generalisations as he considers can at present be safely attempted. For the final bearings of these investigations on the history and evolution of this portion of the Caucasian race, Dr. Ammon states, however, that further observations are necessary both in his own and in neighbouring countries. As a monument of patient research, many of the fruits of which others will pluck, the volume before us reflects the highest credit on the author and his fellow-worker, Dr. Wilser.

The observations have been carried out on recruits and school-children; the two series being kept quite distinct from one another. The country has been mapped out into districts, which were assiduously worked from 1887 to 1894, three out of the four chief districts having been undertaken by Dr. Ammon himself, while the fourth has fallen to the lot of Dr. Wilser. The number of individuals (which is very great) examined in each of the four districts is clearly indicated on the first of the admirable series of maps, which render both the physical features of the country and the results of the survey conspicuous at a glance. In view of the general gradual numerical diminution of blonds and the increase of brunettes as we pass from North to South Germany, Baden, as forming a long narrow strip running from the south towards the centre of the German empire, is admirably circumstanced to display the development of this law in the southern provinces.

In addition to describing the ordinary physical features of the country, the geological structure is likewise taken into account; and the effects of all natural surroundings on the population are thus considered in full detail. To enumerate all the anthropological features which have entered into the scheme of survey would be wearisome; and it must suffice to say that bodily stature (subdivided into total length, sitting-length, and leg-length), the proportions of the length to the breadth of the head, the colour of the eyes and hair, and the development of hair on parts of the person other than the scalp, are all taken into consideration. Especial attention is directed to the difference in the anthropological features of the inhabitants of the rural and urban districts; and, above all, to the changes in the population of the latter induced by immigration from the former. In these investigations, Dr. Ammon lays claim to having founded a new branch of anthropology.

Seeing that to render adequate justice to the scope of the work would require a considerable portion of a number of NATURE, it will be advisable to concentrate attention on a few features. Among these, the relative prevalence of long-heads and round-heads, of blonds and brunettes, in different districts is perhaps the most generally interesting.

At the commencement of the second section of the work we find some theoretical observations on the three "primitive" types of man met with in Europe. In common with many other modern anthropologists, such as Ripley and Sergi, the author recognises, firstly, the Mediterranean long-heads, of medium or small stature, with dark eyes, hair, and skin. Secondly, the North European long-heads, of tall stature, with blue eyes, blond hair, and fair skin. And, thirdly, the Alpine round-heads, whose stature is medium, with dark eyes, hair, and skin. And here it is important to notice that the author speaks of these simply as *types*, in contra-distinction to *races*. He further observes that, owing to crossing, neither of the three types are common in their original purity in any district. In Baden itself, the population at the present day seems chiefly due to a mixture of the fair North European long-heads with the dark Alpine round-heads, the dark Mediterranean long-heads having failed to penetrate so far north in any great numbers.

The following table shows the number of individuals of each type met with among different classes of the population:

Type.	Rural districts.	Immigrants.		Town-born.	
		Small towns.	Large towns.	Small towns.	Large towns.
North European ...	146	4	11	27	15
Alpine	26	3	5	3	1
Mediterranean ...	9	0	0	0	0½

The percentage from these works out as below:—

North European ...	1·45	0·77	1·25	1·94	2·54
Alpine	0·39	0·93	0·91	0·35	0·27
Mediterranean ...	0·09	0	0	0	0·08

From this we see that, while among the immigrants the North European type is rarer in the small and the large cities than in the rural population, among the town-bred the percentage rises so as to exceed that of the rural districts, this being most markedly the case in the large cities, where we have 2·54 per cent., against 1·45 in the country districts.

Respecting the Alpine type, we find the immigrants into small towns standing at 0·93 per cent., and at 0·91 in the larger cities, as against 0·39 in the rural districts; whereas in the town-bred class the percentage is less than in the country districts, the diminution being most marked in the case of large cities.

Here, therefore, we have evidence that the blond long-heads tend to gravitate towards the large cities, where they flourish; and that while there is also a large immigration of the dark round-heads, yet that these tend to die out in their urban homes. Certain details are also given with regard to the position occupied by the dark round-heads among their fellow-students in the schools; but into these it is impossible to enter on this occasion.

To a certain degree, these results accord with those arrived at by Monsieur de Lapouge in France, that anthropologist contending that the enterprising, restless, long-heads migrate in disproportionate numbers from the rural districts to the cities, where, however, they eventually tend to die out. As regards this dying-out, so far as the blond long-heads are concerned, Dr. Ammon's figures do not appear to accord with the French conclusions. And having regard to the objections which have been urged against the latter, our author is wise in stating (in the preface) the necessity of further investigations before definite deductions are attempted. He, however, thinks it quite possible that a "selection of long-heads" may be taking place; and expresses the "pious wish" that such may prove to be the case.

As regards the contention of the French investigator that the dark Mediterranean long-heads are the type best adapted for an urban existence, where they choke out the long-headed immigrants, Dr. Ammon[1] considers that this is not supported by the results of his own work; this showing a total absence of the Mediterranean type in three out of the four urban districts, while in the fourth they are considerably less numerous than in the rural districts.

Pursuing the same subject, we find, in the fourteenth chapter of the second part, Dr. Ammon giving a series of interesting details with regard to the differences of skull-proportion and hair-colour between the sons of the immigrants into the towns and those of their native-bred inhabitants. From these it appears that in the smaller towns the sons of town-bred people exceed those of immigrants both in stature, sitting-height, and length of leg, as well as in the leg-index. In large cities, on the other hand, while the first three factors in the former show a similar increase over the country-breds, the leg-index is less. From the country population to the immigrants, from the latter to the sons of immigrants, and from these again to the sons of the city-dwellers there is an increase in the number of long-heads, with a proportionate diminution of round-heads.

In both generations of the town-breds the relative number of blue eyes at first increases and then diminishes in cities of all sizes; in small towns the number of persons with blond hair does the same, while in large towns it remains constant. In the town generation the North European and the Alpine types tend to converge, and the Mediterranean type to disappear. It is in consequence of these changes that a preponderance of blond persons is not observable among the recruits drawn from towns.

Although the above are only a few of the interesting results of the author's investigations, it will be evident that they are of the utmost importance in regard to current French theories as to the general inferiority of the round-heads, and their absorption in cities of the superior long-heads. But, as even the mental superiority of the latter over the former type is by no means admitted by all anthropologists, it is evident that we are at present only on the very threshold of studies of this nature. That results likely to be of real service in connection with the problems presented by urban and rural populations, especially those connected with the present preponderating increase of the former, will ensue from the steady pursuit of such studies, can but be the earnest hope of all those interested (and who is not?) in the future of the higher branches of the human race. R. L.

[1] Page 448. It is a little difficult to reconcile Lapouge's statement as to the dying-out of long-heads in cities (see Keane's "Man, Past and Present," p. 520) with his contention that the Mediterranean long-heads show a special suitability for such an existence.

LIMNOLOGY.

The Microscopy of Drinking-Water. By G. C. Whipple, Biologist and Director of Mount Prospect Laboratory. Pp. xii + 300, and plates. (Brooklyn, N.Y.: Wiley and Sons. London: Chapman and Hall, Ltd., 1899.)

Examination of Water (Chemical and Bacteriological). By W. P. Mason, Professor of Chemistry, Rensselaer Polytechnic. Pp. 135. (New York: Wiley and Sons. London: Chapman and Hall, Ltd., 1899.)

THIS is an example of a class of books in the production of which the Americans are bidding fair to take a lead, the type of book which may be termed the popular practical scientific manual, where the limitation of the subject-matter and the thoroughness of treatment aimed at are worthy of the German, but devoid of that hair-splitting exactness which so often leads to obscurity; while the general style and breadth of treatment are essentially English, and at the same time are saved from the superficiality too common in native technical treatises, by the industry and original ability of the energetic American. At the same time, the present work is not devoid of a certain diffuseness, which we think is referable to the author's enthusiasm leading him into disquisitions too long for the proper purpose of the book, but which is possibly the more marked to us because he is writing about American waters in particular, and about conditions not known in England.

The title may seem to many to claim too much; for Mr. Whipple puts aside at the outset all that relates to bacteria, and takes a very wide view of "drinking-water." He regards the subject of the examination of water as divisible into

(1) Physical examination.
(2) Biological examination.
  (1) Microscopical.
  (2) Bacteriological.
(3) Chemical examination.

A mode of classification which lands him in some inconsistencies—for some Schizomycetes are dealt with later on—and would vitiate the work if it were not clearly set forth that he is concerned solely with that part of the microscopical examination of water which is not bacteriological in the accepted sense of the word, and comes under the head of Limnology, dealing with those organisms which can be filtered out by means of fine-meshed nets or coarse filters incapable of keeping back water-bacteria.

The position reminds us of Miss Kingsley's diatribe against the utility of filters in West Africa.

"A good filter is a very fine thing for clearing drinking water of hippopotami, crocodiles, water snakes, catfish, &c. . . . ; but if you think it is going to stop back the microbe of marsh-fever — my good sir, you are mistaken."

Mr. Whipple, however, does not attempt to stop the smaller organisms by his filters, but only deals with the

larger ones, and having laid down his position, he proceeds to show, by his own interesting treatment of the theme, how large and important a subject that of limnology is, and how much neglected it has been in spite of the vast amount of information scattered in detail through the scientific literature of Europe.

Diatoms, Cyanophyceæ, Green Algæ, Fungi, and larger Schizomycetes, Protozoa, Rotifera, Crustacea, Polyzoa, Sponges, and miscellaneous higher aquatic plants and animals are dealt with in detail, and very interesting particulars are given of their numbers, distribution, and seasonal abundance in lakes and rivers, as well as many of their biological peculiarities.

Probably few people are aware that some of these small organisms contain powerfully odorous oils, and are responsible for the strong and unpleasant smell of certain waters, quite apart from decomposition.

We think, in spite of the many interesting facts regarding the existence of thermophilous organisms, the biology of blue-green algæ, &c., the author has missed some opportunities. For instance, we find no discussion or even mention of that puzzling phenomenon, the "Breaking of the Meres," although some of the organisms now known to be concerned—*Anabaena*, *Aphanozomenon*, &c.—are referred to. Again, it seems surprising that no reference occurs to the important *rôle* of such organisms as *Phormidium* in building up "Tufa," "Travertin," and other calcareous and siliceous substrata, particularly as some of the most striking examples occur in the United States.

Prof. Mason's little book proposes, if not protests, too much, as it is manifestly impossible for any author to cover the ground implied in the title in 126 small octavo pages of large print; and although we may give him credit for clear writing, an excellent selection of materials, and a general "up-to-date" style of presentment—including modern tables and charts—we cannot recommend this gossip about the chemical examination of water, with a smattering of bacteriological methods, as a serious text-book for students. On the other hand, we do commend it to the would-be writers of similar books in this country as indicating some of the new directions in which such writings should depart, and so abandon the too well-worn grooves in which our present bacteriologists are creeping onward.

Is not "Wolffhüggle," on p. 107, a misprint for Wolffhügel? It recurs on p. 108.

HEART AND SCIENCE.

Kritik der Wissenschaftlichen Erkenntniss. By Dr. H. v. Schoeler. Pp. viii + 677. (Leipzig: W. Engelmann, 1898.)

A FRIEND of Dr. v. Schoeler's died a victim to his devotion to science, when too late he had reached the conviction that his jealous mistress was not worth the sacrifice he had made for her. What, then, asked v. Schoeler, are the data, what the results of science and philosophy? How shall we free ourselves from their obsession, and make them servants rather than tyrants? Is ethical nihilism the upshot and a pessimism subversive of human endeavour in all directions other than the intellectual? Has Nietzsche, after all, the right of it?

Dr. v. Schoeler answers these questions in the present volume at, perhaps, inordinate length, overloading his work with quotations and instances not always quite relevant to his point. He essays nothing short of a critique of philosophy and of the natural sciences and a constructive theory of life without assumptions. In this task his performance is necessarily very unequal in different sections. His chapter on the ancient philosophy, for instance, is a not very valuable contribution to the history of anticipations. Parmenides is a "Schelling of antiquity," but this does not prevent Heraclitus being called in as a forerunner of the *Identitäts-philosophie*, and the account of Aristotelian science goes little, if at all, beyond what can be learned from G. H. Lewes. On the other hand, where he is more at home and possesses a more living interest, our author's criticisms, if rambling, are often to the point. It is, however, not always quite easy to determine what is intended as mere exegesis, what is the expression of v. Schoeler's own view.

His philosophical sympathies lie on the whole with Kant, interpreted not as containing Idealism of the Hegelian type in germ, but as frankly realistic, relativist, even agnostic. His master is the Kant of the antinomies, and of the unknowable *Ding-an-sich*, treating "freedom" as an ideal amid phenomenal determination. He also has a word of praise for the doctrine of monads, leans a little to Schopenhauer, and accepts the results of evolutionist biology and psychology, though critical of the extent to which they solve ultimate problems, and prepared with Kant to admit the teleological judgment with the limited and relative range allowed it in the third critique. In the scientific field, his interests seem to be mainly what may be termed biological in the wider sense.

The smallness of the results of science in general, however frankly we may admit those results, and the little advance made by either philosophy or science towards the solution of ultimate problems, leads to a provisional relativism almost sceptical. But pure scepticism is negated by the facts of life, and if we reject mechanical constructions as dogmatic, and shrink on our spiritual side from the issue of all dogmatisms and positivisms, and, indeed, of all -isms, in the insanity of Nietzsche, we need to find an escape.

Such an escape, v. Schoeler holds, is not provided by religion. It must be sought for in the idea of humanity, and the furtherance of its ideals in art, in the ethics of family life, and in work in the cause of society. That this earth may or will be dissolved with its phantasmagoria of human knowledge, human passions, human needs, human ideals, lies perhaps not obscurely among the teachings of science. But this pessimism is not subversive of effort and aspiration, so long as it does not despair of the commonwealth. There is no absolute, neither god, nor world, that we can know in other than a relative sense or with other than a relative value, for they have no existence other than a relative one. The advance of the new outlook for the beginning of the twentieth century consists in freeing men from an illusion or a madness, in a new and undogmatic positivism or relativism without pride of intellect, and with a soun hold upon purely relative ideals through the æsthetic and the ethical emotions.

Intellectualism is the curse under which the author's friend fell, a martyr going at the last unwilling to his fate. To this we owe the degeneration held to be typically *fin de siècle*. We must meet the danger, exorcise the curse, by derogating from our claim to construe an absolute, and entering instead upon our heritage as men. "The Ideality of the life of feeling is the remedy."

Dr. v. Schoeler is undoubtedly fitted to write the history of philosophical and scientific ideas in certain fields. His chapter on matter, and his section on the achievement of nineteenth century surgery prove this. And his general power of appreciation and range of interest carry him a long way towards the adequate treatment of his encyclopædic task. But his rhetorical tendencies, shown, for example, in his interesting chapter on Nietzsche, and his exuberance, give the book an ineffectiveness which a smaller work might escape. And there is no index to a critique of all philosophy and all science, though laden on every page with citations!

H. W. B.

OUR BOOK SHELF.

Les Plantes Utiles du Sénégal—Plantes Indigènes—Plantes Exotiques. Par Le R. P. A. Sébire. Pp. lxx + 341 (Paris: J. B. Baillière et Fils, 1899.)

RAPID strides have been made of late in opening up to commerce the several European possessions on the West Coast of Africa, and though much has already been done so far as vegetable products are concerned, only a small percentage of such products find their way regularly into European commerce, such, for instance, as palm oil, ground nuts, rubbers, chillies, and a few drugs, including kino, cinchona bark (introduced), strophanthus seeds, kola, &c.

With regard to timbers, there is a wide field for development, as there are many valuable woods in the forests that should find a ready market in Europe. African mahogany, afforded by *Khaya senegalensis* and other trees, is regularly imported into Europe, the trade in this timber having, during the last decade, increased enormously, and though it may lack the figure of Central American mahogany, it commands a ready sale in European ports. Taking into consideration all these facts, any contribution, however small, of the nature of the book under review must be accepted with thanks, so long as the facts and figures are trustworthy. In the preparation of the work the author's aim has been to provide those engaged in agricultural pursuits, or in the development of the vegetable economic resources of Senegal, with a manual of useful instruction. The book affords detailed information on indigenous plants, those that have become acclimatised, and further with those recommended for experimental cultivation.

The first forty pages deal with such subjects as the seasons, water supply, soils, injurious insects, &c., and is followed by a list of exotic economic plants cultivated in the country, with notes on the results obtained, the plants being classified according to their uses. Synoptical tables follow of generic and native names, together with a list of medicinal plants, arranged according to the diseases in the treatment of which they are employed. The main portion of the book, covering 300 pages, consists of a list of plants arranged under their respective natural orders, with scientific and native names and details bearing upon their properties, uses, and distribution. This portion of the work contains much valuable information, and bears evidence of zeal in its preparation. Besides dealing with indigenous and acclimatised plants, notes are given on various exotics and their uses with the view to their introduction into the Colony, or as an aid in determining the properties of indigenous plants upon the assumption that allied species in a given natural order possess similar properties. This is an excellent idea, and adds to the usefulness of the work. An index of Latin and French names, together with lists of native names, complete the work. In a book of this description, written on the spot, one naturally expects to find errors. The scientific names in many instances are obsolete or incorrectly spelled, and due care has not been exercised in the introduction or omission of capital letters, italics, &c. It would have been much better had the information been concentrated under fewer heads, and a good general index of scientific and native names combined would have added to the utility of the book. This may be remedied in another edition, but as the work now stands it can be recommended with confidence to those engaged in the development of the vegetable resources of Tropical Africa as a very useful addition to the limited number of such books already existing. Many illustrations of interesting subjects are intercalated in the text. J. M. HILLIER.

Applied Geology. By J. V. Elsden, B.Sc. (Lond.), F.G.S. Part II. Pp. vi + 250, with 186 Figures. (London: "The Quarry" Publishing Co., Ltd., 1899.)

THE first part of this work was noticed in NATURE, vol. lviii. (1898), p. 615. The second part consists of eleven chapters and an appendix. The first chapter (Chapter vi. of the work) deals in 19 pages with unstratified ore deposits. In the following chapter (vii.) the occurrence of the non-metalliferous minerals is described. We have, for example, 2½ pages on coal, 1½ on petroleum, and 1 on diamonds. As these pages include the illustrations, it is clear that the amount of information is completely out of proportion to the importance of the subject. No doubt the author would plead the lack of space for more, but surely in that case he should have made a judicious selection of the literature bearing on the subjects in question, and given full references to it. The same remark as to the almost complete absence of references applies to the book as a whole. Not only would such references have rendered useful short sketches of great subjects, which, standing alone, are almost useless, but they would have given the weight of authority for many statements which, unsupported, appear dogmatic. Chapter viii. is devoted chiefly to prospecting, developing, bed-mining, and vein-mining. The next four chapters deal with "Building and Ornamental Stones." They are chiefly illustrated by sixteen drawings of microscopic rock sections, clearly executed but without any indication of the amount of magnification. On. p. 76 the igneous rocks are classified into three groups—Plutonic, Intrusive and Volcanic; but it by no means follows, as there stated, that intrusive rocks are microcrystalline, still less that volcanic rocks are necessarily partly or entirely glassy, nor is it logical to classify serpentine as intrusive, while peridotite, of which most serpentines are merely altered examples, is termed plutonic. Rocks used in the arts and manufactures are described in Chapter xiii. Engineering geology, especially the subjects of water-supply, embankments, tunnels and cuttings, occupies Chapters xiv. and xv., and the final chapter is devoted to surface features such as soils. In an appendix are given "simple rough methods for the determination of minerals and rocks," and there is a good index.

The work is very readable, well illustrated, and suited for geological students who wish to learn some of the applications of the science. The practical man will also gain useful hints, though he will feel rather at sea in reading some of the petrographical descriptions, and will wish for more details or references on many practical points.

On Buds and Stipules. By the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S., D.C.L., LL.D. With four coloured plates, and 340 figures in the text. Pp. xix + 239. (London: Kegan Paul, Trench, Trübner, and Co., Ltd., 1899.)

THE new volume of the "International Scientific Series" forms a welcome addition to those already published, and it will be read with interest by all who are drawn to a study of the natural history of plants. For although accounts of bud-protection, &c., are to be found scattered through various journals, there existed no connected story of the numberless artifices by which plants shield their winter buds before the appearance of Sir John Lubbock's book. Naturally much of its contents includes matter of common knowledge to those botanists who care for the study of the living plant, but even for them there is much which will be probably found to be novel, and at any rate well worth reading; whilst the freshness and first-hand character of the recorded observations affords a pleasure which those who are acquainted with the author's previous essays in natural history will naturally expect to enjoy from a perusal of the work. It is refreshing to observe that Sir John has not allowed himself to be trammelled too much by orthodoxy—to find that, for example, he declares for the stipular nature of the outgrowths on the petioles of the early leaves of the flowering currant. In the account of the stipules in the genus *Tropaeolum*, however, there seems to be no mention of the interesting fact that the first two leaves (following on the cotyledons) in the common "nasturtium" are stipulate, whereas these structures are absent from the later developed leaves. Indeed, the whole genus seems worth a more extended treatment from the point of view of stipulation, affording, as it does, almost all transitions from complete development to a complete arrest of stipular formation, and these facts are of especial interest in view of the stipulate character of allied forms.

The tendrils of sarsaparilla and also the ligule of grass leaves are considered, and probably with justice (at least as regards the former), as of stipular nature.

The beautiful arrangements by which buds are protected by means of developments of the axillant leaf, as in the plane, maple, *Rhus*, *Kalmia*, &c., are described and well figured; indeed, the excellence of the numerous drawings forms by no means the least welcome feature of the book. Space forbids us to do more than thus briefly indicate a few of the points contained in the volume, which is a most valuable contribution to the literature of a fascinating subject. J. B. F.

The Philippines and Round About. By Major G. J. Younghusband. Pp. xiv + 230. (London: Macmillan and Co., Ltd., 1899.)

IN this amusing and well-written book the author gives a very good description of the towns of Iloilo and Manila. The volume is the result of a short visit made soon after the Spanish-American war, of which we get an excellent account. The life and customs of the inhabitants of the Philippines are well described, and the reader cannot fail to be surprised at the slow progress civilisation has made in those parts. This fault is due, without doubt, to the bad condition of the Government. The only outcome of centuries of authority is an absolute want of national discipline. The Filipinos, far from being down-trodden by all the oppression and cruelty they have endured, are lazy and insolent; but, perhaps, this is not altogether surprising seeing that no wholesome authority has been used.

The author has been more interested in incidents of travel than in the natural history of his surroundings. There seems to be little domestic comfort in hotels or houses, and we, who realise so well the value of scientific appliances, cannot fail to be forcibly struck with the descriptions of the primitive state of the sanitary arrangements of the towns.

The book is a valuable addition to works of travel, and will be found a useful guide when visiting the Philippines and their neighbourhood, for good descriptions of life in Java and in the town of Saigon are also given.

The Slide Valve Simply Explained. By W. J. Tennant, A.M.I.M.E. (London: Dawbarn and Ward, Ltd.)

THIS little pamphlet of sixty-five pages, forming volume No. 2 of the "Model Engineer Series," was originally intended to help the author's railway students towards the attainment of clear general notions upon the subject of the slide valve. The author conceived the idea of using on a base-board a rotary disc to represent a crank-shaft, together with the idea of obtaining concentric circular diagrams of results, by using a crank-arm marked on the disc as an index-finger, and recording on the base-board the beginnings and ends of the arcs swept out by the crank in the various distribution-periods.

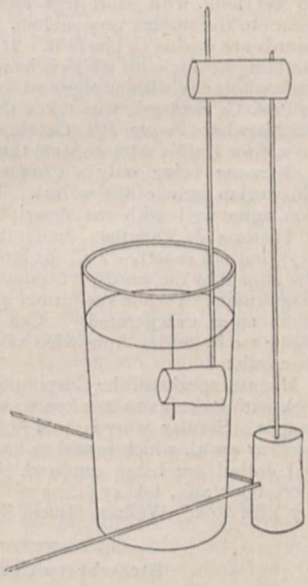
For students with little or no geometrical knowledge the book should be most useful. We think, however, that a student's time would be better employed in acquiring a sufficient amount of geometry to understand the Zeuner diagram, by aid of which the action of the slide valve can be represented more simply, quickly, and conveniently than by the author's disc diagrams. A. S.

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.*]

Expansion of Solids by Heat.

THE following simple apparatus for showing the expansion of metals by heat may interest your readers. A cork rests on the table and is kept steady by two horizontal knitting-needles fixed into it. A third knitting-needle fixed in the cork stands in an upright position, and carries a second cork at its top. Another knitting-needle passes through this cork and projects vertically downwards into a glass of water, and carries a third cork at its lower end. This last cork carries a sewing-needle with its point projecting upwards just above the surface of the water. If one of the vertical knitting-needles is heated with a match, the point of the sewing-needle will disappear below the surface of the water; if the other is then heated, the point will appear again. These small movements can be easily seen by watching the reflection of a bright object in the surface of the water.



HORACE DARWIN.

The Orchard, Huntingdon Road, Cambridge, June 3.

Bessel Functions.

So Mr. A. B. Basset (p. 101) interdicts all such expressions as *Armstrong guns*, *Whitworth lathes*, *Martini rifles*, *Boxer cartridges*, *Whitehead torpedoes*, *Corliss engines*, *Siemens steel*, *Thomson galvanometers*, *Peltier effect*, *Röntgen rays*, hundreds of which are in common use among engineers, physicists, and

mathematicians, to say nothing of the educated general public! His task is only comparable with the historic one which Mrs. Partington set herself with respect to the Atlantic.

Bangor, June 7. A. GRAY.

Larvæ from the Head of an Antelope.

IN preserving the head of an old ♂ Hartebeeste (*A. cokei*), shot on March 31, I took from the nostrils a few hours after death some twenty large larvæ, which I am now forwarding you for identification.

On April 19 I found similar larvæ in the nostrils of an old ♀ Wildebeeste (*C. taurina*); but I think their occurrence in the heads of antelopes in this part of Africa must be comparatively rare; as, though I have shot and preserved the heads of quite a number—including many Hartebeeste—I have not come across them in any other instance. I may add, no appreciable emaciation was shown by the animals from whose heads the larvæ were taken. RICHARD CRAWSHAY.

Kiu, Uganda Railway, British East Africa, April 29.

THESE larvæ are those of a fly of the family Oestridæ, and their structure, as well as their habits, shows them to be referable to the genus *Oestrus*, and to be allied to the well-known "Sheep-bot fly," or "Sheep-nostril fly" (*Oestrus ovis*).

Brauer in his "Monographie der Oestriden" (Vienna, 1863) mentions such larvæ as having been found in three species of antelope, and describes two species of fly (*O. variolosus*, Löw., and *O. clarkii*, Shuck.) from South Africa, both probably parasitic on antelopes.

Probably a search through the scattered literature since Brauer wrote would bring to light the record of other species of *Oestrus* with similar habits; but, unless the flies were bred from the larvæ, which would not be very difficult, the species concerned could not be identified.

WALTER F. H. BLANDFORD.

48 Wimpole Street, London, June 8.

Walrus.

FERDINANDO VERBESTI (1630–1688), in his work in Chinese, "Kwan-yu-wai-ki" (Brit. Mus. copy, 15,297 *a*, 6, fol. 10, *a*), *sub.* "Marine Animals," relates thus: "The *Loh-sze-ma* is about 40 feet long, with short legs, and staying at the bottom of sea comes to the surface very seldom. Its skin is so hard that even swords are unable to pierce it. It has on its forehead horns resembling hooks, with which it hangs itself on a rock, thus sleeping a whole day without slightest awaking." With all deference to Prof. G. Schlegel, who takes the animal here described for the Narwhal (*Toung Pao*, October 1894, p. 370), I will bolden myself for truth's sake to state that the walrus is meant herein, *Loh-sze-ma* being only a Chinese rendering of *Rosmar*, the Norwegian name of the walrus. The main parts of this description agree well with the description given by Olaus Magnus ("Historia de Gentibus Septentrionalibus," Rome, 1555, p. 757), but not exactly—*e.g.*, the latter author indicates the size of the animal by the words, "maximos ac grandis pisces elephantis magnitudine"; while the former gives it more precisely, though much more exaggerated.[1] Can you or any of your readers oblige me by telling from what very source Verbesti derived his description?

Magnus speaks of the sleeping of the walrus hanging itself on rock with its tusks to be often so sound as to expose its life to danger. Similar story is told in Japan of the sun-fish (*Orthagoriscus mola*), which is said to be floating asleep while its flesh and entrail are being removed (Kaibara, "Yamato Honzó," 1708, book xiii., fol. 43 *b*). KUMAGUSU MINAKATA.

7 Effie Road, Walham Green, S.W., June 5.

Strawberry Cure for Gout.

IN connection with the letter of "F. G." in NATURE of June 8 (p. 125), on the strawberry cure of gout, I may mention that last year, when strawberries were so plentiful in England, a lady residing in Kent, who had formerly spent several years in Ceylon, where she had suffered from the wasting and often fatal complaint known as "Ceylon sore mouth" (the chief symptom of which is ulceration of the mucous membrane of the digestive organs), having had a return of the malady, and being unwilling to go abroad to undergo the "grape cure," conceived the happy idea to try strawberries instead, confining her diet to several pounds of these a day with plenty of milk. The remedy was so effectual that after a few weeks she was entirely cured of her malady, and had grown stout and well again.

5 Bedford Place, Croydon. DONALD FERGUSON.

THE FRESH-WATER PEARLS OF AMERICA.

THE production of pearls by numerous species belonging to the fresh-water bivalve family *Unionidae* has been a matter of common knowledge from time immemorial. Such pearl-bearing mussels occur in the Tay, Isla, and several others of the rivers of the British islands, as well as in many of those of the continent, Mesopotamia, China, and North and South America. As a rule, however, such fresh-water pearls, in Europe at least, are inferior in lustre, and consequently in value, to those obtained from the pearl-oyster; and in those British rivers which produce the pearl-bearing species of *Unio*, it is stated that on the average one pearl is found in every hundred shells, and that only one pearl out of a hundred is fairly clear. During the eighteenth century, however, a considerable number of Irish pearls, ranging in value between 4*l.* and 10*l.*, were obtained, while one specimen, when mounted, realised 80*l.* In Scotland, pearls worth from 3*l.* to 4*l.* each are not unfrequently found, and it is stated that as much as 100*l.* has been paid for an unusually fine example. According to Dr. P. L. Simmonds, between the years 1761 and 1764 ten thousand pounds' worth of Scotch pearls were sent to London, while in the corresponding decade of the present century the amount was considerably more than double that value. During the dry season of 1862, when the lowness of the streams rendered the fishing unusually favourable, more pearls were collected than in any previous year; and the average price consequently fell to fifty shillings, or less. Twenty years ago, when from 5*l.* to 20*l.* was obtained for fine specimens, the general price was, however, much higher; and one Scotch pearl, for which forty guineas was given, is the property of the Queen.

British pearls were well known to the Romans, and it is probable that those from continental rivers were in demand at an equally early date. With the opening-up of the American continent by the Spanish explorers, the world was, however, flooded with a totally new supply of pearls, which there is good reason to believe were also of fresh-water origin. Wonderful are the accounts of the pearls found in the possession of the natives during the De Sota expedition from Florida to the Mississippi in 1540; and three centuries later Messrs. Squier and Davis disinterred vast quantities of damaged pearls from the ancient mounds of Ohio. So great was the number of pearls brought to light by these and other explorers, that it was considered improbable they could have been the products of the fresh-water unios of the country, and they were consequently believed to have been obtained from the pearl-oysters of the Pacific. In later years, however, many naturalists of repute were inclined to doubt the truth of this suggestion; and in an important and interesting memoir on the "Fresh-Water Pearls and Pearl-Fisheries of the United States," recently issued by the U.S. Fishery Commission, the author, Mr. G. F. Kunz, sums up the question as follows: "Notwithstanding the intercourse existing between remote Indian tribes, as shown by many authorities, and the fact that Pacific coast shells have been carried to Arizona, and that clam-shells have been found in Zuñi cities by Lieut. Cushing, it is likely that these pearls came, not from the pearl-oysters of the Pacific coast, but from the marine shells of the Atlantic coast and the fresh-water shells of the eastern part of the continent. It is very probable that the Indians opened the shells to secure the animal as an article of food; that the shells of some

[1] Gesner says: "Alium esse puto qui *Rusvaal* nominatur, quinquaginta passuum longitudine. . . ." ("Historia Animalum," lib. IV., *sub.* "De Rosmaro").

varieties, such as the common clam and conch, were made into wampum ; and that the pearls found in the shells were used as ornaments, whether lustreless pearls from the common oyster, or lustrous ones from the *Unio*."

The opinion that these old pearls are of fresh-water origin is based on the fact that many of the North American rivers and lakes still abound with pearl-yielding *Unionidae;* and it is, therefore, the more remarkable that for over two centuries from the date of the Spanish exploration nothing seems to have been ascertained about the latter. As Mr. Kunz says, "the natives have been dispersed, and the white race, occupied with other interests and necessities, took little note of the hosts of fresh-water shells inhabiting the streams and lakes, and did not suspect their power of producing pearls. In the year 1749, John Winthrop, in a natural history catalogue, first mentioned the production of pearls by the fresh-water mussels of the country. But more than a century was destined to elapse before any practical result arose from this knowledge ; for it was not till 1857, when the "queen-pearl" was discovered at Notch Brook, near Paterson, New Jersey, that the country awoke to a conception of its hidden treasures. This pearl, which weighed 93 grains, was sold to the Empress Eugénie of France for 500*l.*, and is said at the present day to be worth four times that sum.

Its discovery immediately gave rise to an outbreak of "pearl-fever" ; and the mussels of Notch Brook and other rivers were gathered by the million and ruthlessly destroyed, frequently with no pecuniary profit. So careless indeed was the mode of operation that a pearl weighing 400 grains, which would probably have proved the record specimen of modern times, was ruined by boiling the mussel in which it was contained. During the first year of the fever, the value of the pearls sent to New York was fully 3000*l.* ; in 1858 it fell to about 400*l.*, while from 1860–63 the yield was only 300*l.* for the whole period. Although there was some slight revival of the trade in 1868, when pearls were discovered in the Little Miami river, Ohio, it was not till 1876 that any important find was made. But in that year 600*l.* worth were obtained from Waynesville, Ohio, a locality which has since yielded many more pearls, among them one of 38 grains weight, although of somewhat irregular shape. Since 1880 pearls have been found in districts further to the south and west ; Kentucky, Tennessee, and Texas becoming the chief pearl-producing States, while Florida has also contributed its quota. New Brunswick and Canada likewise entered into the competition, while in 1889 Wisconsin appeared on the scene with a large consignment of magnificently coloured pearls. Within three months more than 2000*l.* worth of these latter reached New York, including one specimen valued at over 100*l.*, the principal colours being purplish-red, copper-red, and deep pink. These finds led to intense activity among the pearl-hunters, with the result that the mussels were nearly exterminated in that district. Other parts of Wisconsin were found, however, to be equally prolific, and since 1889 it is estimated that pearls to the value of at least 5000*l.* have been obtained from that State alone. From exhaustion of the mussel-beds, the pearl excitement in the North-west subsided in the course of a few seasons.

In 1897, the "fever" burst out anew in Arkansas, where it extended west into Indian territory, and north into Missouri, Georgia and certain districts in Tennessee being likewise affected. This period of excitement and activity promised to extend into 1898, of which year no accounts are at present to hand. A remarkable feature about the Arkansas discovery was the fact that a large proportion of the best pearls were obtained lying loose on the mud of the shores, or at the bottom of shallow waters, while sometimes they were found in or upon the soil at some distance from the water. "This peculiar occurrence," writes Mr. Kunz, "is partly explained by the wide extension of the waters in flood times over the low regions of the State, and by the shifting of streams and isolation of 'cut-offs' ; but the facts indicate further that under some circumstances, probably by agitation of floods and freshets, the loose pearls are lost or shaken out by the unios. A local impression prevails that the mussels 'shed' them at certain seasons. The fact that the pearls thus found were generally round and well-formed ; the aggregation in repeated instances of several or many near or together, and the non-occurrence of shells with them at these places—all point to the washing out of loose pearls from the unios, and their distribution by floods and freshets."

In 1897, the excitement appears to have had somewhat disastrous results in certain districts by abstracting the washers from their regular fields of labour. It has also caused a revival of pearl-hunting in other districts, notably in the neighbourhood of New York. Florida may at present be regarded as an almost unworked country ; but, judging from the specimens hitherto obtained, will probably yield a rich harvest. The two largest and finest pearls at present collected from this State weigh respectively 68 and 58 grains, and realised 170*l.* and 120*l.*

Connecticut has also witnessed a revival of pearl-hunting ; and here one of the collectors has started the German plan of using a pair of pincers to prise open the valves of the shells.

The mussels that yield pearls in the States all belong to the typical genus *Unio*, and include at least sixteen species. Most pearls appear to be obtained from the common *U. complanatus*, which is a very thick and rounded shell, shaped not unlike a *Cyprina*. Pearls are, however, occasionally found in thin and elongated species, like *U. rectus*. In the Amazon basin of South America, the pearl-bearing species belong to the allied genera *Hyria* and *Castalia*, while in China the profitable species is a *Dipsas*, and is much like the ordinary British *Anodonta* in general form. *Unio* (*Margaritana*) *margaritifera* is the British pearl-mussel.

With regard to the occurrence of the Arkansas pearls on the mud, it may be explained that the *Unionidae* generally dwell in America on clear gravelly bottoms, and that in such situations the pearls when extruded from the shell would be ground up by the pebbles, or would be indistinguishable among them. Not so on the mud of the Arkansas streams, which seems to be the haunt of the unios. Whether the supposition above mentioned, that the pearls are washed out or shed from the shells during life, be well founded, requires further investigation. It is stated that their non-association with shells is due to their having been washed away by floods or freshets after expulsion from the living animal ; but this explanation would apply with equal force to the pearls yielded by defunct mussels.

With a view of regulating the industry and preventing, if possible, the reckless destruction of mussels that takes place at each outbreak of the "fever," the U.S. Fish Commission commenced in 1894 an inquiry relating to pearl-fishing in the States ; and the result of its labours up to 1898 is embodied in the report quoted above, the general conclusions being summed up as follows :—"The shells are most abundant in swift and clear waters, where the bottom is sandy or gravelly, and the country-rock calcareous. While still numerous in many streams, they have greatly diminished within a few years past, wherever the pearl-hunting enterprise has extended, and at some points are nearly exterminated. The pearls found are few, and those of marketable value represent the destruction of thousands of shells for every pearl obtained. . . . The methods of gathering the shells and extracting the pearls are the simplest and the most primitive, and the activity of a few

seasons generally exhausts the beds. This state of affairs is one that loudly calls for reform. The wealth of unios that fills our rivers and streams is rapidly being destroyed by ignorant and wasteful methods of pearl-hunting; and either some form of protection is important, or, if that be not possible, a wide diffusion of information as to better methods, and particularly the introduction of the tools used in Germany for opening unios far enough to see if there are pearls contained, without destroying the animal, which may then be returned to the water."

In the clearer streams of the country, the best method of collecting the mussels is by wading into the water armed with a water-telescope and a pair of spring nippers affixed to the end of a stick. The water-telescope consists of a long, light, quadrangular tube open above, and shaped to fit the face (to which it is strapped), and closed below with a glass plate. Dressed in waterproof clothing, the pearl-hunter wades along the bed of the stream in a stooping posture, with the lower end of the tube immersed in the water, by which he is enabled to see the mussels on the bottom, and so to pick them out one by one with his nippers. Fresh-water pearls in general are remarkable for their variety of tints, and nowhere is the variation more marked than in those from Wisconsin. Although white is the most common, almost any colour, from pink, purple, or red, to gold, bronze, and black, may be met with; while even a peacock-blue pearl is on record. The golden and wine-coloured specimens are presumably from the beautiful *Unio dromas*, the only common species with a golden or yellow interior to the shell. Pink appears to be the colour most highly esteemed in America, next to which comes red, and then black; but exceptional colours, like sky-blue, command exceptional prices. So far as shape is concerned, the first place is taken by spherical pearls, after which come hemi-spherical, or bullet-shaped examples, while oval or pear-shaped specimens follow. As regards the maximum prices obtained for American pearls, the statements are somewhat conflicting and indefinite. It seems, however, to be certain that a spherical pink pearl from Tennessee realised 130*l.*, while a sky-blue pearl from Caney Fork, in the same State, was sold in America for 190*l.*, and subsequently in London for 660*l.* With good luck, there is therefore evidently money to be made by pearl-hunting in the American rivers. R. L.

THE GEOLOGY OF MONT BLANC.[1]

MONT BLANC and its aiguilles present some difficult problems to both petrologists and physical geologists; problems, which, though they have something in common, are to a great extent distinct. The authors, however, have grappled with both. Their monograph, as a study of the petrography of the region, is full of valuable information; but we think they have not been quite so successful in dealing with what it is now the fashion to call the tectonics. This portion no doubt contains much that is valuable, but the physical structure of the *massif* of Mont Blanc has been treated too much as if the latter were isolated instead of being, as is really the case, inseparable from the western and central part, perhaps even from the whole, of the Alpine chain.

As most people are aware, the crystalline *massif* of Mont Blanc is defined by two well-marked troughs, occupied by rocks of secondary age, the more northern being furrowed by the valley of Chamonix, the more southern by that of Courmayeur. Each is bounded on the further side from Mont Blanc by crystalline rock, the former by the well-defined range of the Brevent and the Aiguilles Rouges, the latter by one or more varied character, and, generally speaking, of more bedded aspect.

FIG. 1.—Contact of protogine with crystalline schist below the Aiguille du Midi. P, protogine; S, crystalline schists; C, contact.

Of these two marginal crystalline zones, the northern is prolonged to the valley of the Rhone, where it crosses just below Martigny, after which it disappears beneath the sedimentaries of the Western Oberland. The southern passes on to join the Pennine chain to the east of Mont Blanc. The crystalline rock, however, which forms this and the rest of the central *massif*, is more or less fusiform in outline. (The term "amygdaloidal" applied by the authors seems misleading, as its connection with this structure is about equal to that of Monmouth and Macedon.) The central part of the *massif*—though according to them not the very highest rocks of Mont Blanc—consists of a granitoid rock called protogine, formerly said to be composed of quartz, felspar, and talc, and to be the most ancient in the region. The talc is only biotite, more or less hydrous, and the rock intrusive

[1] Recherches Géologiques et Pétrographiques sur le Massif du Mont-Blanc. Par Louis Duparc et Ludovic Mrazec. (Mem. de la Société de Physique et d'Histoire naturelle de Genève.) Tome xxxiii. Ptie 1re.

in the flanking crystallines. Profs. Duparc and Mrazec give an excellent account of the protogine; its microscopic structure and its chemical composition. It is a granite, varying from moderately coarse to slightly porphyritic, the silica percentage occasionally falling rather below that of an average granite. Enclosures of a more basic rock are found in it, which the authors consider, no doubt rightly, to be included fragments of more ancient material and not segregations. The age of this protogine cannot be exactly determined, but in other parts of the Alps a porphyritic granite, occasionally very coarse, yet bearing some resemblance to it, can be seen cutting the truly metamorphic rocks, called by the writer the "upper schists," which apparently are the newest among the Alpine crystallines. The protogine is flanked on each side by a zone of mica schists and fine-grained gneisses, which accordingly must be older than it, and it includes occasional strips of schist. Of these, some may represent wedged-in fragments of the last-named zones, while others probably are dykes, modified by pressure. The affected by subsequent pressure. These are certainly later than the Carboniferous beds, and earlier than the lowest Lias, for they occur as pebbles in a conglomerate of that age. Hence these "porphyries," like similar outbursts in other parts of the Alps, probably represent Permian eruptions. The authors think them not impossibly connected with the vein granites, which would assign the latter also to about the same period.

In discussing the "tectonics," the authors give an excellent *résumé* of the facts, so far as the immediate district of Mont Blanc is concerned, pointing out that the fan structure, of which this mass is generally considered to be a type, is not by any means so simple or so well developed as is generally supposed. They consider the central part of the chain to be a vast synclinal with minor secondary flexures between primitive anticlinals to the north and the south. According to one of them, a section across the range exhibits no less than eight anticlinal bands with intervening synclinals. On this view, we cannot venture to express a definite opinion; we think, however

FIG. 2.—Contact of protogine with crystalline schists below the Aiguille du Midi, seen from the Montagne de la Côte. The schists are at the base of the Aiguille, and of a very dark colour.

whole *massif* is traversed, in some places thickly, with veins of a fine-grained granite, poor in mica (aplite).

The sedimentary rocks associated with the Mont Blanc *massif* belong to two distinct eras. One group occurs but locally; the other has a wide extension, and perhaps was deposited over the whole breadth of this region of the Alps from north to south. The former group belongs to the Carboniferous period. It consists of conglomerates, often coarse, grits, and dark muds (now slates); the latter group forms part of the great Alpine Mesozoic series. At the base, Trias is found; this, however, near the Mont Blanc *massif*, is either feebly represented or absent. It is probably followed everywhere by beds of Rhætic age, but these often cannot be separated from the Lias. In parts of the Alps the series passes gradually upwards into the Eocene; in this district, however, nothing later than some portion of the Jurassic system is preserved. Here and there masses of "porphyry" occur (one with, some without, free quartz), often much that at present a suspense of judgment would be prudent. But that the structure is far less simple than it was formerly represented to be can hardly be doubted. That great complications exist is not surprising, for the region, like the rest of the Alps, has been repeatedly folded. The authors recognise the following as the principal movements: (1) The Caledonian folding, during which the injection of the protogine occurred. This, we presume, so far as it can be dated, would be earlier Palæozoic, perhaps post-Ordovician. Then came the Hercynian folding, which is supposed to have occurred in early Permian times, and to be connected with the ejection of the "porphyries." The axis of this folding ran slightly north of east. During the Mesozoic times, a subsidence continued, the mountains gradually disappearing, while deposition went on steadily.

Then came the Tertiary movements, by which the present chain was formed. We cannot attempt to discuss this part of the subject, for it is a complicated one

and the structure of the chain for a considerable distance to the south and the east must be taken into consideration. That great earth movements had preceded the Carboniferous period, and that mountains of a sort existed during it, and that this period was followed by very acute folding, are certain. We think, however, that the folds in this part of Europe (for reasons which have been published elsewhere) ran approximately from N.N.E. to S.S.W. Evidence of this may indeed be found in the district of which the authors are writing. Such flexures may have been the cause of the frequent trend of outcropping masses along almost the whole of the Alpine chain. During the Triassic period, as has often been observed, highlands, if not mountains, must have existed over more than one large area on the present site of the Alps, which afterwards disappeared beneath a wide-spreading sea. Then came the great Tertiary movements which formed the present chain. The authors apparently treat these as one, but most geologists hold that there were two epochs of maximum disturbance separated by one of comparative rest. The "building" of the present *massif* and the neighbouring mountains should have been treated, we think, in greater detail; for there is more than one interesting problem connected with the courses of the main streams, the positions of watersheds, and the localities chiefly affected by the different movements, which are practically unnoticed. Still the memoir, as a whole, is a very valuable contribution to our knowledge of Alpine geology.

T. G. BONNEY.

THE BERLIN TUBERCULOSIS CONGRESS (1899).[1]

II.

(Section IV. Therapeutics. Section V. Sanatorium Treatment.)

THE fact that 2000 doctors met together and discussed for two days the treatment, using this term in its broadest sense, of phthisis will, to the observant layman, be of evil omen. When a number of remedies or methods of cure for one disease are all guaranteed by their advocates as being efficacious, the attitude that one at once adopts is one of scepticism. How many doctors would meet together to discuss the treatment of primary syphilis, a disease which can be cured, and how long would it take them to do so if they did? In a multitude of counsellors there may be wisdom, but in a multitude of treatments there is rarely a cure.

The subject-matter of this Section was very fittingly opened by a paper of Dr. Curschmann's (Leipzig) on the curability of phthisis. In the narrow anatomo-histological sense, phthisis is rarely if ever cured; in the clinical sense, however, we can often accurately speak of a cure as having taken place, since the local signs in the lungs not only become arrested, but a certain amount of repair takes place, and the attacked individual becomes practically normal. The majority of cases of cure, however, are relative. In these cases, the local disease, although not coming to an absolute standstill, is of such a nature as to allow of the general condition of the patient remaining good.

The congress listened with great attention to a paper read by Prof. Kobert, of Rostock, on the medical treatment of tuberculosis. The results formulated by the author were of especial value, since they were not confined to his own clinical experience at Görbersdorf, but were derived from a series of inquiries addressed by him to general practitioners and lung specialists throughout Europe—200 in number. These specialists and practitioners had treated during 1898, the year to which the inquiry related, 50,000 cases of tuberculosis. The most interesting of these results are as follows: (1) that we have in our possession no drug which exerts what may be termed a specific action in tuberculosis; (2) that the early stages of phthisis can sometimes be met and cured without medicine of any kind; (3) in acute cases of phthisis, the fatal termination is neither avoided nor appreciably hindered by any kind of medicinal treatment; (4) that in the majority of cases of consumption medicinal treatment along with hygienic treatment is of the greatest possible use in allaying and easing cough, keeping up nutrition, and exerting a controlling action on the tubercle bacillus and its products. Dr. Brieger (Berlin) read a paper upon the treatment of pulmonary tuberculosis by means of tuberculine and allied methods. The author regarded Koch's tuberculine as of distinct value in cases of pure pulmonary tuberculosis, asserting that in several cases an active tuberculous process had by its means been brought to a standstill.

A valuable communication upon the climatic treatment of phthisis was made by Sir Hermann Weber; but since this was reported at length in the *British Medical Journal*, no further mention will be made of it here. A paper of great interest was read by Dr. Dettweiler (Falkenstein), the subject being the hygienic, dietetic and sanatorium treatment of phthisis. Dr. Dettweiler, being the chief physician to one of the largest private sanatoria in Germany, spoke upon this subject out of the fulness of his experience. The author, after emphasising the fact that in phthisis we had to deal, not with a local condition, but a symptom complex, considered in how special a manner a sanatorium could meet the individual requirements of each case, and that by this means alone—viz., meeting every special want or symptom of the patient as it arose—could we hope to be successful in our treatment. It was not from open air, baths, exercise, alcohol, or feeding that we were to expect a "cure," but from the co-operation each day, according to the state of the patient, of all these means. Prof. Winternitz (Vienna) discussed the hydrotherapy of phthisis, and was followed on this subject by Dr. Carl Schütze. Dr. Hölscher (Mülheim) read an interesting paper on the treatment of phthisis by guiacol carbonate and creosotal. The author, after giving a short *résumé* of the results of the continued use of guiacol, emphasised the fact that this method must be used in conjunction with forced feeding, especially in so far as concerns proteids. The guiacol is eliminated in combination with sulphur, and the sulphur thus used can only result from the breaking down of proteid material; hence the importance of the strength of the patient being maintained by a plentiful supply of proteid material in the food. Dr. Cervello (Palermo) described his method of treatment, which consists in the inhalation of a formic aldehyde gaseous compound. Prof. Landerer gave the results he had obtained by the injection of cinamic acid (Zimmtsäure $C_6H_5—CH=CH—CO_2H$). This substance, according to Prof. Landerer, acts by causing an increased leucocytosis, especially in the regions affected by the tubercular process. The action of many other antiseptics in tuberculosis was also considered, including iodoform and glycerine (Dr. R. Hammerschlag) and Izal (Dr. Tunnicliffe), a few preliminary observations with the latter drug tending to show that it acted, as would be expected from its composition, similarly to guiacol and creosote.

The serum treatment of tuberculosis was discussed by Prof. Maragliano (Genoa). This investigator's interesting researches in this field have already attracted considerable attention. The author, after having postulated from his own and Behring's researches the existence of tuberculous antitoxines and their presence in the blood of normal animals and man, stated that the quantity of these could be increased by injection. The injection of such antitoxines rendered animals partially or entirely immune to injections of tuberculous material, and lessened in man the reaction to tuberculine (Koch?). He further

[1] Concluded from p. 109.

affirmed that these "tuberculous antitoxines" had no poisonous action. Prof. Maragliano concluded by considering the harmful influence of pregnancy upon phthisis, and recommended it, when occurring in a phthisical person, to be terminated artificially. Many other interesting papers, for which we cannot find room here, were read in this section.

Section V.—Sanatorium Treatment.—Since this tuberculosis congress was the first of its kind, it is difficult, if not incorrect, to speak of any part of it as being a novel feature, but the relative newness of the sanatorium treatment of consumption rendered this Section the most interesting one of the whole congress. As these notes are intended for lay as well as professional readers, perhaps it would not be waste of time and space to discuss what is meant by the sanatorium treatment. It seems to the writer that all that is meant by sanatorium treatment is the placing of patients suffering from phthisis in its different stages in an institution or house where they can be constantly watched by skilled doctors, and where every appliance for rest and exercise and amusement in pure and dry open air, forced feeding ("ubernährung"), and hydrotherapy exist. So much has been said about open-air treatment, Nordrach treatment, and so on, that the more general one's remarks are here the better. If a personal name is to be attached to sanatorium treatment it ought to be that of Brehmer, whose book still remains the classic and, indeed, to all intents and purposes the only book upon the subject. If it is wished to label this treatment with the name of a place, it ought to be called the Görbersdorf treatment, for there in Upper Silesia Brehmer founded his institution, and there it thrives to-day. It must always be remembered that open air is, although an important part, only a part of the whole, insistance upon the food question, and proper and suitable medicines, including alcohol, and above all, the adaptation of all these means to the daily and even hourly fluctuations of the patient, are essential factors in the sanatorium treatment.

The subject matter of the Section was introduced by a paper of Prof. Leyden's, who sketched the development of the sanatorium question. Herr Schmieden (Berlin) read a paper upon the building and arrangement of sanatoria. Dr. Schultzer (Berlin) discussed the arrangement, management and results of sanatorium treatment. The author reckoned the cost of a sanatorium for 120 beds at 3*s.* per diem per patient. He pointed out that the results obtainable from treatment could be greatly improved by the construction of intermediate sanatoria, to which patients almost cured could go and get occupation while being still, to some extent, under treatment. Dr. Edward Kaurin gave an interesting account of the sanatoria for tuberculous patients in Norway. The largest sanatorium is situated on the sea coast, and apparently great attention is paid to diet, for each patient consumes more than two quarts of milk per diem, and about three ounces of butter, in addition to his ordinary meals. The cost per head is 1·20 kronen. Prof. Ewald treated the subject of sanatoria for children. Dr. Rufenacht Walters read a paper on the hygienic dietetic treatment of phthisis in Great Britain. The author emphasised the fact that open-air treatment, combined with increased diet, had long been practised in this country with success. He described shortly the hospitals, convalescent homes, &c., where this treatment had been followed. He pointed out the importance of the modern movement in this country for systematising the struggle against tuberculosis, and concluded with a few pregnant remarks concerning climate in the treatment of tuberculosis, and the necessity for improving the general mode of life of tuberculous patients. Dr. Sinclair Coghill made a communication upon the treatment of phthisis, in which he described the National Hospital for Consumption at Ventnor and the methods practised there.

Many other papers followed in this Section, giving the results at sanatoria situated in the most varied regions, and also discussing the difficulties to be met with and overcome in each country in impressing the hygienic treatment of tuberculosis upon the populace in general. National prejudice and customs, to some extent, perhaps, masked in robust health by the voluntary control of the individual, come very obviously to the surface in disease. The German, disciplined from the cradle to the grave, finds it much less hard to submit to the strict *régime* of the sanatorium than the Englishman, in whose eyes, perhaps, the advantages of individual liberty are somewhat over-estimated.

In these notes, filled with the business of the congress, no space is available even to enumerate its pleasures; suffice it to say that the congressists found ample recreation provided for them by the respective authorities in the evening, and returned refreshed by it to their somewhat depressing subject-matter in the morning.

F. W. TUNNICLIFFE.

NOTES.

THE award of the sixth De Morgan medal was made by the Council of the London Mathematical Society on Thursday last, June 8. The medallist is Prof. W. Burnside, F.R.S., and the ground of his selection was for his researches in mathematics, particularly in the theory of groups of finite order.

THE death is announced of Dr. L. A. Charpentier, Professor and Fellow of the Faculty of Medicine, Paris, and member of the Academy of Medicine.

THE German Imperial School for the study of tropical diseases, the establishment of which is due to the suggestion of Prof. Koch, is to be settled at Hamburg.

MR. W. MARTINDALE has been elected president of the Pharmacutical Society of Great Britain.

MR. STANDEN, Government Quinologist, Madras, has been deputed to visit Java to study the system of planting cinchona and manufacturing quinine there, and will therefore be absent for some months. It is proposed by the Madras Government to considerably extend the cinchona plantations on the Nilgiris, and a large area has recently been cleared close to the Pykara Falls.

MR. H. J. MACKINDER, reader in geography at the University of Oxford, has just left England in charge of an expedition, the object of which is to make a thorough study of Mount Kenia, in British East Africa.

AS already announced, the autumn meeting of the Iron and Steel Institute will be held at Manchester on August 15–18. The preliminary programme shows that numerous visits to engineering and other industrial establishments have been arranged. Receptions will be given by the Lord Mayor of Manchester and the Mayor of Salford. A detailed programme will be issued when the local arrangements are further advanced. This programme will contain a list of the papers that are expected to be read.

THE Société helvétique des Sciences naturelles will meet at Neuchâtel on July 31–August 2. On the first day, discourses will be delivered by the president, Prof. Maurice de Tribolet, Prof. Roux, Dr. C. E. Guillaume, and Dr. L. Wehrli. On the following day, the various sections will meet, and on August 2 there will be discourses by Prof. Schröter, Dr. Morin, and Prof. R. de Girard. A number of excursions have been arranged, and there is every promise of the meeting being a successful one. The secretary is Prof. Dr. Henri Rivier, Neuchâtel, Vieux-Châtel 11.

WE learn from the Allahabad *Pioneer Mail* that some important changes are being made in the Meteorological Department of the Government of India. These comprise the abolition of a number of observing stations which have not proved worth keeping up, and the substitution for them of others in more favourable localities. Of the latter, most important are stations which are to be established at Cherapunji and one or two other places in Assam, which will enable a more careful watch to be kept over the meteorology of the tea districts, also regarding the periodical rise and fall of the rivers which are so important for the jute trade. Arrangements are also being made, but are not yet concluded, for the establishment of an observatory on Dodabatta Peak, the highest point in the Nilgiris, which is likely to be valuable in connection with the warnings of the monsoon.

THE preliminary programme of the eighteenth congress of the Sanitary Institute, to be held in Southampton, from August 29 to September 2, has now been issued. The president of the congress is Mr. W. H. Preece, K.C.B., F.R.S. Mr. Malcolm Morris will deliver the lecture to the congress, and Bailie J. Dick, chairman of the Health Committee, Glasgow, will deliver the popular lecture. Excursions to places of interest in connection with sanitation will be arranged for those attending the congress. A conversazione will be given by the Mayor (Councillor G. A. E. Hussey). The congress will include three general addresses and lectures. Three sections will meet for two days each, and deal with (1) sanitary science and preventive medicine, presided over by Sir Joseph Ewart; (2) engineering and architecture, presided over by Mr. James Lemon; (3) physics, chemistry and biology, presided over by Prof. Percy F. Frankland, F.R.S. There will also be eight special conferences.

A PARLIAMENTARY paper has just been issued showing the number of experiments performed on living animals during 1898, under licences granted under the Act 39 and 40 Vict., c. 77, distinguishing painless from painful experiments. Nearly all the experiments made under the certificate which dispenses with the obligation to kill the animal before recovering from anæsthesia, have been inoculations made (under anæsthetics upon rodents) with the object of diagnosing rabies. During the past three years, the number of experiments other than those of the nature of inoculations, hypodermic injections or similar proceedings has shown little variation (1516, 1462, 1511), while those of that character have increased (5984, 7360, 7640). Many of these latter experiments are performed in the course of professional duty for the diagnosis of disease, the preparation of antitoxins, the testing of water, and so forth. During the past year 43,000 doses of diphtheria antitoxin have been issued from two institutions.

THE second biennial engineering conference, held at the Institution of Civil Engineers last week, was opened by the president, Mr. W. H. Preece, K.C.B., F.R.S. This conference was not an international one in the sense of that held at Chicago in 1893, or of that which is contemplated in the year 1901 in Glasgow, in connection with the exhibition to be held there, but it may well be Imperial; and in furtherance of this idea the president suggested that, at the next conference, the Council should take measures to secure the presence of some members, delegated specially to represent engineering in parts of the British Empire beyond the seas. In the course of his address, the president remarked: "Science has followed, it has not led engineering. It is their intimate association which is the foundation of all industrial progress. The war of the microbes, the latest development of biology, is a consequence of sanitary requirements. Our knowledge of the diffusion of molecules and the solution of solids has sprung from the investigation into the mechanical properties and constitution of iron and its alloys, and the disturbances of the æther are becoming familiar through the practice of the so-called wireless telegraphy. Facts are derived from accident, observation or practice; laws are the result of research. Engineers have always appreciated science up to the hilt, but they wish that its special votaries were less dogmatic and more modest." Appreciative reference was made to the work of investigators like Newton, Faraday, Lord Kelvin, Lord Armstrong, Lord Lister and Lord Rayleigh; otherwise the remarks quoted would convey the impression that purely scientific investigations, such, for instance, as were made by Faraday, Clerk Maxwell, and Hertz, had followed instead of preceded advances in applied electricity.

THE U.S. Congress has shown appreciation of the valuable work accomplished by the Department of Agriculture by providing increased funds for many of the bureaus and divisions. We learn from the *Experiment Station Record* that the grant recently made by Act of Congress provides an increase of nearly 200,000 dollars over last year, and of more than half a million dollars over the year previous, the total appropriation for the closing fiscal year of the century being 3,726,022 dollars. This includes 720,000 dollars for the agricultural experiment stations in forty-eight States and territories, and a special grant for the establishment and maintenance of experiment stations in Alaska. The largest increases in appropriation are for the Weather Bureau and the Bureau of Animal Industry. The total grant for the Weather Bureau is 1,022,482 dollars, which includes an increase of 60,000 dollars for the maintenance of the new stations in the West Indies and adjacent coast, and 25,000 dollars for the erection of an addition to the present buildings of the Bureau in Washington. The total appropriation for the Bureau of Animal Industry is 1,044,030 dollars. This includes 50,000 dollars additional for investigations and inspection, and 20,000 dollars "for the purchase and equipment of land in the vicinity of Washington for an experiment station for the study of the diseases affecting the domesticated animals." The fund for irrigation investigations has been increased to 35,000 dollars. A grant of 10,000 dollars has been made for tobacco investigations, including the mapping of tobacco soils; study of soils and conditions of growth in Cuba, Sumatra and other competing countries; investigations of the methods of curing, with particular reference to fermentation; and originating improved varieties by means of selection and breeding. The Division of Chemistry receives 34,000 dollars—an increase of 5300 dollars—2500 dollars of which is for the equipment of a new laboratory. These additional grants will materially strengthen the Department of Agriculture and extend its sphere of usefulness.

THE process of manufacturing mechanical wood pulp is described by Mr. W. A. Hare in a volume just received, containing papers read before the Engineering Society of the School of Practical Science, Toronto. Within the past two or three years there has been a marked impetus given to the pulp and paper industry in Canada. Wood pulp will, for many years to come, be used to supply the world's demand for a filler in the manufacture of paper, in many of the coarse grades of which it is the only constituent. It is not confined, however, to the manufacture of paper alone, but is made into many useful articles of daily service, the market for which is increasing rapidly. No country in the world is better adapted than Canada for the establishment and expansion of wood pulp manufactures; and a prosperous future may be anticipated for the industry.

THE report of Mr. W. E. Plummer, Director of the Liverpool Observatory, upon the observations made during 1898, has been issued by the Mersey Docks and Harbour Board.

The results of astronomical and meteorological observations are recorded, and mention is made of the latest addition to the equipment of the observatory—namely, a seismograph, which has been placed in the basement, upon the solid rock which forms the foundation of the observatory. The instrument recorded a disturbance on September 17, 1898, probably having its origin in an earthquake near Tashkent, and it also registered movements produced by an earthquake at Port-au-Prince on December 29. Mr. Plummer hopes that during the year he will be able to trace the effects of tidal motion in the estuaries of the Dee and Mersey upon the seismograph in the observatory.

FROM an intemperate article in the *Journal of Indian Engineering* we learn of a regrettable state of feeling in Hong Kong concerning the comparative efficiencies of the Kowloon Observatory, of which Dr. Doberck is director, and the Jesuit Observatories of Manila and Zi-ka-wei. The Jesuit Fathers have long sent telegraphic messages connected with weather forecasts and storm warnings to the Spanish Consuls in Hong Kong, Shanghai and Singapore, who have forwarded the intelligence to the various newspaper offices in the respective districts, where they have been published for the benefit of the public at large. It is contended on behalf of the Jesuits that this voluntary service was of the greatest assistance to the mercantile marine and commerce of those ports: that the work was well organised and accurate and deserving of support and encouragement. But it is also alleged that the Secretary of War of the United States has peremptorily forbidden the despatch of these meteorological telegrams to any place outside the Philippines, and that this action has been put into operation on an appeal from Dr. Doberck. The charge uttered against Dr. Doberck is that he has used his influence with the U.S. Weather Bureau to move the Secretary of War (now the governing authority in Manila) to suppress the Jesuits' correct telegrams in order that his own forecasts may pass unchallenged. But surely the public can test the accuracy and value of weather forecasts, with or without any assistance from the Manila authorities. It is ill-judged policy to limit the distribution of any scientific information; and as in the present case the work is done voluntarily by the Jesuit Fathers, it is difficult to understand why the issue of the weather despatches has been forbidden.

DURING the last week of May, Mr. Walter Garstang, of the Marine Biological Association, carried out the second of his periodical surveys of the biological and physical conditions of the western region of the English Channel. The steam-tug *Stormcock* was again employed, and the same stations were visited as in February, viz., mid-Channel (50 fathoms), Ushant (60 fathoms), Parsons Bank, 50 miles W.N.W. from Ushant (75 fathoms), and Mounts Bay (45 fathoms). The distribution of temperature presented several noteworthy features. At the Ushant station, in spite of the depth of water, the temperature was found to be uniformly high from top to bottom; but at all other stations a surface layer of warm water overlay a deeper mass of cooler water. This warm surface layer was 7 fathoms deep in Mounts Bay, 10 to 15 fathoms deep in mid-Channel, and 15 to 20 fathoms deep over Parsons Bank. The temperature at 5 fathoms depth was 53°·0 F. in mid-Channel, 53°·2 in Mounts Bay, 54°·1 off Ushant, and 54°·5 at Parsons Bank. Rich collections of plankton were made at all stations in a variety of ways. The apparatus employed consisted of a surface tow-net, a fine vertical net after Hensen's pattern and a pump and 40 fathoms of hose for quantitative work, and a new form of opening and closing net for towing horizontally at any required depth. By means of this net many interesting features in the vertical distribution of plankton at the different stations were brought to light. Among the more interesting forms captured during the cruise may be mentioned the medusa *Hybocodon prolifer* (mid-Channel, and Mounts Bay, 40 fathoms), the siphonophore *Agalmopsis* (Parsons Bank, upper strata), the copepod *Isias clavipes* (Ushant, 3 fathoms), *Tornaria*, the larva of *Balanoglossus* (Parsons Bank, surface), and the eggs and larvæ of the pilchard (Ushant, 60 fathoms, and at the surface at all stations except Mounts Bay).

THE director of the National Observatory of Athens has published (1898) a first large quarto volume of its *Annals*, containing (1) an elaborate discussion of the meteorological observations made from 1839 to 1893, and (2) the detailed observations for the years 1894 and 1895; for the latter year, observations are given for every hour, and means are calculated for daily, ten-daily, monthly and yearly periods. The present observatory was regularly established in 1840, at the expense of Baron Sinas, and he also supplied it with the necessary instruments. The first director was Prof. G. Bouris, and the present director is Prof D. Eginitis. As now constituted, the observatory is divided into three sections: astronomy, meteorology and geodynamics, with a separate chief for each service, under the general superintendence of the director. From this long series of observations we note that the maximum temperature recorded was 105°·3, and the mean of the maxima 100°·2; the minimum was 19°·6, and the mean of the minima 29°·1. The average yearly rainfall (1858–94) was 16 inches; the driest month is July, and the wettest months November and December. The number of rainy days averages 99 in the year. In addition to the statements referring to observations made with instruments during the present century, the author gives, under each section, some interesting quotations relating to the ideas and observations of ancient Greek and Latin writers. Many characteristics of the climate of Greece are contained in almanacs dating from the fifth century B.C., and they are frequently found to confirm the results deduced from modern observations.

WE have received from Prof. H. Mohn, Director of the Norwegian Meteorological Service, a pamphlet on the employment of the boiling point thermometer in determining the pressure of the air and the correction for gravity. As recommended by recent meteorological conferences, the correction for gravity is now generally applied or quoted in meteorological tables. But the correction calculated according to formulæ differs more or less from that determined by actual pendulum experiments, and there are comparatively few meteorological stations where such experiments have been made. It is therefore important for meteorologists to find another means of determining this correction, and in the work in question Prof. Mohn publishes the results of experiments made at a number of land stations; and he shows that the correction for gravity may be very accurately determined by the improved thermometers used in conjunction with a mercurial barometer, the difference of the reduced readings being the correction required. It will be interesting to find whether the methods proposed could be employed at sea; at all events, a comparatively smooth sea would be necessary for the experiments.

AN "Annual Review of Physics," by M. Lucien Poincaré, is a valuable feature of the *Revue générale des Sciences* for May 30. It contains a summary of the chief discoveries made by physicists during the past year, classified under their various headings. Speaking of progress generally, it is pointed out that our knowledge of physics has not been revolutionised by any epoch-making discoveries like those of Röntgen and Zeeman, but that the year has been spent chiefly in extending and completing the knowledge of known phenomena.

THE latest researches on the propagation of malaria, by Prof. Grassi, in conjunction with Bignami and Bastianelli, show that all the species of the genus *Anopheles* hitherto observed by

the writers are capable of transmitting this disease. Experiments bearing on the hereditary transmission of the disease among the mosquitos themselves have hitherto led to negative results. Specimens of *Anopheles claviger* have been bred from parents taken in malarial houses, but no sporozooids have been observed in their salivary glands. Moreover, several observers have allowed themselves to be freely bitten by newly-bred mosquitos taken from malarial districts, but in no case have any ill effects been experienced. The present evidence tends to show that those *Anopheles* which have not bitten malarial patients are not infected, and are incapable of inoculating the disease; a single positive result would, however, disprove this conclusion.

MR. STEWART CULIN still continues his interesting comparative studies of games; and in the *Bulletin* No. 3 of the Free Museum of Science and Art, Philadelphia, 1898, he discusses the "platter" or dice of the American Indians, and finds that they originated from arrows and a throwing-stick used for divinatory purposes. He is of opinion that all the various forms of the game are not only derived, one from another, but that its place of origin may be definitely fixed in the country of the reed arrow and the *atlatl*, or throwing-stick; that is, in the arid region of the South-Western United States and Northern or Central Mexico.

VARIOUS items of Indian folk-lore will be found in the *Journal of the Asiatic Society of Bengal*, vol. lxvii. Çarat Candra Mitra writes on Bengali and Behari bird folk-lore and omen birds. The same author has a paper on coincidences between some Bengali nursery stories and South Indian folk-tales, in which he discusses the migration of folk-tales, and concludes as follows: "The similarity between the Bengali and South Indian versions of these tales can be accounted for only on the supposition that the aboriginal Bengali and Dravidian races assimilated the tales from Aryan settlers, the slight variations between the said two versions being due to the difference between the two borrowing races as regards manners, customs and language." Astronomical folk-lore is narrated by Ramgharib Chaube.

THE fourteenth fasciculus of the "North American Fauna," under the editorship of Dr. Merriam, is devoted to the biology of the Tres Marias Islands, the larger portion of the text being by Mr. E. W. Nelson. These islands, which lie off the west coast of Mexico, about sixty-five miles from the port of San Blas, have only recently been systematically explored by collectors. As might have been expected, this exploration clearly demonstrates their continental origin, their situation showing that at one period after their separation they formed a single larger island. The birds and mammals seem to have been more susceptible to modifying influences than has been the case with other groups, seven out of ten representatives of the latter, and twelve out of thirty-six of the former, being regarded as entitled to specific or sub-specific distinction.

MR. NELSON has likewise been devoting attention to the squirrels of the mainland of Mexico and Central America, the results of his investigations appearing in the May issue of the *Proc. Washington Academy*. It is concluded that the arboreal squirrels of North America should be divided, from the characters of the skull, aided sometimes by external peculiarities, into ten distinct sub-generic groups, four of which receive new names. The sub-genera are stated to occupy clearly defined geographical areas—a fact which speaks clearly as to their intrinsic importance; and it is further noticeable that the ranges of the most closely allied groups are invariably separated from one another by distinct gaps. Considerable importance as a group-character is attached to the presence or absence of the anterior upper premolar, and its relative size when developed.

IN his paper on "Mid-winter Surface and Deep Tow-nettings in the Irish Sea," recently published in the *Trans. Liverpool Biol. Soc.*, Mr. I. C. Thompson urges the importance of correlating the gatherings taken from upper and lower strata at the same time, much remaining to be learnt as to the effects of temperature and other influences upon the minute forms of marine life.

IN the *Bol. Mus. Paraense* for December last, the energetic director of the museum, Dr. E. Goeldi, laments the unsatisfactory state of our knowledge of the Brazilian fish-fauna, mentioning at the same time that although it is a subject to which his attention has long been directed, means and opportunity have been lacking. A commencement is, however, now made in the present synopsis of the fishes of Amazonia and the Guianas, which includes nearly forty pages of text, and a double coloured plate. The excellent execution of two of the figures in the latter, representing species recently described by Mr. Boulenger, is a very satisfactory feature.

THE April number of the *Agricultural Gazette of New South Wales* contains an illustrated account of a small ostrich-farm at South Head, where nine birds are kept. The methods of plucking and making-up the feathers are described and photographed. The annual product of each bird is worth from 10*l.* to 15*l.*; and the owner is of opinion that the industry is likely to prove a thriving one in the Colony. He considers that the birds, instead of being allowed to roam over large areas, as at the Cape, should be kept in small paddocks, and shifted from one to another of these at short intervals.

A PAPER by Mr. F. A. Lucas on the fossil bison of North America, published in the *Proc. U.S. Mus.*, vol. xxi., pp. 755–777, is specially noticeable for its wealth of illustration, having over twenty plates. The author, in opposition to some previous writers, is of opinion that all the bison skulls hitherto found in America are specifically distinct from the *Bos priscus* of Europe. No less than six extinct species are recognised; and while one of these is certainly a very distinct form, yet if all the others are valid species, it may be taken as certain that the fossil bison skulls of Europe would also permit of considerable specific division. One of the most important items in the paper is the determination that the so-called *Bos scaphoceras* of Cope, from Nicaragua, is not a bison at all, but a sheep. It seemed very strange that a representative of the former animals should have wandered so far south during the Pleistocene.

PERHAPS the most generally interesting article in the May number of the *American Naturalist* is one by Mr. Herrick, describing a case of the occurrence of a small hen's egg within one of ordinary size. Not that such abnormalities are uncommon—far from it. But the interest of the present case lies in the fact that the enclosed egg was situated in the yolk, instead of in the albumen of the larger specimen. In this respect it appears to be unique. The different types of such abnormalities are considered in detail. In ordinary cases, it seems that the small included egg represents a fragment of a normal ovum which has been ruptured, and has thus parted with some of its substance after leaving the ovary. Usually this fragment is treated in the oviduct like a full-sized egg and duly laid; but it may rarely be driven by antiperistaltic action up the tube so as to collide with the mother-egg, with which it fuses. From the general absence of yolks in such included small eggs, the ruptures that take place in the upper part of the oviduct must, as a rule, be confined to the albumen. Other explanations are given to account for double- or treble-yolked eggs.

IT is curious to note how the natural history of the fast-waning group of giant land tortoises is being gradually pieced

together from the evidences of living specimens transported far from their original habitat. An instance of this is afforded by Mr. E. R. Waite's description in the last issue of the *Records of the Australian Museum* of a male and female of *Testudo nigrita* recently living in the grounds of the Gladesville Hospital, near Sydney. The female, which died in 1896, was brought from the Galapagos in 1853, and the male, which has been acquired by Mr. Walter Rothschild, about 1866. Unfortunately, in neither case is there any evidence as to the particular island in the Galapagos group from which they were obtained, so that the exact habitat of the species still remains unknown.

SPECIAL interest is naturally felt at the present time in the geology of many of the islands in the Malay Archipelago, and therefore the summary just published by Dr. B. Kotô, Professor of Geology at Tôkyô, will be of service (*Journ. College of Science*, Imp. Univ. of Tôkyô, Japan, vol. xi. part 2). The author acknowledges his indebtedness to the labours of Prof. Suess; but he gives additional information, his object being to compare the structure and physical features of Taiwan with those of the Far Eastern Indies. Brief references are made to a great variety of strata and to the volcanic phenomena.

WE have received the summary report of the Geological Survey of Canada for 1898, in which the Director, Dr. G. M. Dawson, records the progress of the Survey, and quotes from the reports of the several officers on the staff "the more important results of their investigations, particularly such as may be of immediate value to the public from an economic standpoint." In northern Alberta some further experimental borings have been made in search of petroleum, and great trouble has been experienced in the effort to penetrate the "tar-sands" at the base of the Cretaceous strata, owing to "the clotting of the casing and tools with the heavy tarry petroleum, or maltha, mixed with sand, which was thrown up by the discharge of gas." The indications of oil-bearing strata have been proved over a large area, and it is hoped that the liquid petroleum may be found in the Devonian limestones which underlie the Cretaceous rocks.

MR. R. G. MCCONNELL and Mr. J. B. Tyrrell's report on the Klondike Region, Yukon District, is referred to in the publication mentioned in the foregoing note. The productive part of the Klondike gold-field, as at present known, covers an area of one thousand square miles. The gold occurs in the gravels flooring the bottom of the valleys, in stream-terraces lining the lower slopes of the valleys, and in a remarkable moraine or glacial deposit that occurs along the slopes of Eldorado and Bonanza creeks. The gold has been derived from the rocks of the immediate vicinity, and these consist of schists probably of Cambrian age. In various regions the want of good topographical surveys is a sad hindrance to the geological work, but that this is carried on in various portions of the vast territory of Canada with great energy and enthusiasm is evident from the details enumerated in this report of the Canadian Geological Survey. There are numerous observations on petrology, palæontology, and natural history generally. A large number of reptilian remains have been obtained from the Belly River formation in the Red Deer River district. The age of the formation, judged by the invertebrate fauna, is considered by Mr. Whiteaves to be the same as that of the Laramie (Cretaceous) series.

IN NATURE for January 19 we gave a brief account of the progress of the Maryland Geological Survey, which is under the direction of Prof. W. B. Clark, State Geologist. We have since received the second volume issued by the Survey, which embodies the full reports to which we previously alluded. As in the case of the first volume, it is beautifully printed and handsomely illustrated. The coloured plates picturing the macroscopic appearance of various granites and the Potomac marble are particularly good. There are, moreover, numerous pictorial views of quarries and of the physical features; there are excellent topographic and geological maps, and reproductions of some of the earlier topographic maps dating from 1527. The volume is mainly occupied (1) with an account of the building and decorative stones of Maryland, by Mr. G. P. Merrill and Mr. E. B. Mathews, by whom the physical, chemical, and economic properties of the stones, and their distribution, are very fully considered; and (2) by a report on the cartography of Maryland by Mr. H. Gannett and Mr. E. B. Mathews, who deal with the aims and objects of cartography, and with the maps and map-makers of Maryland.

MR. G. K. GILBERT describes a "Bowlder-Pavement" (to use the American spelling) at Wilson village, about twelve miles east of Niagara river, New York (*Journal of Geology*, Nov.-Dec. 1898). Such a pavement is formed when the boulders in till or boulder-clay are grouped in an approximately horizontal plane, and are striated on their upper surfaces in a common direction. The features are indicative of local glacial action which has affected a previously accumulated till, this action having removed a certain amount of material and caused the pressing down and striation of boulders along the plane of erosion.

IN treating of the glacial sculpture in Western New York (*Bull. Geol. Soc. America*, March), Mr. Gilbert shows how the broad plateau of Niagara limestone was but little modified, while its escarpment was rendered more prominent owing to the excavation by ice of the underlying shales which occupy the lowlands. Mr. Gilbert draws attention to a flexure produced by ice-action in the Medina shales at Thirty-mile Point, New York; and in a subsequent article he describes some giant ripple-marks in the Medina sandstones of New York, and these suggest that the formation was laid down in a large ocean whose waters were agitated by storm waves sixty feet high.

MR. G. CLARKE NUTTALL contributes to the current number of *The Contemporary Review* a popular account of the dependence of the flavour of tobacco upon the activity of bacteria during that important stage in the preparation of tobacco known as fermentation. Interesting reference is made to the work of Suchsland, who examined the germs which he found in the fermenting heaps of the finest West Indian tobacco. This German bacteriologist isolated and cultivated these bacteria, and then introduced some into quantities of inferior German tobacco, which was subsequently transformed so that connoisseurs could not distinguish it from the finest brands of tobacco.

WE have received from Messrs. Dulau and Co. a copious list of books and papers in British botany offered for sale.

COURSES of instruction in cryptogamic and cytological botany are given at the Marine Biological Laboratory, Woods Hole, Mass., during July and the early part of August.

HERR J. DÖRFLER, the compiler of the *Botanists' Directory*, proposes to publish a new edition about the commencement of the year 1900, and desires the co-operation of the botanists of all countries. His address is Barichgasse 36, Vienna IV.

A CIRCULAR has been issued inviting the attention of biologists to the biological station at Ambleteuse, in the Department of Pas-de-Calais, France. It has been erected very much on the plan of the American station at Wood's Hole, and is primarily designed as a summer school for biological students in connection with the Catholic University of Lille.

THE Reading College Agricultural Department has just issued its Fifth Annual Report on Field Experiments for 1898. The experiments were carried on with the co-operation of the Coun

Councils of Berkshire, Oxfordshire, Dorsetshire, and Hampshire, subsidies being granted by these bodies to the College to meet the expenses. The experiments were chiefly concerned with manuring and the rotation of crops, and furnished results which ought to be useful to farmers. Only one disease of cultivated crops, the "finger-and-toe," appears to have been attacked. Experiments on the cultivation of the sugar-beet in the neighbourhood of Reading gave good results. We notice that the staff of the College engaged on the field experimental work comprised two lecturers in agriculture, a lecturer in chemistry, an assistant chemist, a lecturer in geology and meteorology, and the director of the agricultural department, but no botanist or entomologist.

MANY admirers of Tyndall's writings will be pleased to know that the volume entitled "Hours of Exercise in the Alps," which has been out of print for some years—the last edition (the third) having appeared so far back as 1873—has been reprinted. Many adventures in the Alps and elsewhere are narrated therein, and the volume has as much freshness and vigour now as ever it had. Messrs. Longmans, Green, and Co. are the publishers.

A NEW volume of the "Year-Book of the Scientific and Learned Societies of Great Britain and Ireland" has just been published by Messrs. Charles Griffin and Co. The volume contains, not only particulars as to officers, meetings, and membership of learned societies, but also lists of papers read before, or published by, every Society of importance throughout the kingdom during 1898. As a convenient work of reference, the volume only needs to be known to be used.

THE current number of the *Photogram* contains as a supplement a very excellent reproduction of a snow scene, entitled "A Winter's Night," on special rough velox paper. The same number also contains the spectrum of iron and the solar comparison (on a slightly reduced scale), which has recently been obtained direct on a film thirty inches long at one exposure at the Solar Physics Observatory, South Kensington.

As Rugby was the first of the Public Schools to afford facilities for the study of science, we look to the Natural History Society of the School for a good report; and the one just issued is not disappointing. A prize essay, by Mr. P. H. Bahr, on "The Birds of Staffordshire and North Wales," is included in the report, together with reports on the work of various sections, and Mr. G. M. Seabroke's report on the observations made at the Temple Observatory in 1898.

THE course of study in technical electricity, arranged by M. Eric Gerard for the Montefiore Electro-technical Institute of the University of Liége, formed the basis of a volume of "Leçons sur l'Electricité" written by M. Gerard, and published several years ago by MM. Gauthier Villars et Fils. The first volume of the sixth edition of this work has just been received. The subjects dealt with are the theory of electricity and magnetism, electro-magnetic induction, electrical measurements, thermo-electricity, dynamo-electric machines, transformers and alternating currents. Many changes have necessarily been made in order to include some of the more important inventions and discoveries of the past few years. The volume now runs into 819 pp., and is illustrated with 388 figures.

MANY practical hints for photographers are given by Dr. E. Vogel in his "Taschenbuch der praktischen Photographie," the sixth revised and enlarged edition of which has just been published by the firm of Gustav Schmidt, Berlin. Among the additions to the volume is a description of the preparation of, and printing with, potassium bichromate paper (Gummidruck). Concise notes on the materials and methods available for the production of good negatives and various kinds of prints form a characteristic of this photographer's pocket-book.—Another photographic publication just published by the firm of Gustav Schmidt is a new part of the fourth edition of the late Dr. H. W. Vogel's "Handbuch der Photographie," edited by P. Hanneke. The subject of the new section is photographic printing by different kinds of processes.

"PICTURE Taking and Picturing Making" is the title of a neat and clearly printed little book of 115 pages, published by the Eastman Kodak Company. The object of this guide, as we may call it, is not to deluge the reader with theories and technicalities of photographic optics and formulæ, but to state clearly the main features regarding the production of good negatives, prints, and lantern slides. Parts of the book are somewhat familiar, in that they have appeared in the small Kodak manual; but the reader will find much that is new and useful. Needless to say, there are numerous and well-reproduced illustrations.

IN the "Year-Book of Photography and Amateurs' Guide" the reader will find that the 650 pages of which it is composed contain a mine of information that should be of the greatest service to the photographer, whether he be amateur or professional. The five sections of the book, which bring before us progress and practice, being a collection of helpful articles by practical photographers, the tourists' companion and holiday guide from the photographic point of view, winter work, facts and formulæ, and, lastly, novelties of the year, contain useful and valuable information suitable for every one. Not less important is the collection of fine reproductions from negatives, on many different subjects, taken with several kinds of cameras and shutters, which lends an additional charm to this year's volume. The author has succeeded in presenting his readers with, not only an interesting volume to read, but one that should be at the side of every amateur for reference.

A SECOND edition of "The Aborigines of Tasmania," by Mr. H. Ling Roth, has been published by Messrs. F. King and Sons, Halifax. In a supplementary note to the preface, Prof. E. B. Tylor points out that since the publication of the first edition, nine years ago, noteworthy progress has been made in the anthropological study of the Tasmanians. He adds, "That these rude savages remained within the present century representatives of the immensely ancient Palæolithic period, has become an admitted fact. . . . That the workmanship of the Tasmanians may be generally taken as below that of the Palæolithic Drift and Cave men, is apparent from the absence of any Tasmanian implement comparable to the symmetrical pointed picks worked on both sides, characteristic of the Mammoth Period in Europe." The additional information and figures referring to the position of the Tasmanians in the history of the human race make Mr. Ling Roth's volume of exceptional interest to students of anthropology.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus*, ♀) from West Africa, presented by Mr. G. Le Tantt; a Bonnet Monkey (*Macacus sinicus*, ♀) from India, presented by Mrs. C. Tarrant; two Slender Loris (*Loris gracilis*) from Ceylon, presented by Mr. Stanley S. Flower; a Leopard (*Felis pardus*, ♂) from Ceylon, presented by Mr. Edward Booth; a Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Mr. David D. Keith; a Two-spotted Paradoxure (*Nandinia binotata*) from West Africa, presented by Mr. Arthur Knights; a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. G. Marson; a Brown Gannet (*Sula leucogastra*) from Accra, presented by Miss Williams; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Mr. G. T. Harris; two Common Vipers (*Vipera berus*) from Hampshire, presented by Mr. Chas.

C. Dallas; an Algerian Skink (*Eumeces algeriensis*) from North Africa, presented by Mr. R. H. Archer; a Rufescent Snake (*Leptodira hotambaeia*), a Hissing Sand Snake (*Psammophis sibilans*) from South Africa, presented by Mr. W. Champion; three Barbary Turtle Doves (*Turtur risorius*) from Africa, presented by Colonel E. J. Gardiner; three Blue-necked Cassowaries (*Casuarius intensus*) from New Guinea, a Senegal Parrot (*Paeocephalus senegalensis*) from West Africa, two Mute Swans (*Cygnus olor*, 2 ♂), European; an Echidna (*Echidna hystrix*) from New South Wales, deposited; a Hunting Crow (*Cissa venatoria*) from India, three Bar-tailed Godwits (*Limosa lapponica*), four Black-tailed Godwits (*Limosa aegocephala*), ten Green Lizards (*Lacerta viridis*), four Toads (*Bombinator bombinus*), European, purchased; a Japanese Deer (*Cervus sika*, ♂), an English Wild Cow (*Bos taurus*), two Squirrel-like Phalangers (*Petaurus sciureus*, 2 ♀), two Short-headed Phalangers (*Petaurus breviceps*, 2 ♂), a Patagonian Cavy (*Dolichotus patachonica*), a Crested Porcupine (*Hystrix cristata*), a Hybrid Lemur (between *Lemur macaco* and *Lemur brunneus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

TEMPEL'S COMET (1873 II.)—Continued from *Astr. Nach.* (Bd. 149, No. 3554).

Ephemeris for 12h. Paris Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″	Br.
June 15 ...	19 54 47·2 ...	− 5 12 25	
16 ...	56 11·5 ...	5 22 24	
17 ...	57 35·4 ...	5 33 2 ...	1·829
18 ...	19 58 58·9 ...	5 44 20	
19 ...	20 0 21·9 ...	5 56 19	
20 ...	1 44·5 ...	6 8 59	
21 ...	3 6·7 ...	6 22 21 ...	2·048
22 ...	4 28·5 ...	6 36 27	
23 ...	5 49·8 ...	6 51 16	
24 ...	7 10·7 ...	7 6 49	
25 ...	20 8 31·1 ...	− 7 23 7 ...	2·281

The comet is now more than four times as bright as when it was first re-observed by Prof. Perrine at Lick on May 6. Perihelion passage occurs on the 18th inst. During the period included in the above ephemeris the comet travels from the south-eastern part of Aquila to the north-west of Capricornus, being about 5° due north of α Capricorni on the 25th.

RETURN OF COMET HOLMES (1892 III.).—Continued from *Astr. Nach.* (Bd. 149, No. 3553).

Ephemeris for 12h. Greenwich Mean Time.

1899.	R.A. h. m. s.	Decl. ° ′ ″	Br.
June 15 ...	1 22 38·3 ...	+18 47 18 ...	0·0341
17 ...	22 56·5 ...	19 23 22	
19 ...	29 13·8 ...	19 59 19	
21 ...	32 29·9 ...	20 35 8 ...	0·0351
23 ...	35 44·9 ...	21 10 50	
25 ...	38 58·8 ...	21 46 25	
27 ...	42 11·4 ...	22 21 51 ...	0·0362
29 ...	1 45 22·7 ...	+22 57 10	

During the above period the comet moves from near η Piscium to about 2 degrees north of β Arietis.

A telegram from Kiel, dated June 12, announces the first detection of this comet by Prof. Perrine at the Lick Observatory. The observation was made on June 10, at 15h. 2·2m. Lick Mean Time, the recorded position being

R.A. = 1h. 15m. 32s.
Decl. = + 17° 29′ 39″,

which will be seen to be fairly in agreement with the computed position. The comet is described as being very faint.

COMET 1899 *a* (SWIFT).—A circular from the Central Bureau at Kiel calls attention to the importance of the increase of brightness of this comet, which was recorded by several observers on June 4 last. Herr Kreutz has received a telegram from Herr Pokrowsky, of Dorpat, stating that communications received by him from Vienna, Bamburg and Hamburg, confirm the fact that on June 4 a decided brightening of this comet took place. The increase of magnitude was from 6 on June 2nd and 3rd to 5½ on the 4th. A telegram also from Herr Hartwig gives further details. "The nucleus was of 9·5 magnitude, the total brightness being of magnitude 5. Greatest diameter of Coma about 9′; increase of brightness undoubted."

Another, from Herr Schorr, states: "Strong eccentric fixed star-like nucleus of 6·5 magnitude. Total brightness of comet 5 magnitude. Coma 9′ in diameter."

It will also be remembered that there was a decided increase in brightness of this comet from May 9 to 23, after which it gradually began to decline until the above sudden change was noted.

WHITE SPOT ON JUPITER.—Herr Ph. Fauth, writing from a private observatory at Landstuhl to *Astr. Nach.* (Bd. 149, No. 3570), announces the observation on several occasions of a brilliant white spot on the north-eastern belt of the planet. The marking was observed to pass central meridian on May 8 at 11h. 25m., and on May 18 at 9h. 33m. It is about 4″ in diameter. The observations were made with a telescope of 7 inches aperture.

TWO NEW VARIABLE STARS.—M. Luizet, of the Lyons Observatory, announces in *Astr. Nach.* (Bd. 149, No. 3570) his observations leading to the discovery of two new variable stars in the constellations Vulpecula and Cygnus respectively.

The first is U Vulpeculae,

B.D. + 20°·4200. R.A. = 19h. 30m. 17·3s. Decl. = + 20° 0′·8. } 1855·0.

Four comparison stars were used and forty-three observations made during the period August 4 to December 26, 1898. These observations after reduction are plotted as the light curve, which is symmetrical and similar to that of ζ Geminorum. A maximum was found to fall on the date

1898 October, 21·61 Paris Mean Time,

and this in conjunction with a previously observed maximum by MM. Müller and Kempf,

1897 October, 2·4765 Paris Mean Time,

gives the period as

8·003 days.

The elements of the star U Vulpeculæ are therefore adopted as

1897 October, 2·4765 Paris M.T. + 8·003d. E.

The second variable is S U Cygni, the position being

B.D. + 28°·3460. R.A. = 19h. 39m. 1·0s. Decl. = + 28° 54′·9. } 1855·0.

Fifty-eight observations of this star were made from July 9 to December 26, 1898, and the results again plotted to give the light curve.

The period is determined to be

3·846d.,

and succeeding maxima may be calculated from the elements:

1897 October, 4·6665 Paris M.T. + 3·846d. E.

This star has a light curve showing an *irregular* decrease of brightness from maximum during about 2·7d., and a more regular increase during 1·1d., these features showing the variability to be somewhat analogous to that of δ Cephei.

THE BORE AT MONCTON, BAY OF FUNDY.[1]

MONCTON is situated on the Petitcodiac River, nineteen miles above the mouth of the Petitcodiac, where it enters the Bay of Fundy. This part of the river is more correctly an estuary which continues thirteen miles further up, as far as Salisbury Junction. At high tide the river at Moncton forms a sheet of water half a mile in width, while at low tide it consists of mud banks and flats, with a stream about 500 feet wide

[1] Abridged by Prof. G. H. Darwin from an advance copy of the Report for 1898 of the Tidal Department of the Survey of Canada, sent by Mr. W. Bell Dawson.

running with a strong current in a devious channel amongst the bars and mud flats, which are left dry at low water.

The run of the rising tide first breaks into a bore at Stony Creek, eight miles below Moncton, and it continues to the head of the estuary at Salisbury, thirteen miles above. The total distance on the river that a bore occurs is therefore twenty-one miles.

With regard to the time of arrival of the bore at Moncton, this really corresponds with the time of half tide. At the central moment between the previous and the following high water, which we may term the theoretical time of low water, the level of the water in the river is still falling; and it continues to fall, though at a much slower rate, for about three hours longer before the bore arrives. The time of the arrival of the bore is thus only about three hours before the next high water, which serves to account for the very rapid rise which takes place after the bore passes.

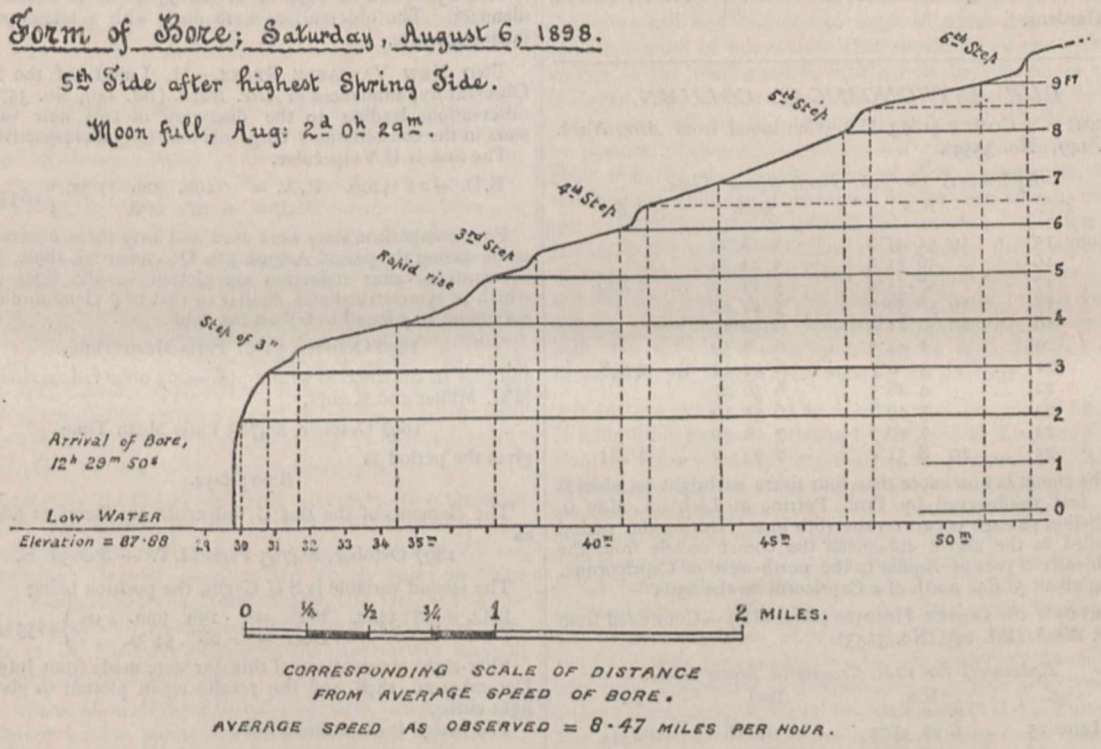
The rate at which the tide falls amounts at its maximum to eight feet per hour; but after the theoretical time of low water, the rate of fall soon becomes very slow, and the river appears to a casual observer to remain at the same level for some two hours before the arrival of the bore. The flow, however, continues to be fairly swift; and it no doubt still consists of tide water. The rate of fall in the level of the water, as measured shortly after spring tides, was found to be as follows:—

From	4½ to 2½	hours	before	arrival of bore,	rate of fall *six inches* per hour.
,,	2½ to 1	hour	,,	,, ,,	*four inches* ,,
,,	40m. to 15m.	,,	,,	,, ,,	*three inches* ,,

The first observation of the bore was made on the evening of August 4. The point of view commanded some two or three miles down stream below the bend, as well as the foreshore opposite Moncton. The moon was a little past the full, and was well risen before the bore arrived; and the sky was then clear also. There was a very slight breeze, and in the stillness sounds could be distinctly heard. It was thus at the spring tides, and twenty-four hours after the lowest of the tides at that moon.

The first sound of the approaching bore was heard at 23h. 8m., in 60th meridian time, and two minutes later the sound was quite distinct. This sound was very similar to the noise of a distant train when heard across water. It afterwards increased to the usual hissing and rushing sound of broken water, as in a rapid on a river; but there was no mingling in this sound of any roar, such as a waterfall makes when falling into deep water, even from a moderate height. The bore arrived at the wharf at 23h. 19m., or eleven minutes after its sound was first heard. The rapidly-flowing layer of incoming tide advanced over the current of the river in the opposite direction, with a front of broken and foaming water, which had a height of perhaps two or three feet. The front edge was by no means straight. The higher part of the bore extended across the waterway, and this was bent back and also heightened in the middle by the opposing current of the river, which is naturally swiftest at the centre of the stream. Beyond this the bore formed a long sweep, where it broke over the flats, retarded and decreasing in height towards the further bank of the river.

The surface current of the water following the main front has the same speed of flow as its rate of advance; and after the main front passes, there usually follow a series of others, stepped up a few inches of additional height. These form irregular lines of curve across the surface of the advancing tide, which do not extend far without interruption. These may be due in part to back-wash from the flats into the main channel. As seen in the day-time, the water forming the bore is excessively muddy and reddish-yellow in colour, just as the outflowing water of the river also is. The actual broken water in the front is nearly white, except at the shore end; but the long edge of the advancing water on the flats appears nearly black in strong sunlight. With a stiff breeze down stream, the sound of the bore cannot be heard till it has approached within a few hundred yards.



During the neap tides the bore still appears, and the front edge usually breaks a few inches high. But there are times when it consists merely of a heavy ripple, like the side waves from the bow of a steamer when they are advancing over still water; and it then only breaks occasionally, except in passing over the flats.

The rate of advance of the bore was timed from a point of observation on one of the upper wharves, which commands a view around the bend of the river. The velocity, as determined from several observations, was about 8½ miles an hour.

To ascertain the form of the bore, and its rate of rise, a graduated board 13 feet high was set up in the front of the wharf, at which the tide gauge was placed. The current, after the bore passes, appears to have the same surface velocity as the rate of advance of the bore itself.

The height of the bore, as observed at spring and neap tides, and the rise of the water following it, are shown in the report by diagrams, of which one is reproduced here. The rise is by

no means uniform. There are at times distinct steps, which are sometimes visible as such, on the surface of the incoming water. At other times the water holds its level for a short interval, and then rises rapidly afterwards to make up, as it were, for lost time.

The diagram may also be taken to represent the form of the bore, or its profile along the river at any given moment. Strictly speaking, this involves the assumption that the whole mass of water moves forward at the same speed as the broken front which forms the bore itself; which in all probability is not very far from the truth. To assist this view, a scale of distances is given on the diagram, which is based upon the average rate of advance of the bore in running up the river.

The bore itself is clearly the broken water at the front edge of a long water-slope which advances up the river. The greatest rate of rise at spring tides after the bore has passed amounts to 3·00 feet in 10m. 5s.; and if we take for the average speed 8½ miles per hour, the equivalent water-slope is 2·10 feet per mile. This slope appears very moderate in the circumstances, although it is really greater than in most rivers, except where rapids occur. Also, as a question of hydraulics, this slope would undoubtedly prove to be in correspondence with the speed of the currents following the bore, if the problem were fully worked out.

It is said that formerly the bore used to be higher than at present, owing to changes that have taken place in the bars in the river, which now obstruct the channel at low water and interfere with its development. No very definite information could be obtained as to this.

On August 22, 1892, a good photograph of the bore was obtained, which has been published in a report of the Geological Survey. Its height as then measured was 5 feet 4 inches. It is clear, from the observations, that in three to four minutes after the bore passes the water has already risen an extra foot. The greatest height which was measured in the above observations was 3 feet 3 inches, although it would be a little higher at the middle of the river. This may probably be taken as a fair average at ordinary spring tides. The maximum no doubt occurs when the moon is in perigee at full or change, and also at its maximum declination, as this gives the greatest difference in favour of one of the two tides in the day. Something also depends on the level to which low water falls, as this practically adds to the height of the bore. The total difference, however, in the level of low water between spring and neap tides, and between one set of spring tides and another, was found to be little more than one foot altogether, as observed in the summer season. Late in the autumn, when the fresh water outflow of the Petitcodiac is increased, the water surface at low tide does not fall so low.

The time of the arrival of the bore, with reference to the time of high water, was worked out from the observations obtained while the tide gauge was being erected. The time of high water at Moncton was obtained by difference of establishment, from the tide tables for St. John. The comparison shows that the time of arrival of the bore varies from 3h. 1m. to 3h. 34m. before the time of high water. This result may, however, be subject to revision.

It is hoped that the arrival of the bore, being a well-defined moment, may serve to throw light on the whole question of the progress of the tide in the Bay of Fundy.

The only other place in the Bay of Fundy at which the bore has been seen is in the upper part of Cobequid Bay. The tide there used to arrive as a bore at Maitland, at the mouth of the Shubenacadie River; but a change in the position of the sand bars below Maitland now prevents this. In running up the Shubenacadie, however, the tide still breaks occasionally into a ripple or miniature bore.

THE BOYLE LECTURE ON THE PERCEPTION OF MUSICAL TONE.

ON Tuesday, June 6, Prof. McKendrick delivered in the Lecture Room of the New Museums, Oxford, the annual Boyle Lecture, the subject being the perception of musical tone. The lecture was entirely devoted to a consideration of the functions of the cochlea, the minute anatomy of which was fully described. The internal ear consists of a complicated series of sacs and tubes filled with fluid. In certain situations the walls of the sacs contain highly differentiated epithelial structures, which are intimately related to the terminal filaments of the auditory nerve. The problem is to explain how the pressures transmitted by the foot of the stapes affect these terminal structures in such a way as to excite sensations corresponding to the pitch, intensity, and quality of tone. The dimensions of the internal ear are so minute as to form only a small part of the wave-lengths, even of tones of high pitch. The nerve endings are still smaller, but they also act as minute portions of any wave, and any reasoning as to the effect of such waves is quite irrespective of the small dimensions of the receiving organs in the internal ear. If we consider a wave of sound as a series of states of condensation and states of rarefaction, travelling on continually in one direction; and, further, if we remember that the motion of each individual particle forming the wave is very small, and is alternately backwards and forwards, in the same line as that in which the wave travels, we see that the movements, inwards and outwards of the base of the stapes, correspond to these oscillations, or, in other words, to increase and diminution of pressure with each wave. Some of the possible movements of the base of the stapes were described, along with their action on the perilymph surrounding the utricle and saccule. We can hear musical tones and noises, we have a peculiar auditory sensation to which we give the name of beats, and we have the power of analysing a musical tone into its component parts. A demonstration was then given of the limits of pitch perception, of beats, and of beat tones. As regards the perception of intensity, the results of inquiries made by Töpler and Boltzmann, and more especially by Lord Rayleigh, showed the delicacy of the ear for sound, as regards energy, is about the same as that of the eye for light. The ear may be affected by vibrations of molecules of the air not more in amplitude than ·0004 mm., or 0·1 of the wave-length of green light; while Lord Rayleigh says "that the streams of energy required to influence the eye and ear are of the same order of magnitude." The question of analysis was next considered, and the bearing on it of Ohm's principle and Fourier's theorem, as regards wave-forms. The lecturer stated that on the whole he was not yet satisfied from any observations he had been able to make that the ear took cognisance of differences of phase, and he pointed out the peculiar difficulties in making observations on this point. He was still inclined to support the views of Helmholtz. Illustrations were given of wave-forms as revealed by the phonograph, and an instrument enabled the audience to hear experiments on pitch, intensity, and quality. Several violin records of rare beauty were reproduced. The lecturer next discussed the probable action of the cochlea. There are only three ways in which the ductus cochlearis, which contains the nerve-endings, may be affected. Either (1) small vibratile bodies may exist between the pressures sent into the organ and the filaments of the auditory nerve, each vibratile body having a frequency period of its own; or (2) individual nerve-fibres may be directly excited by waves of a definite period—that is to say, there may be differences in the nerve-fibres, so that they have a selective action; or (3) the organ may be affected as a whole, all the nerve-fibres being affected by any variations of pressures, and thus the power of analysis, which is admitted, is relegated from the peripheral to the cerebral organs. The first hypothesis seems most probable, for (1) the existence of such bodies would give a natural explanation of many, if not all, of the phenomena; (2) the evidence of comparative physiology points to a gradually increasing complexity in the structure of all the terminal organs of special sense, as there arose a necessity for differentiation and discrimination in the effects of various kinds of stimuli; and (3) investigations into the action of all the sense-organs, such as those of touch and temperature in the skin, of light and colour in the retina, of taste in the tongue, and of smell in the olfactory region—all indicate specialisation of function in the peripheral apparatus. The action of the cochlea was then fully described, and stress was laid on the movements of segments of the membrana basilaris causing contacts between the apices of the hair-cells and the under-surface of the membrana tectoria. Suppose that, in accordance with the view of Helmholtz, a segment of the basilar membrane were thrown into sympathetic vibration, it would move in a direction at right angles to the direction of its fibres. These movements would be communicated to the structures lying on its upper surface, and if we suppose the arches of Corti to be elastic, such movements would be transmitted to the hair-cells. These would move in the line of their long axis; in other words, their hairs would move up and down in the meshes of the membrana

reticularis, and strike against the under surface of the membrana tectoria. A reaction would take place from the latter, and thus the delicate nerve-endings between the hair-cells would receive pressures corresponding in frequency to the oscillations of the membrana basilaris. In the cochlea of birds and amphibia, the mechanism is practically the same, but in consequence of the membrana basilaris not being highly differentiated, there cannot be the nice discrimination of pitch of tone which exists in the higher animals. The lecturer gave reasons for holding that a bird has a power of discriminating pitch only through a narrow range. These views were also, on the whole, supported by pathological observations in cases of deafness, and of the deafness of boiler-makers in particular. In the latter there is the loss of perception of high tones, and degenerations are observed in the lower whorl of the cochlea, as is required by theory. The action of the cochlea, as thus conceived, was demonstrated with a model. The lecturer also gave a large number of measurements of parts of the ear, showing that there were a sufficient number of structures in the cochlea to enable us to detect differences of the 1/64th of a semitone, thus amplifying the conclusions reached long ago by Helmholtz. The number of nerve-fibres in each cochlear division of the auditory nerve is about 14,000, giving something like 1250 for each octave through the eleven octaves of audibility. Assuming that the number of auditory filaments is the same for each of the eleven octaves (an unlikely supposition, as there will probably be a larger number of filaments for octaves in the middle of the range of the ear), there will still be two filaments for each 1/64th of a semitone; while, for the same interval, there will be three fibres of the membrana basilaris, and two hair-cells. The production of combination tones, differential and summational, was next considered, the lecturer stating that, in his opinion, and founded on experiment, both had an objective existence. They are not beats, but true sounds superadded to the generators, and thus they fall within the scope of Ohm's law. The theories, other than that of Helmholtz, were then criticised; namely, those of Rutherford, Waller, Hurst, and the more recent one of Max Mayer. The most obvious objection to any theory which dispenses with peripheral analysis is that it leaves the exceedingly elaborate structure of the organ of Corti, and indeed of the cochlea, as a whole, out of account; or, to put the matter in another light, it assigns to that organ a comparatively simple function. Ohm's law also may be subject to certain limitations, but there is no substitute for it. Max Mayer agrees with Hurst in imagining a series of waves transmitted along the scalæ, instead of the scalæ forming part of one wave. The two differ in respect that Max Mayer supposes, on physical grounds, that the amplitude must diminish from base to apex of the cochlea; while Hurst argues, also from the physical point of view, that the amplitude must increase. This is a serious discrepancy, inasmuch as Mayer's theory rests wholly on the supposition of diminished amplitude. It seems impossible to conceive of minute waves following each other in rapid succession in the minute tubes forming the scalæ. These theories are independent of the principle of sympathetic resonance, imperishably associated with the name of Helmholtz, and which still, in the lecturer's opinion, holds the field. Lastly, the lecturer pointed out that the roots of the auditory nerves were probably more widely distributed and had more extensive connections than those of any other nerve. The intricate connections of these nerves were only being unravelled. This pointed to an explanation of how music penetrates to the very roots of our being, influencing by associational paths, reflex mechanisms, both cerebral and somatic, so that there was scarcely a function of the body that might not be affected by the rhythmic pulsations, melodic progressions, and harmonic combinations of musical tones.

THE DARMSTADT MUSEUM.

THROUGHOUT the civilised world attention is being concentrated on the improvements in the mode of arranging specimens in the exhibition galleries of natural history museums; so that they should be both attractive and instructive to the general public, and at the same time useful to the student. Nowhere does this advance seem more marked than at Darmstadt, where the Director, Dr. G. von Koch, has just published an interesting and well illustrated progress report ("Die Aufstellung der Tiere im neuen Museum zu Darmstadt," Leipsic, 1899.)

We gather from this report that a large proportion of the museum is devoted to the systematic classification of animals; and it is gratifying to observe that not only are skeletons and skulls ranged side by side with the mounted skins, but that anatomical preparations and remains of extinct forms are introduced in their proper serial position. A notable feature (in the seventh gallery) is the exhibition of a series of economic animal products, such as furs, wool, leather, ivory, tortoise-shell, mother-of-pearl, shell, coral, &c. But the greatest novelty is the formation of a gallery (the eighth in the series) illustrating the geographical distribution of animals on the globe. And here, instead of arranging the specimens on the conventional wooden stands on tier upon tier of shelves, an attempt has been made to reproduce the natural surroundings of their habitat.

To take, for example, the South and Central American region, we find, as shown by one of the plates accompanying the report, alligators, tapirs, carpinchos, chajas, &c., occupying the low land by the river. In the adjacent forest tract we have anteaters, sloths, coatis, pacas, opossums, armadillos and the characteristic monkeys. On a higher level we have the open pampas and llanos, with peccaries, brockets, pumas and rheas; while the background of the scene is formed by mountain peaks tenanted by guanacos, vicugnas and condors. Birds of other kinds are likewise introduced in appropriate positions so far as the limits of space permit. Similar scenes represent the other great zoo-geographical regions; and it is important to notice that the whole series is ushered in by the fauna of Hessen-Darmstadt itself.

It would undoubtedly add much to the interest and instructiveness of our own natural history museums if arrangements could be made for the formation of galleries of economic and distributional zoology on somewhat similar lines.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—A number of the foreign guests who had been present at the Stokes jubilee celebration and the Royal Institution centenary were invited to Oxford on the 8th, and were entertained at a luncheon in Christ Church. Among those who came were Profs. Arrhenius, Barker, Barus, Becquerel, Bleekrode, Ciamician, Cornu, Deslandres, Fianchimont, Egoroff, Gautier, Körner, Le Chatelier, Liebreich, Martius, Michelson, Moissan, Nasini, Newcomb, and Sivewright.

In a convocation held the same day, the honorary degree of D.C.L. was conferred upon Profs. Becquerel, Körner, Liebreich, Moissan and Newcomb.

The following were the speeches made by the Regius Professor of Civil Law, Dr. H. Goudy, in presenting them.

Nihil pulchrius nobisque optatius est quam viros e gentibus externis de scientiarum studiis optime meritos societati nostrae adscribi atque arctissimo et dignitatis et amicitiae nobiscum vinculo consociari. Quae res hodie Universitati nostrae contigit quae eos viros, quos mihi adstare videtis, communi omnium ejus membrorum consensu (Instituti quod dicitur Regii annum centenarium feliciter actum commemorans) insigniri jussit.

BECQUEREL.

Primum ad vos duco virum illustrem, Gallica stirpe oriundum, qui in scientia physicae famam eximiam est adeptus, patris in eadem scientia illustris filius. Physicae studiosorum in manibus sunt scripta ejus praeclara principiis scientiae illius illustrandis destinata. Operum numerum quorum auctor doctus ille exstitit referre longum est; neque tamen, ut plurima praeteream, silentio praetereunda videntur opuscula illa, publici juris facta, in quibus de magnetis et electri proprietatibus felicissime disseruit, ipsamque Naturam, rerum creatricem, in lucem proferre coegit quanam ratione quaedam corpora aliquando lumina emittant atque vires electricas eis transmissas per longum tempus retinere possint.

KÖRNER.

Praesento vobis virum egregium, Germanica stirpe oriundum, inter eos qui praecipuam curam rebus chemicis dederunt notissimum. Quantum in ea parte Naturae profecerit, quam multa ingeniose et subtiliter excogitaverit, mihi exponere minime concedit sermonis academici egestas! Quid de compositis aromaticis ab eo recte libratis, quid de ἰσομοιρία, ut Graeco utar vocabulo, corporum in conjunctione naturali disseram?

Audisse sit satis kunc de his studiis ita meritum ut omnibus inter nostrates qui se iisdem studiis maxime devoverint dignus omnimodo laureâ nostrâ videatur.

LIEBREICH.

Salutamus deinceps virum e finibus Germaniae insignem. Ille secreta cerebri feliciter rimatus ad ipsa materiae atoma penetrando phosphorum capitalem Phosphorus et Lucifer ipse clarissimus nobis primo patefecit. Idem acerbissimos animi corporisque dolores impune extinxit,

Spargens chlora venena soporiferumque papaver.

Immo somnum insomnibus attulit, mollem, mortique simillimum.

MOISSAN.

Praesento vobis virum illustrem Lutetiis Parisiorum professorem. Viri hujus ingenium illustre, diligentiam, eruditionem in ea scientia quam ad illustrandam unice se devovit, jamdiu confessi sunt qui eadem in re florentissimi extiterunt. Sed nomini suo immortalitatem quandam justissimo titulo meruisse videtur, invento uno scientiae suae utilissimo; scilicet Fluorii elementum segregando, id quod nulli ante facere contigit, neque sine vitae periculo prioribus constabat experimentum hujusmodi; (scilicet qui sese ante nostrum experimento huic dedicaverant, duo, ante victoriam partam, occubuerunt, lauream tamen reportavit noster, periculo superstes atque, utinam diu superstes sit!)

NEWCOMB.

Sequitur deinceps vir insignis qui trans fluctus Atlanticos transvectus ad nos venit—senex antistes Naturae. Hunc virum scitote per multos annos astrorum motus rationemque coeli ita ingeniose perscrutatum fuisse ut multa non solum nova reperiat sed etiam sermone dilucido expressa argumentis confirmaret certissimis. Idem luminis velocitatem et quantum sol ab orbe terrarum distet singulari curâ investigavit, et tabulas Lunae motus correxit.

"Scire juvat magni penitus praecordia mundi."

At the Encænia, on June 21, the honorary degree of D.C.L. will be conferred upon the Earl of Elgin, Lord Kitchener, Sir Charles Parry, F. W. Maitland, F. D. Godman, Father Ehrle, Cecil Rhodes, and J. G. Frazer.

The eleventh annual report of the delegates of the University Museum (for 1898) is published in the *University Gazette* for June 6. This publication, which increases in dimensions every year, contains the reports of the Regius Professor of Medicine, the Linacre Professor of Comparative Anatomy, the Waynflete Professor of Physiology, the Professor of Human Anatomy, the Hope Professor of Zoology, the Professor of Experimental Philosophy, the Waynflete Professor of Chemistry, the Professor of Geology, and the Waynflete Professor of Mineralogy, and records substantial progress in all these departments.

Mr. E. S. Goodrich has been re-appointed Aldrichian Demonstrator of Anatomy.

Dr. J. F. Payne has been elected a member of the Medical Council of the United Kingdom, in place of Dr. W. S. Church, resigned.

Scholarships in Natural Science are advertised at the following Colleges:—Balliol, November 21; Merton, June 27; New, June 27; Magdalen, October 10; Corpus Christi, June 27; Christ Church, November 21; Trinity, November 21.

On June 14, a statue of Charles Darwin, by Mr. Hope Pinker, which has been presented to the University by Prof. Poulton, will be inaugurated at the University Museum.

CAMBRIDGE.—Mr. H. M. MacDonald, of Clare College, fourth Wrangler 1889, has been appointed University Lecturer in Mathematics in place of Prof. Love, now of Oxford.

Mr. A. E. Shipley, of Christ's College, has been re-appointed University Lecturer in Invertebrate Morphology.

The Adams prize for an essay on the Theory of the Aberration of Light has been divided between Mr. J. Larmor, F.R.S., Fellow of St. John's, and Mr. G. T. Walker, Fellow of Trinity, Senior Wranglers in 1880 and 1889 respectively.

The Smith's prizes for 1899 are adjudged to Mr. W. H. Austin and Mr. G. W. Walker, of Trinity, senior and fourth Wranglers respectively in 1897. Mr. Frankland, of Clare, and Mr. Whipple, of Trinity, receive honourable mention.

Prof. Thomson announces a course of demonstrations in Physics, to be given in the Cavendish Laboratory during the Long Vacation, beginning July 5.

The Council of the Senate propose to expend 125*l.* in preparing an appropriate exhibit for the Educational Exhibitions to be held in London and in Paris in 1900.

The accommodation in the new chemical laboratory is already insufficient for the numbers seeking instruction, and it is accordingly proposed to expend 609*l.* in adapting the attic story as an additional laboratory for elementary students.

The Senior Wranglership this year is divided between Mr. G. Birtwistle, of Pembroke, and Mr. R. P. Paranjpye, of St. John's. Pembroke has had no Senior Wrangler since Sir George Stokes in 1841, and does well thus to mark the year of his jubilee as Lucasian Professor. Mr. Paranjpye is a Mahratta student, who gained numerous distinctions in the University of Bombay before coming to Cambridge: he is the first native of India who has attained the highest mathematical honours. There are forty names (including two ladies) in the list of Wranglers, indicating that the "year" is a strong one.

In Part II., Messrs. Hudson, of St. John's, and Cameron, of Caius, are alone in the First Class (first division). These were senior and second Wranglers respectively in 1898. Miss F. E. Cave-Browne-Cave, of Girton, appears in the third division of the First Class.

In the Mechanical Sciences Tripos, Part I., six students have attained the First Class. In Part II. Mr. B. W. Head, of Emmanuel, has the First Class to himself. Mr. H. E. Wimperis, of Caius, has in the same Tripos qualified for his degree as an "advanced student."

Mr. J. E. Marr, F.R.S., of St. John's, is appointed a member of the General Board of Studies, in place of Dr. Langley, resigned.

Dr. D. MacAlister, Mr. C. E. Grant, and Mr. C. Warburton are appointed members of the new Board of Agricultural Studies.

WE learn from *Science* that Dr. C. E. Beecher, professor of historical geography in Yale University, has been appointed to succeed the late Prof. O. C. Marsh as Curator of the geological collections of the Peabody Museum.

THE Education Department has received from Berne an announcement that an educational exhibition will be held in that city next autumn. The authorities organising the exhibition will welcome exhibits illustrating education in this country. Communications from those willing to take part in the exhibition should be addressed to the Director, Schweizerische Permanente Schulausstellung, Berne, from whom further particulars can be obtained.

WITH a view to assisting teachers of schools and classes to acquaint themselves with the methods and principles of natural science, especially as bearing upon aspects of school and class work, the Technical Instruction Committee of the Liverpool City Council have made arrangements with Prof. W. A. Herdman, F.R.S., Professor of Zoology at University College, to give a short course of lectures and laboratory demonstrations on the study of natural history.

IT has already been pointed out in these columns that the appointment of particular authorities to be responsible for technical and secondary education within their districts will reduce the overlapping which at present exists in many places. The London County Council was recently appointed as the sole authority to distribute the Science and Art grant in London, and as such it has taken exception to certain items of expenditure by the London School Board on technical or secondary education, on such lines as to compete injuriously with similar work in the Council's polytechnics and institutes in the same districts. The *Times* reports that the Local Government Board auditor has now ruled that such expenditure by the School Board is illegal, and can only be carried through as financial aid from the County Council. It is stated that the London School Board will appeal against this decision. Meantime, it is understood that the ruling will apply, not only to the London Board, but also to other School Boards throughout the country.

SOME statistics relating to engineering education are given by Dr. M. E. Wadsworth in a paper published in the *Transactions* of the American Institute of Mining Engineers. Engineering education in the United States has been, on the whole, a thing of comparatively recent date—the pioneer schools being the Rensselaer Polytechnic Institute, established in 1824; the Lawrence Scientific School, dating from 1846; and the Sheffield School, from 1847. But little further prominent work was done until 1863, when the Columbia School of Mines was established and followed rapidly by numerous other engineering schools,

The tables given by Dr. Wadsworth are not complete, but so far as they go they show that "in mining engineering the leading schools in the world, so far as shown from the records here published, are Freiberg, Leoben, Clausthal, Berlin, Paris, St. Etienne, Schemnitz, Przibram, Michigan College of Mines. California, Columbia, Lehigh, Massachusetts Institute of Technology, and Colorado."

AN account of the proposed Institute of Scientific Research for India, which Mr. J. M. Tata, of Bombay, has undertaken to endow with an annual income of a lakh and a quarter (125,000 rupees), is given by Sir Henry Acland in the second edition of his little volume, "Medical Missions in their Relation to Oxford" (London: Henry Frowde). As already announced, it is intended to found an institution which shall be, or correspond to, a Teaching University for India, concerning itself principally with post-graduate studies and scientific research. A committee has been organised to take the matter in hand and appeal for funds; and Mr. Tata's commissioner, Mr. B. J. Padshah, is making inquiries in Great Britain, in Europe, and in the United States, how best to carry out the scheme. Sir Henry Acland utilises the opportunity which the proposed scheme affords to accentuate his appeal that "a generous benefactor, or some great National Company, should complete in Oxford the Public Health Department for University Education in the subject of public health and anthropology, with special reference to Mr. Jamsetji M. Tata's great scheme for natural science in general, and sanitary science in particular, in India."

AN exhibition of practical work executed by candidates at the recent examinations of the City and Guilds of London Institute was opened at the Imperial Institute, on Friday, by the Duke of Devonshire. Referring to the character of the instruction given under the direction of this institute, His Grace remarked: The object of this instruction is to familiarise a student with all the processes and all the details the use of which is required in the trade he is going to undertake, and to show to him how the knowledge he has acquired in lectures or in books may be applied to the practical performance of his business. This exhibition, I hope, will help those who see it to realise the real need of the technical instruction now being given. If you sent students direct from the classes of the Science and Art Department into a workshop they would be utterly incapable, in all probability, of applying in a practical way the knowledge which they have acquired in the classes. If you separate by too long an interval the lecture-room from the workshop, the work will be lost, but if you combine the lecture-room with the workshop, you have the material from which we may reasonably expect that expert finished artisans will be provided, although, of course, perfect workmen can only be produced by long and continuous practice. The artisan students in the registered classes of the institute now number over 34,000, in addition to nearly 2000 students in its manual training classes, and of these numbers 13,800 were examined last year, showing an increase of 800 over any previous number.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 20.—"Note on the Fertility of different Breeds of Sheep, with Remarks on the Prevalence of Abortion and Barrenness therein." By Walter Heape, M.A., Trinity College, Cambridge. Communicated by W. F. R. Weldon, F.R.S.

The paper is a brief abstract of information obtained from 397 sheep-breeders, who have supplied records of flocks containing 122,673 ewes for the breeding season of 1896-7.

The information obtained referred especially to the following eight pure breeds of sheep: Suffolk (7506 ewes), Kent (9931), Southdown (9134), Hampshire (26,400), Oxford Down (3555), Dorset Horn (10,285), Shropshire (8492), Lincoln (17,880). Besides these, returns were received for a small number of flocks for each of ten other pure breeds, referred to below as "various pure breeds" (10,010), and for certain cross-bred flocks (19,480).

Fertility.—The importance of fertility as a factor in the survival of a species is referred to, and some of the influences attending domestication which tend to reduce that importance are pointed out. Reference is made to Prof. Karl Pearson's account of the racial characteristic of fertility in the human species, and it is demonstrated that, in spite of the equalising effects of domestication, fertility in different breeds of sheep is also of a racial character.

Owing to the fact that the returns supplied by flock-masters of the number of lambs born are admittedly not always correct, and in view of the fact that the record of twins produced is considerably more accurate, statistics of the latter have been chiefly utilised for generalisations regarding fertility. These records show that the pure breeds dealt with stand in the following order:—

Suffolk (52·22 per cent. of twins), Shropshire (46·84), Dorset Horn (37·55), Oxford Down (35·02), Kent (31·38), Lincoln (29·09), various pure breeds (28·09), Hampshire (24·09), Southdown (18·67); that the average percentage of twins for these breeds is 30·02; and that the cross-bred flocks produce 31·04 per cent. of twins.

From this return, it is seen that the value of the Suffolk and Shropshire breeds, as prolific breeds, is incontrovertible, while the records of the Southdowns is so low as to show urgent need for close attention to the subject on the part of breeders. It is to be noted that several of the pure breeds show a higher rate of fertility than the cross-bred flocks.

The fertility of certain of the pure breeds is then examined with regard to locality, and it is demonstrated that while locality may affect the fertility of a breed, it does not do so to a sufficient extent to alter the racial characteristic of the fertility of the breed. The chief possible exception to this is found among flocks of Lincoln sheep kept in Yorkshire, in which the percentage of twins recorded is practically double the percentage obtained in the home county; but it is pointed out that, in this case, there are circumstances which indicate the difference is due to an abnormally low percentage of fertility in the Lincolnshire rather than to an especially high rate of fertility in the Yorkshire flocks.

The influence of management, of the condition, kind and amount of food available, of the season, weather, subsoil, and the age of breeding ewes upon the fertility of a flock was referred to.

Considering the percentage of lambs produced by the pure-bred flocks individually, it is seen that the percentage ranges, in 306 flocks, from 203·8 to 59·09 per cent., the most frequent percentage being between 110 and 120 per cent.

As regards the different breeds, the most prominent points demonstrated by this inquiry are the value of the Suffolk breed from a point of view both of fertility and low rate of loss from abortion and barrenness; the unsatisfactory condition of Southdowns, both as regards fertility and loss; the urgent need for investigation of the fertility of Dorset Horn ewes with rams of their own breed; and of the conditions affecting both fertility and loss in flocks of Lincolns in the home county.

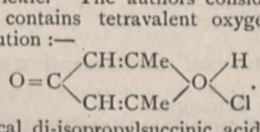
Physical Society, June 9.—Prof. Lodge, President, in the chair.—The Secretary read a paper, by Mr. C. G. Lamb, on the distribution of magnetic induction in a long iron bar. A Lowmoor iron rod, whose length was 250 times its diameter, was taken, and a B–H curve plotted by ballistic measurements made with a search coil at the centre of the bar. The search coil was then moved along the bar, and the distribution of induction was determined for magnetising forces varying from H = ·74 to H = 35·0. Up to fields of 3·35 the induction leaks out more and more quickly as H increases, but above this value the induction tends to keep in more and more. From the curves obtained, the mean induction was deduced as well as the distance of the resultant pole from the middle of the bar. It is shown that this distance first decreases and then increases with the rise in field strength. According to the ellipsoidal theory, it should be constant. The bar was then made into a ring, and the B–H curves again determined. From these curves, together with known relations between B, H and μ, curves showing the variation of μ along the bar were constructed. The Chairman gave a general explanation of the way the leakage depended upon the permeability in the case of a long iron bar.—A paper on the absolute value of the freezing point was read by Mr. Rose-Innes. The corrected values of the absolute value of the freezing point determined by Lord Kelvin from experiments on hydrogen air and carbonic acid contain discrepancies amounting to 1/3 per cent. between the carbonic acid and the hydrogen, while the separate measurements for carbonic acid agree among themselves to about 1/6 per cent. Starting with Lord Kelvin's equation for the forcing of a gas through a plug, the author has obtained a formula for the ab-

solute value of the freezing point, which can be worked out from the experimental researches of Regnault. The formula is based on the experimental proof by Joule and Kelvin, that the ratio between the cooling effect per atmosphere of differential pressure and the pressure is constant for all pressures. Applying data from Regnault's experiments to the formula deduced by the author, the values of the freezing point are practically the same as those given by Lord Kelvin. Hence it is thought probable that the discrepancies are due to inaccuracies in the experiments of Regnault which were conducted at constant pressure. The value of the zero calculated from experiments on hydrogen at constant volume made by M. Chappius is, if we treat hydrogen as a perfect gas, 273·034. Applying a thermodynamic correction for the deviation of hydrogen from the laws of a perfect gas, the value of the freezing point becomes 273·19. This figure agrees very closely with the value 273·14 obtained by Lord Kelvin from the constant pressure experiments on air. The correction has only been applied to hydrogen, because in this case it is so small that a large percentage error in its determination has a very small effect upon the absolute value of the freezing point. In constant pressure work the experiments are difficult to carry out, and the correction is easily applied, while in constant volume work the experiments are easily performed, and the thermodynamic correction is difficult to apply. Prof. Gray expressed his interest in the manner in which Mr. Rose-Innes had obtained his results without using the experimental data of Joule and Kelvin, and pointed out that Lord Kelvin attached most importance to the results he had obtained for air. It would be useful to have the gas constants redetermined with greater accuracy. The compensating arrangement devised by Prof. Callendar would enable experiments at constant pressure to be carried out satisfactorily. Dr. Lehfeldt drew attention to the sign of the correction applied by the author, and asked if it should not be negative instead of positive. He pointed out that variation in the specific heat of a gas might affect the formula, and said that Boltzmann had shown that it was impossible to determine an absolute temperature without introducing calorimetric measurements. As Joule and Kelvin had sometimes found positive and sometimes negative values for the cooling effect in the case of hydrogen, large percentage errors might occur in the value of the correction. Mr. Blakesley asked what the probable error was in the numbers given by Lord Kelvin. Mr. Watson said that the author had calculated the value of the freezing point from experiments on hydrogen, and had shown that the result agreed closely with the value of the zero deduced by Lord Kelvin from experiments on air. He would like to know what agreement would be got by applying Mr. Rose-Innes' correction to the case of air. Mr. Rose-Innes, in replying, said he agreed with Prof. Gray that it would be useful to have the constants redetermined. It was only in their early work that Joule and Kelvin observed a cooling effect for hydrogen, the bulk of the experiments giving a heating effect. The sign of the correction depended on the increase or decrease of the effect with temperature, and was positive in the case of hydrogen. Regnault has proved experimentally that the value of the specific heat is constant.

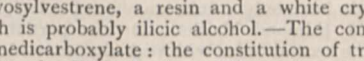
Chemical Society, June 1.—Dr. W. H. Perkin, Vice-President, in the chair.—The following papers were read :—The hydrosulphides, sulphides and polysulphides of potassium and sodium, by W. P. Bloxam. The author has prepared substances of the following compositions :—

$K_2S,2H_2O$; $K_2S,5H_2O$; $K_2S,12H_2O$; $Na_2S,9H_2O$; $2KHS,H_2O$; $NaHS,2H_2O$; $NaHS,3H_2O$; $K_4S_5,10H_2O$; $K_4S_8,6H_2O$; $K_4S_8,19H_2O$; K_4S_9,xH_2O ; K_4S_{10},xH_2O ; and $Na_4S_9,14H_2O$.

—On the relative efficiency of various forms of still-head for fractional distillation, by S. Young. The author has tested the efficiency of a number of forms of still-head in common use, and has devised new forms of greater efficiency.—The salts of dimethylpyrone and the quadrivalence of oxygen, by J. N. Collie and T. Tickle. The authors consider that dimethylpyrone chloride contains tetravalent oxygen, and has the following constitution :—



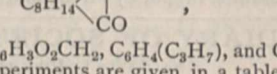
—The symmetrical di-isopropylsuccinic acids, by W. A. Bone and C. H. G. Sprankling. By the action of isopropyl bromide on ethyl sodioisopropylcyanosuccinate and subsequent hydrolysis of the ethereal salt produced, the authors have obtained *cis-* and *trans*-di-isopropylsuccinic acid ; the dissociation constants have been determined.—Active and inactive phenylalkyloxyacetic acids, by A. McKenzie. Phenylalkyloxyacetic acids, in which the alkyl group is either ethyl, methyl, propyl or isopropyl, have been prepared from lævo and inactive mandelic acid ; in some cases racemation occurs.—The chemical composition of the oleo-resin of *Dacryodes hexandra*, by A. More. The oleo-resin of *Dacryodes hexandra* contains lævopinene, lævosylvestrene, a resin and a white crystalline substance which is probably ilicic alcohol.—The condensation of ethyl acetonedicarboxylate : the constitution of triethyl orcintricarboxylate, by D. S. Jerdan. The author has obtained a diethyl orcintricarboxylate as a new condensation product of ethyl acetonedicarboxylate ; the diethyl- and triethyl-salt both yield derivatives of two orcindicarboxylic acids, so that the constitution of triethyl orcintricarboxylate is determined.—A series of substituted nitrogen chlorides, by F. D. Chattaway and K. J. P. Orton. The authors have prepared a number of substituted nitrogen chlorides by aid of a reaction represented by the following equation :—



Royal Microscopical Society, May 17.—Mr. E. M. Nelson, President, in the chair.—Mr. C. L. Curties exhibited and described a new electrically heated stage for the microscope, made by Reichert. It was constructed so as to be heated by the current from the ordinary electric lighting supply. By an ingenious automatic arrangement the stage could be maintained at any required temperature to within 0·1° C.—Messrs. Watson and Sons exhibited a form of dissecting stage, designed by Mr. T. G. West, which could be used with any microscope without damaging the stage of the instrument when doing rough work.—The President called attention to some beautiful photographs of Mr. Grayson's rulings, taken by Mr. Wedeles.—Dr. Sorby's communication not being forthcoming, the President read a paper on the fine adjustment. He described the various forms which had been adopted from time to time, and said that in the course of his investigations he had discovered that Varley's inventions had been ascribed to others, and that the long lever fine adjustment generally ascribed to Ross was really first made by Powell.—The President then called attention to the exhibition of "pond life" by Fellows of the Society and Members of the Quekett Microscopical Club.

PARIS.

Academy of Sciences, June 5.—M. van Tieghem in the chair.—On the development in series of the integrals of differential equations by Cauchy's method, by M. Émile Picard.—Remarks on the formation of alcohol and carbonic acid, and on the absorption of oxygen by the tissues of plants, by M. Berthelot. Some remarks on a note in the previous number of the *Comptes rendus*, by M. A. Devaux. M. Berthelot recalls some experiments on the formation of alcohol made by him in 1860, and emphasises the necessity of very careful manipulation in experiments of this nature. Thus the alcohol may be driven off by a current of hydrogen at 110°, if the carbon dioxide is to be determined, or in a rapid current of steam if the isolation of the alcohol only is aimed at. If the manipulation of the leaves is not carried out as rapidly as possible, alcohol is readily formed during the process.—On the molecular refractions, molecular dispersion, and specific rotatory power of the combinations of camphor with some aromatic aldehydes, by MM. A. Haller and P. Th. Müller. The substances studied would be represented by the general formula



where R was C_6H_5, $C_6H_3O_2CH_2$, $C_6H_4(C_3H_7)$, and $C_6H_4(OCH_3)$. The results of the experiments are given in a table showing the molecular refractions of each of these substances for the rays Na, H_α, H_β, H_γ, the molecular dispersion, and the specific rotatory power $(\alpha)_D$ at 20°, all determined in toluene solution. Both the molecular refractions and dispersions deviate strongly from the values calculated from the usual moduli, and this peculiarity is still more marked in the specific rotatory power, which for camphor is about 42°, and for these aldehyde camphors is of the order of 500°.—Construction of a plane mirror of 2 metres diameter by mechanical methods, by M. P.

Gautier.—Stellar photographs taken with the large telescope of the Observatory of Meudon, by M. H. Deslandres. The telescope used had a great focal length (25 times the aperture, 60 cm.); the photographs taken of the moon, Jupiter, Saturn, and nebulæ are said to compare well with the earlier work of Pickering, Scheiner, and Lord Rosse.—Remarks on the preceding communication, by M. J. Janssen.—On the determination of reference points in the spectrum, by M. Maurice Hamy.—On indeterminate equations of two or three variables which have only a finite number of solutions in prime numbers, by M. Edmond Maillet.—On the partial differential equations of the second order with real characteristics, by M. J. Coulon.—On the calculation of the constant of rectilinear diameters, by M. E. Mathias. The method given for the determination of the constant a is applied to the observations of Knietsch on chlorine. The value of the constant in this case is 0·5872, showing that the assumption made by Thorpe and Rücker that $a=1$ is wanting in generality.—New galvanometric method, by M. Féry. When the torsional couple acting on the suspended portion of the galvanometer is weak, considerable uncertainty is introduced into the results by the uncertainty of the zero. By measuring the angular velocity with which the suspended system starts off, this difficulty is avoided.—On the use of potassium chlorate in explosives of the ammonium nitrate class, by M. H. Le Chatelier. From a solution containing potassium chlorate and ammonium nitrate, crystals of very constant composition and containing 5 per cent. of the former salt can be separated by modifying the temperature and composition of the mother liquor. These crystals, used instead of pure ammonium nitrate in safety explosives, have a greater certainty of detonation.—On the effect of low temperatures upon certain steels, by M. F. Osmond. The results of the experiments upon certain alloys of nickel and iron are in general agreement with those of Dewar and Fleming upon the same subject, the steel acquiring magnetic properties at the temperature of liquid air.—Action of phosphoretted hydrogen upon copper, cuprous oxide, and ammoniacal solutions of copper salts, by M. E. Rubénovitch. Metallic copper reacts with PH_3 at 180°–200° giving hydrogen and Cu_3P. Cuprous oxide reacts with the same gas at ordinary temperatures, giving the same copper phosphide and water. Various salts of copper, if treated in ammoniacal solution with hydrogen phosphide, behave differently according to the nature of the salt.—On the aloins, by M. E. Léger. Two distinguishing tests are given for barbaloin, and several derivatives are described prepared from the aloes of Natal.—On some derivatives of the unsymmetrical tetra-methyl-diamido-diphenylethane, by M. A. Trillat.—Study of some substituted diphenyl-anthrones, by M. L. Tétry.—On some colour reactions of the oxycelluloses, by M. Edm. Jandrier.—Contribution to the study of mineral waters: on the Croizat spring, near Mont Doré, by M. F. Parmentier. The results of an analysis of the water are given. Iron is absent, but salt and arsenic are present in notable quantities.—On mineral waters containing fluorine, by M. Parmentier. The waters analysed by the author contain no trace of any fluorine compound.—Modification of the respiration of plants produced by varying the temperature, by M. W Palladine.—On the systematic position of *Trichophyton* and neighbouring forms in the classification of fungi, by MM. L. Matruchot and Ch. Dassonville.—The coal-bearing strata of the central Pyrenees, by M. Caralp.—Concerning the effect of blood serum in preventing the action of rennet, by MM. L. Camus and E. Gley. Reclamation of priority against M. A. Briot.—Coagulating action of the liquid from the external prostate of the hedgehog on the contents of the seminal vesicles, by MM. L. Camus and E. Gley.—Bunge's law, and the mineral composition of the newly-born infant, by M. L. Hugounenq.—Lesions of the nervous centres in experimental epilepsy of absinthe origin, by M. G. Marinesco.

DIARY OF SOCIETIES.

THURSDAY, JUNE 15

ROYAL SOCIETY, at 4.—Prof. A. Michelson will read a Paper.—A Comparison of Platinum and Gas Thermometers at the International Bureau of Weights and Measures at Sèvres: Dr. J. A. Harker and Dr. P. Chappuis.—A Preliminary Note on the Life-History of the Organism found in the Tsetze Fly Disease: H. G. Plimmer and Dr. J. Rose Bradford, F.R.S.—The Colour Sensations in Terms of Luminosity: Captain Abney, F.R.S.—On a Quartz-Thread Gravity Balance: R. Threlfall, F.R.S.—On the Orientation of Greek Temples, being the Results of some Observations taken in Greece and Sicily in May 1898: F. C. Penrose, F.R.S.—And other Papers.

LINNEAN SOCIETY at 8.—Contributions to the Natural History of Lake Urmi and its Neighbourhood: R. T. Günther.—A Systematic Revision of the Genus Najas: Dr. A. B. Rendle.—On the Anatomy and Systematic Position of some Recent Additions to the British Museum Collection of Slugs: Walter E. Collinge.—The Edwardsia Stage of Lebrunia, and the Formation of the Œsophagus and Gastro-cœlomic Cavity: J. E. Duerden.

CHEMICAL SOCIETY, at 8.—Ballot for the Election of Fellows.—On the Decomposition of Chlorates, with special reference to the Evolution of Chlorine and Oxygen: W. H. Sodeau.—The Action of Hydrogen Peroxide on Formaldehyde: Dr. A. Harden.—Homocamphoronic and Camphononic Acids: A. Lapworth and E. M. Chapman.—Action of Silver Compounds on α-Dibromocamphor: A. Lapworth.—The Colouring Matter of Cotton Flowers: A. G. Perkin.—Experiments on the Synthesis of Camphoric Acid: H. A. Auden, W. H. Perkin, jun., and J. L. Rose.—Methylisoamylsuccinic Acid, Part I.: W. T. Lawrence.

SATURDAY, JUNE 17.

GEOLOGISTS' ASSOCIATION.—Excursion to Lichfield and Cannock. Directors: Prof. C. Lapworth F.R.S., and Prof. W. W. Watts.

MONDAY, JUNE 19.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Exploration between Lake Rudolf and the Nile: Colonel J. R. L. Macdonald, R.E.

VICTORIA INSTITUTE, at 4.30.—Address by the Right Hon. Sir Richard Temple, Bart.

TUESDAY, JUNE 20.

ZOOLOGICAL SOCIETY, at 8.30.—On the Species of Cassowaries: Hon. Walter Rothschild.—On the Remains of a New Bird, *Praphaethon shrubsolei*, gen. et sp. nov., from the London Clay of Sheppey: C. W. Andrews.—On the Antipatharian Corals of Madeira: J. Y. Johnson.

MINERALOGICAL SOCIETY, at 8.—On the Constitution of the Mineral Arsenates and Phosphates. III. Plumbogummite and Allied Minerals: Mr. Hartley.—Note on Plumbogummite: Prof. Miers.—On a Pyroxene from South Africa: Mr. Bowman.—On the Chemical Composition of Tetrahedrite: Messrs. Prior and Spencer.—(1) On a Constituent of the Meteoric Iron of Youndegin, Western Australia; (2) On the Meteoric Stones which fell at Mount Zomba, British Central Africa, on January 25, 1899: Mr. Fletcher.

ROYAL STATISTICAL SOCIETY, at 5.—The Flag and Trade: A. W. Flux.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Retouching: Redmond Barrett.

WEDNESDAY, JUNE 21.

GEOLOGICAL SOCIETY, at 8.—Agglomerates, Ashes, and Tuffs in the Carboniferous Limestone Series of Congleton Edge: Walcot Gibson and Wheelton Hind.—Ironstone Fossil Nodules of the Lias: E. A. Walford.—Additional Notes on the Glacial Phenomena of Spitsbergen: E. J. Garwood.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—Heavy Falls of Rain recorded at the Observatories connected with the Meteorological Office, 1871–98: Robert H. Scott, F.R.S.—Average Height of the Barometer in London: R. C. Mossman.—A New Self-recording Anemoscope: Joseph Baxendell.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Notes on some Sponges belonging to the Clionidæ obtained at Madeira: J. Y. Johnson.

CONTENTS.

	PAGE
The Anthropology of Baden. By R. L.	145
Limnology	146
Heart and Science. By H. W. B.	147
Our Book Shelf:—	
Sébire: "Les Plantes Utiles du Sénégal—Plantes Indigènes—Plantes Exotiques."—**J. M. Hillier**	148
Elsden: "Applied Geology"	148
Lubbock: "On Buds and Stipules."—**J. B. F.**	149
Younghusband: "The Philippines and Round About"	149
Tennant: "The Slide Valve Simply Explained."—**A. S.**	149
Letters to the Editor:—	
Expansion of Solids by Heat. (*Illustrated.*)—**Horace Darwin**	149
Bessel Functions.—**Prof. A. Gray, F.R.S.**	149
Larvæ from the Head of an Antelope.—**Richard Crawshay; Walter F. H. Blandford**	150
Walrus.—**Kumagusu Minakata**	150
Strawberry Cure for Gout.—**Donald Ferguson**	150
The Fresh-water Pearls of America. By R. L.	150
The Geology of Mont Blanc. (*Illustrated.*) By **Prof. T. G. Bonney, F.R.S.**	152
The Berlin Tuberculosis Congress (1899). II. By **Dr. F. W. Tunnicliffe**	154
Notes	155
Our Astronomical Column:—	
Tempel's Comet (1873 II.)	161
Return of Comet Holmes (1892 III.)	161
Comet 1899 *a* (Swift)	161
White Spot on Jupiter	161
Two New Variable Stars	161
The Bore at Moncton, Bay of Fundy. (*With Diagram.*)	161
The Boyle Lecture on the Perception of Musical Tone	163
The Darmstadt Museum	164
University and Educational Intelligence	164
Societies and Academies	166
Diary of Societies	168