THURSDAY, OCTOBER 25, 1900.

THE ENGLISH GAULT AND UPPER GREENSAND.

Memoirs of the Geological Survey of the United Kingdom. The Cretaceous Rocks of Britain. Vol. I. The Gault and Upper Greensand of England. By A. J. Jukes-Browne, B.A., F.G.S. With contributions by William Hill, F.G.S. Pp. xiv + 499. (Published by order of the Lords Commissioners of H.M. Treasury, 1900.)

TO review this book is no easy task. To select is difficult when details are so full; to criticise requires one to have studied, at any rate, certain districts of Cretaceous deposits as thoroughly as Mr. Jukes-Browne, by whom it has been written. So, in regard to the latter, we reserve the right of private judgment only on one or two small matters. A slip of the pen on p. 411, line 47, substituting eastern for western, and the reference to the map at the bottom of the same page (to a less degree) will cause a passing perplexity to readers. But who can help occasionally nodding in passing five hundred pages through the press? To have included the Cretaceous deposits of Scotland and Ireland, would, we think, have made the subject more complete, and not materially increased the number of pages. We think also that Neocomian is big enough and distinct enough, physically and palæontologically, to be released from its subject position of Lower Cretaceous. Surely its claims to systematic independence are as good as those of Oligocene. Yet that has been officially welcomed while Neocomian is slighted. Mr. Jukes-Browne has, however, coined a new, though more subordinate name—that of Selbornian—to include the Gault and Upper Greensand, from the place hallowed by the memory of Gilbert White. We confess to retaining something of primitive man's prejudices against strangers, especially in nomenclature, but must admit that its author makes out a very strong case for the novel term. Briefly stated it is this: During the last twenty years it has been gradually ascertained that the Gault and Upper Greensand in this country are not two distinct stages of the Cretaceous system, but that "the greater part of the Folkestone Gault and the greater part of the so-called Upper Greensand are correlative deposits formed at the same time in different parts of the same sea." As the author shows, uncertainties in regard to their usage prevent us from borrowing either Albien or Cenomanien from the French, and, as a comprehensive term is so much needed, we have no choice but to coin a new one.

In a series of chapters Mr. Jukes-Browne, aided by Mr. William Hill, whose services in the field as well as in microscopic investigations have been of the highest value, describes the Selbornian in different districts. First, however, by way of clearing the ground, comes an introductory chapter on the Upper Cretaceous system as a whole; a second contains an historical account of the Chalk, Upper Greensand and Gault. For purposes of reference, this epitome of various opinions will be very useful, and has probably cost Mr. Jukes-Browne more labour than any other chapter in the book, for tracking down misconceptions and errors is a longer business and less exciting than hunting a fox, while the prey is equally malodorous and worthless. A chapter follows on the value of zones in the Cretaceous system, and another with a general account of the Selbornian. The Lower Gault, the most persistently argillaceous member, is a little over 34 feet thick at Folkestone; it increases to 90 feet at Devizes, is proved by borings to be 150 feet in Bucks, and in Bedfordshire may perhaps be still thicker; thence it thins gradually towards the north-east, till at Roydon, in Norfolk, it is only 7 feet. Afterwards it disappears as a clay, being represented by part of the Red Chalk from Hunstanton to Speeton. It is separable into three zones—that of *Ammonites mammillatus* at the base, thin, sandy, perhaps sometimes absent; then that of *A. interruptus;* the third being that of *A. lautus*. The Upper Gault with part of the Upper Greensand, the zone of *A. rostratus*, is lithologically variable, consisting of marly clays in the south-east, in Bucks and in South Norfolk, it becomes more sandy elsewhere (as in the Isle of Wight, and especially in Dorset and Devon) while in most other parts it is largely composed of the rock known as malmstone. The Warminster Beds, or the zone of *Pecten asper*, arenaceous and containing chert, form the uppermost division of the Selbornian. All have their equivalents in the Red Chalk of Norfolk and the north-east. The third and second are missing in the neighbourhood of Cambridge; while in the west the Haldon Beds begin and end a little later than those of Blackdown.

Details are given of the sections in different parts of England, including those pierced by borings under London and in the Eastern counties, with lists of fossils and information of economic value, while Mr. W. Hill supplies two very interesting chapters on the lithology of the Gault and Upper Greensand. From these and the palæontological data Mr. Jukes-Browne concludes that the Gault clays were probably deposited in a sea, increasing in depth from about 150 to 200 fathoms, the sands of the upper part indicating stronger currents, possibly without any shallowing. He also discusses the physical geography of the period and the direction from which the sediment came. Here perhaps he touches on questions too speculative for an official publication, which should be restricted as far as possible to facts and to such inferences as follow directly from them. In this matter, while accepting Mr. Jukes-Browne's general conclusions as to physical geography, we doubt, for that very reason, whether the mud can have been brought from the south-east. If the region in which it was deposited was then an elongated gulf, open in that direction to the sea, we are unable to understand how an inflowing current of any strength could have been produced. If the gulf resembled the Red Sea, the inset from without would be sufficient to balance evaporation but not strong enough to carry the mud very far; while if it received important rivers, the flow and consequent supply of material would be from the opposite direction. Mr. Jukes-Browne, it is true, refers to the possibility of a return coast current from the north, but we fail to see how, in a gulf of this form, the

"blind-cord" action could be set up enough to be a primary agent in the transportation of sediment.

Quitting this very debatable question, we heartily congratulate Mr. Jukes-Browne and the Survey on this instalment of a complete memoir on the Cretaceous rocks of England. The possession of a synoptic view of any one formation is a great boon to geologists, as it saves them from the labour of hunting through a number of separate Survey memoirs. In future it might perhaps be well to shorten those explanatory of the maps by reserving all broader question for volumes like the present one. In this we note with especial pleasure the inclusion of chapters written by a geologist without any official position as an indication that the Survey now welcomes external help. The "get-up" of the volume shows improvement, but there is room for more. The illustrations, for instance, suffer from the thinness of the paper, through which the type can be seen. This defect spoils an excellent outline sketch on p. 152. A few plates, however, are printed on separate paper, and yet the book is issued at a moderate price. Difficult as it notoriously is to overcome the love of saving a ha'porth of tar so characteristic of Treasury officials, we wish the Director-General still greater success in persuading them to come nearer to the level of the volumes issued by the Geological Survey of the United States.

T. G. BONNEY.

THE PRINCIPLES OF PATENT LAW.

The Law and Practice relating to Letters Patent for Inventions. By R. W. Wallace and J. B. Williamson. Pp. lxv + 922. (London: W. Clowes and Sons, Ltd., 1900.)

THE subject of inventions is always an interesting one whether to the manufacturer or to the man of science, nearly all new improvements in commercial chemistry or mechanics being, in these days of vigorous competition, sought to be protected by Letters Patent. Whether the English system of patent law is entirely satisfactory in all its details is a matter on which there are many opinions, and the Committee now inquiring into this may possibly suggest some alterations being made.

As a guide to the existing state of the law up to the most recent decisions in the Courts, Messrs. Wallace and Williamson have issued this volume, which may be called a treatise rather than a text-book. The arrangement and division of the subject is clear; starting from the granting of the Letters Patent, the reader is carried on to what is required of an inventor to render the grant valid and up to the petition for extension. Very little attention is given to the past history of the law, only a few pages being devoted to the well-known cases of the early part of the seventeenth century and a few remarks made on the history of claims. On the difficult subject, in which every discoverer of some new process must be interested, of what is necessary to constitute a patentable invention, the authors have not attempted to lay down any definition of their own, but have devoted two chapters to a careful collection of the important decisions on the point. In fact, throughout the book there is given the material for forming an opinion rather than definitions.

For those who have not a well-stocked library of law-books there is the very great advantage that this volume gives verbatim extracts of nearly every important case, and even for those who have the books at command it will often save them the trouble of hunting up the passages they most often need. For those professionally interested in the subject there is a full and accurate account of the various steps in an action for infringement, which is very clearly set out; and after 600 pages of text there are some 250 of appendices containing the various statutes, together with forms and precedents for almost every conceivable case.

The principles upon which the specifications and claims should be drafted are adequately dealt with, and the question of amendment is gone into. There is a short chapter on the procedure on petitions for compulsory licenses, which procedure, curiously enough, does not appear to have attracted the attention of those who would be likely to benefit by it until within the last two or three years.

The printing of the work has been well done in large type and on good paper, the headings to the various paragraphs being sufficiently clear. A conspicuous feature of the work is the full index and the table of cases, which gives with each case the date of the decision and the subject-matter of the patent decided on. The book may confidently be recommended to any one desiring a complete account of the principles upon which our system of patent law is founded, as well as to those who constantly require a trustworthy book of reference.

HISTORICAL CHEMISTRY.

Lectures on the History of the Development of Chemistry since the Time of Lavoisier. By Dr. A. Ladenburg. Translated from the second German edition by Leonard Dobbin, Ph.D., with additions and corrections by the author. Pp. xvi + 373. (Edinburgh: Published for the Alembic Club by W. F. Clay. London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1900.)

THE small knot of chemists in Edinburgh who constitute the Alembic Club have already earned the thanks of chemists by placing at the disposal of English readers their valuable reprints of important chemical memoirs, a series which it is hoped may run on long and, if possible, at an increasing rate. The present volume is a more ambitious undertaking, being the translation of a substantial work which has long enjoyed much favour in Germany as a lucid and not too bulky account of the development of modern chemistry.

English chemical literature is not rich in original historical writing, though there are at least one or two British chemists who may be looked to with confidence for the occasional production of a scholarly and readable contribution. Going back a long way, it may be said that Thomas Thomson's "History" is inferior to no book of the kind published since—in respect to literary style and readableness. But in those days the science was narrower, and it was well within the ability of one man to do justice to the whole subject. The exhaustive historical

writings of Hermann Kopp, and the more recent contributions of Berthelot, leave little to be desired in completeness, and provide a repository of information invaluable for purpose of reference. This, however, is literature for the fully fledged chemist or chemical author.

The chemical student requires something different. The importance to him of attending to the historical aspect of chemistry is recognised by most teachers. It is indeed maintained by some that there is no other satisfactory way of approaching even the elements of chemistry, than by performing experiments in historical order. A Board School might be cited where the older boys are given the Alembic Club reprints, and asked to do the experiments as there described. Whatever may be thought of this, it cannot be denied that a study of chemical history is most important, not only for a clear grasp of the origin and growth of our present theories, but because of that more subtle influence on the mind and imagination which perhaps may be included in the much-abused word culture.

The full advantage of historical study is not to be obtained by the reading of such a work as the one under notice, but rather by the careful study of those original memoirs or books which will ever remain landmarks in the track of scientific progress. At the same time, a connected history is a useful and perhaps a necessary adjunct to these partial studies, and this want is met extremely well by the book under notice.

Prof. Ladenburg has cast his story in the form of lectures, and for the purpose in view this is a satisfactory arrangement. In tracing the history of chemistry from the time of Lavoisier to the present day a vast amount of material has, of course, to be dealt with ; and of the prodigious amount of reading and critical examination entailed upon the author there is abundant evidence both in the text and in the numerous references which are appended. As to the general balance of the book it may be said that the earlier part is fuller and more explanatory than the later. The account, for example, of the controversy between Berthollet and Proust is very clear and interesting, whilst the accounts of the controversies that raged later in the century in regard to fundamental questions of organic chemistry are much more compressed and difficult to follow. The last chapter of the book is little more than an enumeration of the chief chemical topics that have engaged attention during the past fifteen years.

However, looking at the book as a whole, it must be said that Prof. Ladenburg has produced a most useful history, extremely readable considering the inevitable compression, remarkably free from the bias of personal opinions, and giving a connected view of the progress of chemical science which will be of great benefit to students.

Dr. Dobbin has succeeded admirably in the arduous work of translating narrative German into narrative English. Here and there sentences are to be found which declare their origin ; but on the whole the English (or should one say British ?) flows smoothly, and there is a remarkable absence of typographical errors or mistakes of a more serious kind. Dr. Dobbin and the Alembic Club may certainly be congratulated on their latest contribution to chemical literature. A. S.

OUR BOOK SHELF.

Untersuchungen über Mikrostrukturen des erstarrten Schwefels nebst Bemerkungen über Sublimation, Überschmelzung und Übersättigung des Schwefels und einiger anderer Körper. By O. Bütschli. Pp. iv + 96; 4 plates. (Leipzig : W. Engelmann, 1900.)

Untersuchungen über die Mikrostruktur künstlicher und natürlicher Kieselsäuregallerten (Tabaschir, Hydrophan, Opal). By O. Bütschli. Pp. 287–348 ; 3 plates. (Reprinted from *Verhandl. d. Naturhist.-Med. Vereins zu Heidelberg*, N.F. Band vi. 1900.)

A PREVIOUS work by the professor of zoology at Heidelberg ("Untersuchungen über Strukturen," 1898), reviewed in NATURE (vol. lx. p. 124), dealt more especially with the microstructure of organic substances, comparing them with the supposed alveolar structure of protoplasm. In the first of the present pamphlets the author describes in minute detail his observations in the same direction made on inorganic substances, more particularly sulphur. Amongst the various globular and crystalline forms produced by the sublimation and subsequent transformations of sulphur, he describes some which have a radial or concentric arrangement of vacuities or air-spaces suggesting an alveolar structure. The subject is, however, treated throughout from a crystallographic rather than from a biological point of view, and much the same ground has been covered in a more concise and earlier paper by Dr. R. Brauns, the professor of mineralogy at Giessen ("Beobachtungen über die Krystallisation des Schwefels aus seinem Schmelzfluss," *Neues Jahrb. f. Mineralogie, &c.*, 1899, Beil.-Bd. xiii. pp. 39–89 ; 7 plates).

The second pamphlet describes with equal minuteness the appearances shown under the microscope by chips and thin sections of dried gelatinous silica, as well as of the natural forms of colloidal silica, tabasheer and opal (including hydrophane and precious opal), which are all very similar in their minute structure.

Both pamphlets are admirably illustrated with numerous well-prepared microphotographs.

The School Journey. A Means of Teaching Geography, Physiography and Elementary Science. By Joseph H. Cowham. With additional "Journeys" by G. G. Lewis and Thomas Crawshaw. Pp. 79. (London : Westminster School Book Depôt, 1900.)

FOR many years the study of geography at the Westminster Training College has been supplemented by an excursion from Croydon to Godstone, under the guidance of Mr. Cowham, the lecturer on education at the college, and the author of several excellent educational works. In this volume a description is given of the chief characteristics observable during the ramble ; and horizontal and vertical sections, as well as photographic illustrations, elucidate the physical geography of the district traversed. In addition, the book contains accounts of excursions to Greenwich and Woolwich, and along a river bank in Lancashire, contributed by two of Mr. Cowham's former pupils.

The book appears at the right psychological moment ; for the feeling that geography should, whenever possible, be made an outdoor study, is spreading, and every statement of experience is of value to teachers who want to improve methods of instruction in geography but are unable to see clearly how to carry out schemes which have been put on paper by persons who may not have given full consideration to ways and means. Here, however, we have notes upon actual excursions and how they were planned and performed, and with these before them, teachers should have no difficulty in arranging others if they have some knowledge of physical geography. The Geologists' Association and Prof. Seeley's Geological

Field Class provide teachers in London or the neighbourhood with exceptional opportunities for acquiring a knowledge of the significance of the geological structures and formations in the home counties, and Mr. Cowham's book will show them how the facts can usefully be applied to school excursions.

Air, Water and Food. By Ellen H. Richards and Alpheus G. Woodman. Pp. 226. (London: Chapman and Hall, Ltd. New York: John Wiley and Sons, 1900.)

OF the many volumes which have been written on these subjects, there are few which, in the opinion of the writer, can be more safely recommended to the student of sanitary science. Each of the three subjects is introduced and fairly discussed in language which is clear, trenchant and concise.

The authors are, moreover, no mere theorists, but describe the operations of the laboratory in a business-like fashion which leaves no doubt about their practical knowledge. The diagrams are more successful as illustrations than the photographs, in which, as frequently happens, the glass apparatus has such an ill-defined and ghost-like appearance as to be unrecognisable by the unprofessional eye. In other respects the book is well got up. J. B. C.

Elementary Physics and Chemistry, ii., iii. By R. A. Gregory and A. T. Simmons. Second stage, pp. vi + 140; third stage, pp. vi + 114. (London: Macmillan and Co., Ltd., 1900.)

THESE two volumes complete a work of three parts, consisting of a course of experimental illustration of the elementary principles of chemistry and physics. The syllabus of subjects considered is based on the new Code issued by the Education Department, but the descriptions are by no means confined to it. The subject-matter is arranged in the form of a succession of separate gradated lessons, each consisting of description of apparatus, method of conducting experiment, results obtained and the reasons for them, short summary, and a set of exercises. The books thus arranged seem especially valuable to teachers having to give a comprehensive course in a definite number of lessons—in Evening Continuation Schools, for instance—as the whole work to be gone through may be at once divided into sections. Numerous excellent illustrations add considerably to the utility of the volumes. C. P. B.

Principes D'Hygiene Coloniale. Par Le Dr. Georges Treille. Pp. iv + 272. (Paris: Georges Carré et C. Naud, 1899.)

THIS useful little volume is addressed particularly to those who wish to inform themselves of the physical conditions of life in the tropics with a view to living there, and to those who have an indirect interest in tropical regions. The earlier portion of the volume deals with tropical climatology in general, and in particular with the climatology of the French colonies. A chapter is devoted to considering the action of the climate on bodily functions. The latter portion deals with public and domestic hygiene. In the discussion on European habitations in the tropics, one would have wished to see more stress laid on the importance of Europeans living apart from the natives—a custom which has been so universally adopted in India, and which no doubt accounts to a large extent for the comparative freedom of Europeans from malaria in that country.

We fully endorse the indictment of the use of alcohol specially in the form of absinthe, but we should have liked to see more information on measures to be taken to ensure a supply of good water for domestic purposes. C. B. 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.*]

Genesis of the Vertebrate Column.

IN the review of "The Foundations of Zoology," by Prof. W. Keith Brooks, which was contained in the last number of NATURE, the reviewer quotes from him the following sentence:—"Herbert Spencer tells us that segmentation of the backbone is the inherited effect of fractures caused by bending."

Before the reader accepts this version of my view, he would do well to read §257 of "The Principles of Biology." The simplest expression of that view is contained in the criticism of Prof. Owen's "Theory of the Vertebrate Skeleton," originally published by me in the *British and Foreign Chirurgical Review* for 1858, and now appended to "The Principles of Biology." The sentence setting it forth runs thus:—

"The production of a higher, more powerful, more active creature of the same type, by whatever method it is conceived to have taken place, involved a change in the notochordal structure. Greater muscular endowments presupposed a firmer internal fulcrum—a less yielding central axis. On the other hand, for the central axis to have become firmer while remaining continuous, would have entailed a stiffness incompatible with the creature's movements. Hence, increasing density of the central axis necessarily went hand in hand with its segmentation; for strength, ossification was required; for flexibility, division into parts."

There is here no mention or thought of "fracture"—no implication of a dense part formed and then broken, but the implication of dense matter being deposited in successive separate portions, in such way as to fulfil the two requirements of strength and flexibility. HERBERT SPENCER.

Brighton, October 21.

Albinism and Natural Selection.

A CASE of partial albinism in fishes which has recently come under my notice is likely to be of general interest from the evidence it apparently affords of the value of the normal specific coloration of predaceous fishes, and of the serious disadvantage of conspicuous abnormalities.

A white-skinned specimen of the common hake (*Merluccius merluccius*, L.) was trawled in the Bristol Channel last week amongst a catch of normal hake, and was sent to me from Milford immediately on landing, owing to the fishermen's impression that it belonged to some rare species unknown to them.

It was, however, perfectly normal in all respects except its remarkable leanness and the absence of all pigmentation from the external skin and the inner lining of the buccal cavity and gill-covers. The pigmentation of the retina and peritoneum was normal.

In a normal hake there is a profuse black pigmentation over the upper part of the body, as well as over the inside of the mouth and gill-covers. The general appearance of a normal hake is consequently dusky; that of the abnormal specimen was white.

The lean and emaciated condition of the white hake was very striking, especially in the head region, where not only the bony ridges of the skull and cheeks projected sharply beneath the thin layer of skin, but even the lines of sculpture of the superficial bones were plainly recognisable. In a normal hake, of approximately equal length, with which I compared the specimen, these details were quite invisible, and the bony ridges were rounded off or hidden by the plumpness of the integument. In girth and weight the albino was far inferior to the normally pigmented fish. The albino measured 26¼ ins. in length to the base of the caudal fin, and 6¼ ins. in length of head (from snout to opercular spine). Its girth round the back of the head was 9 ins., and just behind the 10th anal finray 9⅛ ins. The normal hake measured 27½ ins. in length, and had the same length of head as the albino. Its girth in the same two regions was 10⅛ ins. and 10½ ins. respectively. The albino weighed 4 lb. 5 oz., the normal hake 5 lb. 9½ oz., both fish being gutted in the same way.

That is to say, although the length of the albino was only 4½ per cent. less than that of the normal hake, the deficiency in girth amounted to 11 per cent. and the deficiency in weight to 23 per cent.

The question arises whether the emaciation of body, and lack of pigmentation, should be regarded as results of some disease (which was not otherwise apparent); or whether the lean condition should be attributed to the insufficient nutrition of a predaceous fish whose stalking powers had been reduced by its conspicuous appearance.

The hake is a predaceous and nocturnal fish, which preys on mackerel, herring and other active fish, especially at night.

The bulk of evidence appears to favour the view that albinism in fishes is a congenital, and not an acquired character (*cf.* colour variation in flat fishes); and I am not aware that leanness of body is specially correlated with the albino condition.

Perhaps some of your readers could refer me to other records which would throw light on this case?

Plymouth, October 10. WALTER GARSTANG.

Tenacity of Life of the Albatross.

SIR WILLIAM CORRY told me some time ago that on one of his steamships coming from New Zealand, an albatross, supposed to have been choked dead, kept in an ice box at a temperature which was always much below freezing point, was found to be alive at the end of fourteen days. He has been kind enough to obtain for me the following statement in writing from Captain Reed. Of course the birds mentioned in this statement could not really have been choked dead, but I think the facts are very interesting. JOHN PERRY.

October 11.

THE bird referred to was supposed to be killed by being strangled with twine tied as tightly as possible round the neck. This twine was not removed. The beak was closed and tied and the legs crossed behind the tail and tied. It was then wrapped in an old meat cloth and put with three other birds in the return box at the end of the port snow trunk. It remained there for certainly not less than ten days at a temperature of from zero when machine blowing on that side to 18° F. when blowing on the starboard side. The snowboy complained that the bird "grunted" when he went near it with his lamp, and Mr. Coombes, the 1st Ref. Eng. brought it out. When put down on the engine-room floor, it could move its neck about and open its beak, and the eyes were open and lifelike. The lower half of the body and the legs were frozen hard. The fastening on the beak had come off. It was alive for two hours after being taken out, and was then strangled and put in the snowbox.

There was another bird treated in the same way, and hung up by the beak in the meat chamber for over four days, and then found to be alive and able to make a "grunting" noise. The temperature of the chamber was never higher than 4° F., and often 8° to 10° below zero. Mr. Coombes, then 1st Ref. Eng., now in *Star of Australia*, and Mr. Boyes, then 2nd, now 1st Ref. Eng., both declare this to be quite true.

If opportunity offers on the passage home I will try how long it is possible for these birds to live in these low temperatures,

S.S. Star of New Zealand, Wellington, WM. J. REED.
August 22.

The Peopling of Australia.

IN the issue of NATURE for October 4, Mr. J. Mathew has questioned the accuracy of certain observations upon the linguistic part of his book, "Eaglehawk and Crow," which were made by me at the request of Prof. A. C. Haddon, and included by him in the review of Mr. Mathew's book in NATURE for December 28, 1899.

I shall be glad if you will permit me to reply as briefly as possible to the complaints in Mr. Mathew's letter.

Mr. Mathew charges me with being "unnecessarily caustic" in my remarks on his theories, and with attending to "petty points" instead of the main issues. To the former charge I must plead zeal for accuracy, and fear of the formation of hasty conclusions. To the second I may be allowed to say, that as the whole of Mr. Mathew's theory (linguistically at least) is based upon the "petty points," their accuracy is vital to the whole structure. Although on p. 44 of his book Mr. Mathew disavows the fallacy that "likeness of words in sound and meaning is a proof of a common origin," he nevertheless adopts it in very many of his comparisons. Take, for example, the Malay and Central Australian words on p. 59; the south-west Australian and New Guinea words on p. 72, the examples in his chapter on the Malay element in Australian, and the satisfaction expressed in his letter to NATURE at a comparison between Australian, Malay and New Hebridean, because the "terms for father and skin are the same."

My summary of his chapter on the Malay element in Australian is quoted by Mr. Mathew in his letter as "ridiculous nonsense." I maintain that it is a perfectly fair summary of his actual words. He states on p. 5 that "Malay refers generally to the people of that race to the north of Australia without distinguishing nationality," and on page 61 that the Malay invasion came from the north. Speaking of the invaders, he says on page 61, "The straggling stream winds about here and there, touches the shore at various places and recoils back inwards," but when I state that the meaning of this is "wandering about the interior," he says the latter phrase is a "pure invention of Mr. Ray's."

Although Mr. Mathew declares in his letter that the Malays came from an indeterminable (though probably Sumatran) locality, all the Malay words in his proofs are those of the current literary or colloquial Malay, and several of them (*e.g.* tangan, gigi, kapala, bapa, rambut), are by no means the common words used by the Malayan peoples of the Archipelago. In two instances his words are incorrect: *kaka* is wrongly given *kaku* (p. 59), so as to agree with Australian words like *kako*, *kahkonja*, and '*duwan*' (p. 60), said to mean 'ear' is probably meant for *daun*, "leaf," which only means the "external ear," *i.e.* the 'leaf of the ear,' when conjoined with *telinga*.

That Mr. Mathew believes the Malay words were "scattered all over the island continent" plainly appears from his examples. He shows so-called Malay words on the coast of New South Wales, East Queensland, and the extreme east (p. 58); others across the centre of Australia from the Gulf of Carpentaria southward, and on Cloncurry River (p. 59), and others in West Australia (p. 60).

Mr. Mathew states that in the *Journal* of the Anthropological Institute for 1894–5, I have used languages as the basis of a classification of the New Guinea Islanders. That is so, but my method is not comparable with Mr. Mathew's. I showed that certain New Guinea languages (Motu, Keapara, &c.) should be called Melanesian because they agreed with the languages of the Melanesian islands, *almost entirely in grammar, and very largely in vocabulary*, and that others should be called non-Melanesian because they had *no agreements whatever* with the Melanesian. Can Mr. Mathew show by a similar grammatical and lexical comparison, that the Australian is related to any other group of languages? With regard to terms like 'bapa' and 'mama' for 'father' and 'mother,' my argument was that no dependence can be placed on these words to show a connection of languages. They are among the earliest vocables uttered by a human being, and in very many languages of the world have become appropriated to the earliest recognised human relationships.

This is not the time or place to reply to the somewhat contradictory propositions in Mr. Mathew's letter. He wishes me to prove: (1) That words of 'mama' type are not adopted words in Malay; (2) that they were not earlier in use in the East Indian Archipelago; (3) that they are not more markedly Papuan than the 'bapa' type. I may, however, be permitted to remark: (1) That words for father containing the syllable *ma* (of which *mama* is a reduplication) are the commonest in the vocabularies of the tribes of Borneo, Celebes, Philippines, &c., least subject to Malay influence, whilst words containing the syllable *ba* or *pa* are confined to the nearest connections of the Malay. Hence the words of *ma* (or *mama*) type are the original, not adopted words, and (2) were necessarily the earlier in use. Mr. Mathew's second proposition thus contradicts his first. Also (3), the languages of the Papuans in West New Guinea have forms of *bapa* for 'father,' those in Central New Guinea have *babe* or *apai*. One Papuan and all the Melanesian have forms of *ma* (*ama* or *tama*).

Mr. Mathew complains that I have not explained the New Guinea numerals. Could I do this within the limits of a review? The convergence of Australian forms towards Cape York, stated by Mr. Mathew, does not necessarily imply that the words came from New Guinea, and his examples only show that the Saibai

numeral *may be* connected with the Australian. On the opposite New Guinea coast the numerals for 'one' are very different to the Saibai *urapon*. They are: *nambi* (Morehead River), *ambior* (Wasi Kasa), *tarangesa* (Bugilai Tribe), *iepa* (Kunini Tribe), *atanok* (Dabu Tribe), *netat* (Murray Island), *nao* (Kiwai Island), *monou* (Purari Delta), *farakeka* (Papuan Gulf), *aia* (Yule Island). Mr. Mathew asks us to believe that the Kalkadoon numeral "*luadi*" (two) is a Melanesian numeral used in Australia 150 miles south of the Gulf of Carpentaria, when the only comparable form in Melanesia is the Duke of York Island *ruadi* (second). This is a flagrant example of the method adopted, though disavowed, by Mr. Mathew.

The point missed by Mr. Mathew in discussing the phrase "*ori kaiza*," which I called mongrel, is that he has no proof that '*ori*' and '*uroi*' are the same words. Considering that the Gulf tribes have a word (*uiva*) for 'cassowary' (the emu is not found), and that nowhere else in New Guinea is there a word similar to *ori*, meaning 'bird,' and also that it requires a Torres Straits word to give '*ori*' an Australian meaning, it is highly improbable that it can explain words like *waitch*, *wadgie*, *warritch* for "emu." The Saibai for 'big bird' is '*koi urui*,' for 'cassowary,' '*samu*.'

In his letter, Mr. Mathew objects to my calling comparisons of Australian with Malay and New Hebridean "absurd and misleading." He suggests, without any warrant, that I find the absurdity in analogies between Malay and New Hebridean, whereas I have directly affirmed the connection of Malay with Melanesian (including New Hebridean) in the *Journal* of the Polynesian Society for 1896. The real absurdity is that of supposing that there is a relationship between Australian, Malay and New Hebridean, because "the terms for father, skin are the same."

In conclusion, I must again express my regret that Mr. Mathew should regard my criticism of his work as 'mere fault-finding and ridicule.' I have studied these languages for many years (without postulating theories), and have much material yet unpublished. To point out the weakness of Mr. Mathew's argument, with regard to method and deductions is fair criticism, and should not lead to a charge of unsoundness and inaccurate knowledge. If, as Mr. Mathew states, his materials are imperfect, why found a theory upon them?

218, Balfour Road, Ilford, Essex, SIDNEY H. RAY.
October 14.

RECENT AND PROPOSED GEODETIC MEASUREMENTS.

IN the history of geodesy and the discussion of the problem of the figure of the earth, the measurement of three arcs of meridian stands out conspicuously. These are the Peruvian and Lapland arcs in the Northern Hemisphere, and that of Lacaille in the neighbourhood of the Cape of Good Hope. Those who took part in the original measures worthily distinguished themselves, but it is inevitable that with the demand for greater accuracy in geodetic inquiries the necessity for repeating the ancient measures should be acknowledged. Without experience and with imperfect instruments, it is remarkable that the old astronomers accomplished what they did. To determine the approximate figure of the earth, and to derive a fairly accurate value of the compression was no mean achievement. But Lacaille's arc of meridian soon fell into disrepute, and other measures have had to be substituted by Maclear and others. Svanberg repeated the original work of Clairant and his colleagues, in Lapland, soon after its completion, and within these last few years a new determination of the Peruvian arc has been imperatively called for. There is no doubt but that the French nation, who have so honourably distinguished themselves in the difficult task of geodetic measurement, will be able to undertake this work, and increase their scientific reputation. From 1734, when the enlightened Government of the day undertook the measurement of two of the aforementioned arcs, down to our own time, when we have seen the Mediterranean successfully bridged by a geodetic survey, and the interior of Africa connected in one unbroken chain with our own Shetland Islands, French men of science have played a conspicuous part in all questions connected with the true figure of the earth. At a moment therefore when the re-measurement of the famous arc of Peru has been forced upon us, it would have been with a feeling akin to disappointment if we did not find the French nation eager to repeat the historic work with all the skill that long experience has suggested, and all the accuracy that modern science demands. The report of a committee of the French Academy of Sciences, however, assures us that the ardour displayed by the French in the past is no whit abated, and that though the sacrifice of time and money is considerable, these drawbacks will be cheerfully borne. For the arc in Lapland another has been substituted on the Island of Spitsbergen, and the necessary work of triangulation has been for some time quietly carried on under the auspices of the Russian and Swedish Governments; while at the same time, the reports of Her Majesty's Astronomer at the Cape of Good Hope tell us what is being done in the way of supplementing Lacaille's arc in the Southern Hemisphere. With this activity before us, it seems a fitting opportunity to compare the aims and the motives that inspired those who inaugurated the earliest geodetic expeditions with those that will influence and guide the latest surveys in the same or similar regions.

In the middle of the last century a distinct issue was presented to the scientific mind. Then the general figure of the earth was an undetermined problem, and whether the polar or the equatorial axis was the longer was a vexed subject of controversy. It is amusing enough now to read of the disputes between the partisans of defective observations on the one hand, and the upholders of an incomplete theory on the other. To-day no such broad issue is before us, the differences are of a more subtle character, demanding great nicety of observation and more effective analysis. Then the true difficulties of the problem were scarcely apprehended. Only a few years earlier, Fernel had attempted to determine the length of a degree by counting the number of revolutions of his carriage-wheel between Paris and Amiens, a method which recalls the earliest attempts of Eratosthenes. Picard, it is true, had recognised the necessity of employing means of greater accuracy, and had taught the true principles of geodetic measurement; but the methods pursued by his descendants, and the precautions taken to ensure accuracy and recognise the surface to which the measurements are referred, constitute almost a new science. For with accumulating materials and greater experience, it has become necessary to distinguish between three surfaces. First, the ellipsoid of revolution, which corresponds most nearly to the form of the earth; secondly, the true geoid, that is to say, the surface of equilibrium of water at rest under the influence of centrifugal force, and the attraction of the earth's mass; and, thirdly, a corrected geoid, differing but slightly from the true, in which it is attempted to eliminate the effect of unequal masses on the earth's surface and in its interior. Theory shows that the true length of the arc of meridian, measured on the corrected geoid, will be given in terms of the measured base, if the effect of local attractions has been correctly determined. It is precisely in overcoming the difficulty of correctly eliminating the effect of local attractions, and of reducing the length of the measured base to the level of the water surface of the geoid, that the measurements of this century will mainly differ from those of the last.

A preliminary survey of the district undertaken by Captains Maurain and Lacombe has shown that the country of Peru possesses peculiar difficulties for an accurate geodetic survey. The levels vary very considerably with the distance from the coast, while here and there mountains of a volcanic character rise to a height of 6000 metres. But for the interest attaching to a historic site,

and the desirability of continuing measurements outside middle latitudes to which they have hitherto been almost entirely confined, a project involving so many hardships might well be abandoned. Not the least interesting part of the report of Captain Maurain is his description of the country in which the pioneers of the last century carried out their observations, often on the slopes of mountains rising abruptly to the height of some 3000 metres. Of this monumental work scarcely a vestige remains, and the original line of route can be traced only from the written records. The care with which the fundamental points in a triangulation are now marked was not appreciated in those early days, and even the pyramids constructed to commemorate the ends of the arc, and the successful

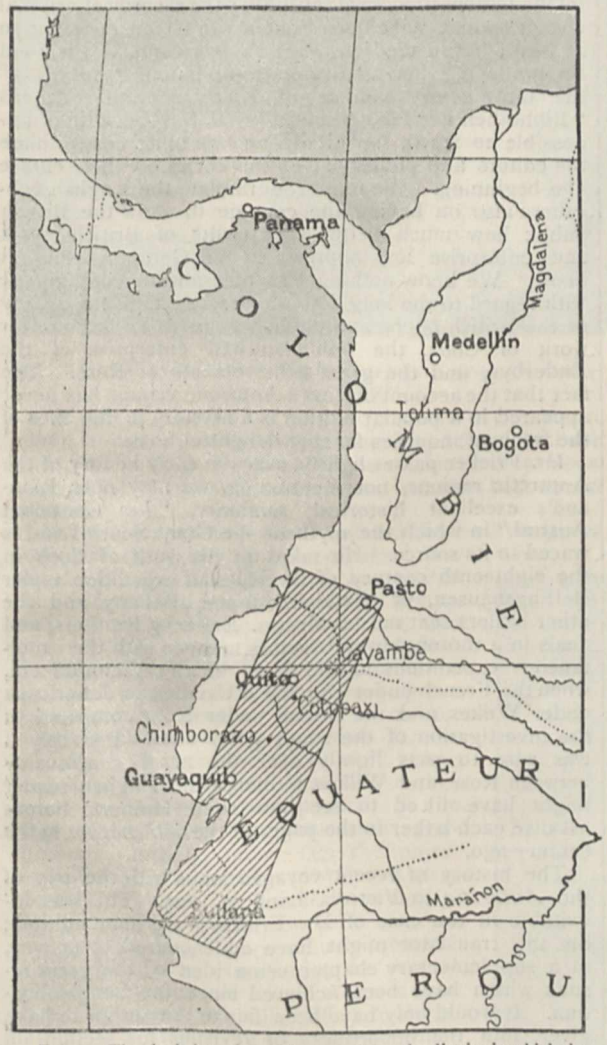

FIG. 1.—The shaded portion of the map shows the district in which the measurements will be made.

termination of the work, have been demolished by the Indians, who hoped to find buried treasure under the monuments, though the jealousy of the Spaniards has led to almost equally deplorable results.

But the enterprise of the French will not be contented with the simple re-measurement of the arc of Bouguer, which extended from the environs of Quito on the north to Cuenca, somewhat south of Guayaquil (Fig. 1). Captain Maurain's instructions led him to examine the country north and south of these stations, with the view of extending the arc to six degrees of latitude. In neither direction does the task become more simple. Towards the north the two chains of the Cordilleras unite in a confused mass, bristling with numerous summits, rising to an altitude only less than that of Chimborazo or Cotopaxi. On the southern side the country becomes more open, but covered with forests, and with a wet climate, suggestive of fever. Nevertheless, it seems possible to push northwards as far as Pasto in Columbia, and southwards to the Peruvian town of Sullana, an arc of six degrees, or about double that originally measured. The Finance Minister asks, as Finance Ministers will, whether it is absolutely necessary to carry the arc beyond the limits of the ancient survey, and the answer of the French Academicians, as might have been anticipated, is to insist on the maintenance of the whole scheme as contemplated in the preliminary examination.

The entire programme is vast, and worthy the best traditions of French science. Three bases of about eight or nine kilometres in length will be measured, one approximately central, and two of verification at the north and south ends respectively. The difference of level between the central base and the sea at Guayaquil, where tide gauges will be erected, will be determined with the greatest nicety. Throughout the arc fifty-two stations will be selected for observation, of which three will be fundamental, and the longitudes be determined by telegraph. Magnetic observations will be carried on as a matter of course, and in a country marked by so many mountain masses special care will be taken to determine their extent and density, with the view of eliminating the effect of local attraction. But, after all precautions, it is not impossible that the measures be made on a lengthened protuberance on the surface of the geoid, and that the curvature of the line of route should differ sensibly from that which would be found along a line nearer to the Pacific or further inland. To decide this point, two methods are proposed—one by means of pendulum observations, which will give the variation of gravity throughout the whole region; the other, by determining the difference of geodetic and astronomical longitudes between a point on the coast and the observatory at Quito. The army of experts who have examined the plan and arranged the details assures us that no difficulty has been overlooked, and as a result an admirably equipped expedition will leave France next spring, to take up quarters on the equator, where four years' hard and anxious work awaits the members.

As already mentioned, towards the polar end of the quadrant the expedition under the Russians and Swedes has already made good progress. The arc measured by Maupertuis and Clariaut extended through only fifty-seven minutes in the latitude 66°, and Svanberg attempted no greater distance than 1½°. But the modern scheme includes an arc of more than 4° in length, in the much higher latitude of 77°–81°. The general control is in the hands of H. Sergieffsky, and trained as he has been in the accurate school of Pulkowa, admirable results may be expected. The difficulties to be encountered are probably not less, though of a different kind to those that await the French in the tropics. Fifty stations will be occupied in the course of the triangulation, which compares satisfactorily with the fifty-two of the French scheme. Two base lines only will be measured, in which it is proposed to use Jäderin's steel tape line twenty metres long. Very little is known of the success that has attended this method, though its accuracy is vouched for by Dr. Döllen's careful examination, and the French prefer to rely upon the same apparatus that was used in the determination of the French meridian. It was expected that the field-work in Spitsbergen would be finished this summer, but we are still waiting information concerning the amount of progress that has been made.

Lacaille's arc of meridian, measured in 1752, and

practically the only measurement effected in the Southern Hemisphere, was long a subject of perplexity in all theoretical investigations of the figure of the earth, since the result indicated that the earth's surface was less curved in the Southern than in the Northern Hemisphere; but though the verification of the arc was an urgent necessity, it was not till 1840 that Sir Thomas Maclear commenced the work that solved the difficulty. The apparently anomalous result offers a good instance of the effect of local attraction in disturbing astronomical latitudes. The astronomical amplitude of Lacaille's arc (1° 12′) was proved to be very nearly correct, but a large local disturbance of the direction of gravity at the northern end caused a zenithal error of some 8″. Maclear enlarged the arc to nearly 5°, and here geodetic operations practically ceased, till the present astronomer, Sir David Gill, developed a scheme which dwarfs into insignificance all previous measures, and which, if it can be carried out, will prove of the utmost scientific value. He regards all that has been accomplished in South Africa as the first step in a chain of triangulation which, approximately traversing the 30th meridian of east longitude, shall extend continuously through Africa to the mouth of the Nile. He would make his chain follow, or rather precede, the line of that taken by Mr. Rhodes's transcontinental telegraph, proceeding northwards along Lake Tanganyika, through the region of the Lakes Albert and Victoria Nyanza, and along the Nile Valley. The definite survey of Egypt has not yet been undertaken, but commercial and political motives will doubtless soon bring this within the domain of practical science, and assist the onward progress of the scheme. Sir David Gill does not stop at the shores of the Mediterranean. Onwards, by an additional chain of triangles from Egypt along the coast of the Levant and through the isles of Greece, he would connect the African arc with the existing European systems, till it reached an amplitude of 105°. Sir David Gill puts before us a number of considerations by which such a scheme might be carried to a successful issue, without by any means minimising the difficulties which his experience teaches him stand in the way. It is not necessary to dwell on these obstacles, some of which are sufficiently obvious. It should, however, be remembered that no other meridian offers greater, if equal, facilities, or furnishes a better prospect for the realisation of this magnificent scheme. Sir David Gill has not confined his attention merely to the elaboration of schemes; he has accomplished much good work himself, often with straitened means, and by his personal influence and indefatigable energy aided and encouraged others. Under his auspices a chain of triangles has been carried eastward from Cape Town to Port Elizabeth, whence two branches have been carried to the north, one ending at Kimberley, while the other, crossing Natal, stops for the present at Newcastle in the extreme north of the colony. Much exploring work, hardly inferior in point of accuracy, has been carried through Bechuanaland and northwards along the 20th meridian, marking the boundary between German and British South Africa. His latest report tells us that on the eastern side of the continent stations were occupied from Bongwe (Lat. 19° 51′ S., Long. 30° 19′ E.) to a point in 16° 30′ S., and within sixty miles of the Zambesi. There the smoke from extensive grass fires compelled stoppage of field-work for the season, and his party retired to the observatory to occupy themselves in the work of reduction. The outbreak of the war and interruption by the Boers of telegraphic communication with Cape Town have for the moment delayed the determination of longitude of distant stations, but we may be sure that once the country has settled down to normal conditions, Sir David Gill will be ready to prosecute his scheme with the ardour that has ever characterised his undertakings.

RECENT ANTARCTIC BOOKS.[1]

THE long-continued neglect of Antarctic exploration has given place to a period of great activity. Several expeditions have, during the last five years, been hovering on the margin of the unknown, and penetrating within it a few steps farther than their predecessors. Great preparations are being made for what ought to prove the most determined effort to explore and study those regions by means of simultaneous national expeditions from this country and from Germany, and the public will soon begin to ask where the Antarctic regions may be and why people wish to go there.

The forerunners of the inquiring public have hitherto been obliged to cull such information as may be obtainable by the tedious process of consulting the records of original voyages which have been "out of print" for a generation at least; but in 1898 Dr. Karl Fricker came to their aid by producing his admirable compilation, "Antarktis," the introductory volume of Kirchhoff and Fitzner's "Bibliothek der Länderkunde." Of this book it is impossible to speak too highly, and we must congratulate the editors and publishers of the series on their choice of a beginning. We must congratulate the English publishers also on having the courage to show the British public how much better the results of British pluck and enterprise are appreciated in Germany than at home. We know nothing less pleasant to contemplate with regard to the long Antarctic record than the apathy of the British public and publishers alike to the pioneer work of Cook, the public-spirited enterprise of the Enderbys, and the great achievements of Ross. The fact that the account of Ross's Antarctic voyage has never appeared in a popular edition is a mystery in the face of the frequent inquiries for that delightful book.

Dr. Fricker passes lightly over the early history of the Antarctic regions, not mentioning, we may note, Rainaud's excellent historical summary, "Le Continent Austral," in which the myth of the Great South Land is traced to its source. He takes up the work of Cook in the eighteenth century, of the Russian expedition under Bellingshausen, of Weddell, Biscoe, Balleny and the other sealers sent out by Messrs. Enderby Brothers, and deals in a thoroughly satisfactory manner with the simultaneous expeditions at the dawn of the Victorian era, when the French under Dumont d'Urville, the Americans under Wilkes and the British under Ross competed in the investigation of the south polar seas. Probably it was wise to pass lightly over the acrid controversy between Ross and Wilkes, although the English reader might have liked to see how such Homeric heroes assailed each other in the pages of the *Athenaeum* half a century ago.

The history of recent voyages stops with the trip of the *Antarctic* to Victoria Land in 1895. This was inevitable in the case of Dr. Fricker's German edition; but the translator might have endeavoured to convey, in a supplementary chapter, some idea of the great results which have been achieved since the first publication. It would only have been fair to the author to have given him the opportunity of revising his section on Bouvet Island, with which the detailed description of the various known lands of the Antarctic regions commences. The translator might at least have added a note to let the reader know that this interesting group, which was sought in vain by Cook and by Ross, was re-discovered by the *Valdivia* on November 25, 1898, during the first scientific voyage conducted by Germans to the edge of the Antarctic (see NATURE, vol. lx. p. 114).

[1] "The Antarctic Regions," by Dr. Karl Fricker. Pp. xii + 292. Maps and Plates. (London: Swan Sonnenschein and Co., Ltd., 1900.)

"Through the First Antarctic Night, 1898–99. A Narrative of the Voyage of the *Belgica* among newly-discovered lands and over an unknown sea about the South Pole." By Frederick A. Cook, M.D., Surgeon and Anthropologist of the Belgian Antarctic Expedition. Illustrated. Pp. xxiv + 478. (London: William Heinemann, 1900.)

The description of the various portions of land seen by Antarctic explorers is well done, and the critical remarks of the author appear to be judicious and likely to be of service to subsequent expeditions. Then follow accounts of the ice-conditions, on which Dr. Fricker has made himself an authority, climate and life. The book ends with a chapter on the future of Antarctic exploration, excellent when it was written, but now happily out of date.

FIG. 1.—Curious weather-worn iceberg (300 feet high). (From Dr. Cook's "First Antarctic Night.")

Mr. A. Sonnenschein has translated the book very well indeed from the literary point of view. We could scarcely have believed it possible that a translation could be made so literal, and yet so free from constraint, as this one is. Still a scientific man cannot help noticing some slips in the rendering of technical expressions, and it may prove useful to the general reader to correct some of these. On p. 104, line 32, the translator interpolates "Mount" before "Erebus," not noticing that the author refers to the temporary position of the ship which was the mountain's godmother; similarly, on p. 117, the objectionable word "insects" is introduced after "coral" without Dr. Fricker's authority. On p. 120 "the lower parallel" scarcely conveys the idea "a great-circle course" which the author expressed. In several places the geological *dip* of rocks is rendered by *slope*, a totally different thing. On p. 175 "layers of secondary formation" suggests Mesozoic rocks, but drift, without regard to the geological character of the stones, is the true meaning. On p. 176 "precipitate rock" should be "sedimentary rock." In several places the word *schären* is translated "dunes," but it really refers to skerries or rocky islets like those of the Skärgård of Sweden. The phrase "relative moisture" is used throughout instead of the familiar "relative humidity." On p. 248 the translator suggests the use of the German word *firn* in English; but it seems to us that the French equivalent *névé* has received too general currency to be displaced from English writings. On p. 261 the word "Translator" has been inadvertently added to one of the author's footnotes.

The editorial note prefixed to the English edition is not very satisfactory. It is gratifying news, which we have not seen before, that Belgium is actively fitting out an expedition for Antarctic exploration; but the statement that a Belgian expedition was sent out in 1897 should have been supplemented by the fact that it returned in 1899 with rich results. The *Valdivia* expedition is not noticed, although Mr. Borchgrevink's return properly finds a place. It would have been useful if the numerous recent papers on Antarctic exploration in English had been added to the bibliography, and if the efforts of Sir Clements Markham and the councils of the Royal Society and the Royal Geographical Society in promoting the British Antarctic Expedition had been specifically referred to.

Dr. Cook is the first of the staff of the *Belgica* to place his experiences on record in book form, and his description is intended for the general rather than the scientific reader. Its great value lies in the frankness with which the subjective side of exploration in the polar regions is dealt with, and in the professional observations on the health of the explorers. It will be remembered that the *Belgica*, after surveying part of the coasts of the channel which continues Bransfield Strait to the south between 64° and 65° S, sailed west and south, and wintered in the Antarctic pack, where for thirteen months the ship was fast in the ice. The claims as to geographical discovery, and the results of the scientific observations, may be left for discussion when the official report of the expedition is published. Dr. Cook says very little about the leader, M. de Gerlache, whose resolution to push as far as possible to the south does not seem to have met with the approval of his subordinates, and it is notice-

FIG. 2.—Making soundings. (From Dr. Cook's "First Antarctic Night.")

able that de Gerlache's portrait is not given in the admirable series showing the officers and scientific staff before and after their experiences.

The preliminaries of the expedition when one might almost think time was wasted in Tierra del Fuego, are described in considerable detail; but the interest of the reader will be mainly attracted by the description of the first winter night (a night of seventy days) ever lived through by human beings in the Antarctic regions. It is described with a restrained realism that suggests many thoughts. We do not admire the author's style in such a passage as—"Even the sailors cannot resist the temptation to stand still and drink, with awe-inspiring amazement, the strange wine of action which hangs over the mysterious whiteness of the new world of ice"; but when he comes to deal with the details of every-day monotony in the narrow limits of the lonely ship, the narrative acquires an intensity of interest which the simplest and most correct expression could hardly increase. The efforts of the scientific staff to carry on observations in most unfavourable conditions deserve the greatest praise.

Dr. Cook attributes the terrible depression of spirits and the circulatory troubles which affected every one on board the *Belgica* to the absence of sunlight and the monotony of the food. He never mentions scurvy; but the symptoms described read not unlike the incipient stages of that disease. With regard to food, he raises a strong protest against essences and "artificial" foods of every kind. However nourishing these may be, their softness and want of flavour excite repulsion. Something with a taste, and tough enough for the teeth to have some work, was what the officers of the *Belgica* sighed for. Of all the foods on board, the Norwegian *Fiskeballar*, or "Fiskabolla," as it is written, were the objects of the heartiest detestation. Either the supply must have been of inferior quality or the abundance produced disgust, for only a few weeks ago we heard a person of intelligence declare spontaneously, on first tasting this delicacy, that with a supply of fiskeballar he could face a polar winter with equanimity. Sugar and milk ran short, and their loss was very severely felt. The experience of the *Belgica* should be very carefully considered by those responsible for victualling the new Antarctic expeditions, and compared with that of the *Fram*. Dr. Cook, by the way, throws doubt on the perfect health and general serenity of Dr. Nansen's expedition; but it appears possible that with a small company of one nationality, personally selected by the leader, and living together, the chance of harmony is greater than with a larger number divided into cabin and forecastle, composed of five nationalities, and speaking as many languages.

Both the books which we have brought together in this review are good, splendidly illustrated, and full of interest; but each would have been better of careful revision. Dr. Cook is unhappy with his proper names; we note *Grand* (for Gand), *Recluse* (for Reclus), Bismark, Monacho, Bellany (for Balleny), Jessup (for Jesup), and there is also carbon diolide, all of which are wrong. In both works the comparison of temperatures on the centigrade and Fahrenheit scales is sometimes at fault, and in one between the hours of 4 a.m. on Sunday and 8 a.m. on Monday several gentlemen succeeded in obtaining thirty-six hours of continuous sleep. HUGH ROBERT MILL.

NOTES.

LORD KELVIN proposes to give a valedictory address to the London Mathematical Society on November 8. The subject will be "The Transmission of Force through a Solid."

THINGS scientific are beginning to move in Egypt a little. A notice has been published in the official journal that on and after September 1 universal time will be adopted in Egypt, and the noonday signal given at mean noon of the 30th Meridian East of Greenwich, *i.e.* East European time. The Ports and Lights Administration have also notified that the time balls at Alexandria and Port Said will on and after October 1 be dropped according to the same time, and not local time as heretofore. At present these time balls are dropped by local arrangements, but before the end of the year the midday signal ball at each place will be dropped automatically by electric signal from Abbassia Observatory. Regarding meteorology, there are now eight stations between Alexandria and Khartum forwarding daily telegraphic weather reports, and these will be increased shortly. Abbassia has now a complete self-registering equipment, and hourly observations for 1900 will be published.

MR. J. S. BUDGETT, of Trinity College, Cambridge, who, it will be remembered, accompanied Mr. Graham Kerr on his journey in search of *Lepidosiren*, and who last year spent several months investigating the zoology of the Gambia region, has just returned to England from a second expedition to that river. Mr. Budgett's main object was to obtain material for studying the development of the Crossopterygian fish *Polypterus*. In his first expedition he obtained eggs and larvæ which were said to be those of this fish, but which, as it turned out, belonged apparently to a Teleost. Mr. Budgett has in his recent expedition failed to obtain the Polypterus material, but he is to a certain extent compensated for this by having obtained a mass of other embryological material which appears to be of great interest. Amongst this is a practically complete series of eggs and larvæ of the Dipnoan *Protopterus* whose developmental history had hitherto remained quite unknown. It is an interesting fact that the developmental stages of all three surviving members of the important group Dipnoi—*Ceratodus*, *Lepidosiren* and *Protopterus*, belonging to Queensland, South America and Africa respectively—owe their discovery and first observation to workers of the Cambridge school of Zoology.

AT the meeting of the Röntgen Society on November 1, Dr. J. B. Macintyre will deliver his presidential address.

LIEUT. C. LECOINTE, who was second in command of the Belgian Antarctic Expedition, has been appointed director of the astronomical work at Brussels Observatory, in succession to M. Lagrange, retired.

A REUTER correspondent at Friedrichshafen describes another ascent made with Count Zeppelin's air-ship on October 17. The balloon remained for three-quarters of an hour at an elevation of 600 metres, and, after carrying out a number of successful steering manœuvres, alighted safely on the lake shortly before 6 o'clock, half a mile from Manzell. Herr Eugen Wolf, who took part in the ascent, has given the following account of his experience:—"The trial lasted an hour and twenty minutes. The start upwards was first-rate. The air-ship moved at an almost unvaried height of 300 metres and went against the wind. All the steering tests proved the efficacy of the new gear, and the air-ship satisfactorily answered the movements of the steering apparatus. The horizontal stability of the vessel was wonderful. Any list was easily counteracted by shifting the sliding weight. The speed of the air-ship was such that, when going against the wind, it outstripped the motor boats on the lake. In still air its own speed was at least eight metres per second. We descended at full speed in the direction of the air-ship's shed rather faster than we expected, owing to an as yet unexplained escape of the whole of the gas in one of the balloons in the forward part of the ship. No damage of any importance was sustained in the descent. The King and Queen of Württemberg and Princess Maria Theresa of Bavaria watched the trial on private steamers."

SIR HENRY DYKE ACLAND, whose death we recorded last week will probably be remembered more on account of the influence he exerted on behalf of scientific education at Oxford than for his contributions to natural knowledge. He was born in 1815, and graduated in medicine in the University of Oxford in 1846, having previously been appointed Lee's Reader in Anatomy. He became Radcliffe Librarian in 1851, and Regius Professor of Medicine in 1857, which post he held until the year 1894. He was a member of the General Medical Council from 1854 to 1874, and president in the years 1874-1887, when Sir Richard Quain succeeded him. Referring to his work on the Council, the *Lancet* says it was invaluable, and as he was likewise a member of the Medical Education Committee of the Hebdomadal Council of the University of Oxford, his influence on the scope and direction of the course of studies of a medical student was very great indeed, and was invariably directed towards the enlargement of the scope of scientific training. Not only did he use his influence for the good of the medical profession in his own country, but he extended his interests to foreign countries, and in 1879 sent an eloquent and encouraging letter to the authorities of the Johns Hopkins University, urging his readers to higher things and to the raising of the standard of medical education. He always placed the greatest stress upon general culture as a necessary qualification for the successful medical man, and being himself of very wide interests and a man of science, displayed an excellent example of a scientific and scholarly physician. In 1869 he was appointed a member of the Commission to inquire into the sanitary laws of England and Wales, and did valuable work in connection with it. He was the author of several works on medical and scientific subjects, including an important memoir on the visitation of cholera in Oxford in 1854, and another on village health and village life written in 1884 for the International Health Exhibition.

A LITTLE more than a year ago the attention of the Council of the Manchester Literary and Philosophical Society was directed to the fact that Dalton's tomb in Ardwick cemetery, Manchester, was in a very bad condition, owing to neglect. A committee was appointed to take steps to put the monument in a thorough state of repair, and there was no difficulty in obtaining subscriptions for this purpose. A full-page illustration of the tomb in its restored condition appears in the latest number of the *Memoirs and Proceedings* of the Society.

REFERRING to the age of the big trees of California, Prof. C. E. Bessey records in *Science* that he once counted with much care the rings of growth of the tree of which the stump constitutes the floor of the so-called dancing pavilion. This count was made from circumference to centre, and every ring in all that distance was counted, no estimates or guesses being made. The result was that 1147 rings were counted, and accordingly it is safe to say that this tree, which was fully 24 or 25 feet in diameter, and considerably more than 300 feet in height, acquired these dimensions in eleven hundred and forty-seven years. Prof. Bessey doubts whether any of the existing trees approach the age of two thousand years.

A DESCRIPTION of the condition of gases, materials and food in a mine which had been tightly closed for fifteen months was given by Mr. F. G. Meachem at the recent meeting of the Institution of Mining Engineers. When the mine was reopened, the air was analysed and was found to consist of 84 per cent. of nitrogen, 12 per cent. of fire-damp, and 4 per cent. of carbon dioxide. The gases were greatly compressed, and it is estimated that about 1,500,000 cubic feet escaped from the first bore hole in twenty-four hours. When the mine was entered, it was found that the gases had had no deleterious effect upon the food, or the materials left in the mine; in fact, everything left in the mine was found practically undamaged. Bread had become as dry as biscuit, cooked bacon was as fresh as when left, and water in the horses' tubs had not evaporated, although surrounded by perfectly dry coal-dust. Previous to the fire, oatmeal was supplied to men working in hot places to mix with their drinking-water, and this was found to be as sweet as when sent down the pit. The rails and ropes were not rusted. Men's clothing was dry, and in practically the same condition as when left. In the stables, the chaff was unimpaired, and the horses readily ate it. The timber in the pit did not seem to have undergone any change whatever. In the three months that had elapsed since the reopening of the mine, greater decay had taken place than during the fifteen months that the pit was closed.

MALARIA is not the only disease which is propagated by mosquitoes. In the *Atti dei Lincei*, ix. 5, Prof. Grassi and G. Noè describe observations on the transmission of the filariæ of the blood by mosquito bites. The same species, *Anopheles claviger*, which is mainly responsible for the dissemination of malaria, also plays the part of host to *Filaria immitis*. The present investigation deals with the mode of exit adopted by the filariæ in passing from the mosquito to the punctured animal, and it would appear that the parasites make their escape by means of a rupture in the integument of the labium. In the succeeding part of the same journal, Prof. Grassi describes experiments carried out by a committee with the assistance both of the Italian Government and of the Mediterranean Railway Company, with a view to the prevention and cure of malaria in infected districts. The experiments were carried out in the plains about Pæstum, which have long been known as a hotbed of malaria ("malaricissima" is the epithet Grassi applies to the region), and fell into two categories, namely, cure of the disease by the use of quinine, and protection from the bites of *Anopheles claviger* by the use of wire gauze as a covering for windows, doors and even chimneys of houses, the inhabitants of which were required to remain indoors from before sunset till after sunrise, or to go about covered with veils at night. By thus preventing mosquito bites, it was found that the malarial regions could be safely inhabited even at the season when the fever was at its height, and under such conditions the district might be made as healthy as any part of Italy.

IN opening the recent International Aeronautical Congress at the Meudon Observatory, the president, M. Janssen, rapidly and very eloquently reviewed the most important points of the progress made since the meeting of the last congress held at Paris in 1889. During the interval, progress has been considerable in all directions, and new and important questions have been dealt with. The military authorities of several of the European countries have rendered much assistance in allowing their balloons and requisite appliances to be used in scientific investigations. In Germany alone no less than seventy-five ascents have been made during the last five years, the results of which have recently been discussed in a valuable work by MM. Assmann and Berson. Since the last congress in 1889, M. Le Monnier's idea of employing unmanned balloons has been realised; the success of these ascents and the results obtained by their means, notably in the investigations of MM. Violle and Cailletet, have given rise to the creation of the International Aeronautical Committee, which recently met in Paris under the presidency of Dr. Hergesell. M. Janssen also referred to the important results obtained from kite observations, especially by Mr. Rotch and M. L. Teisserenc de Bort. At the Berlin Meteorological Office a new service has been established for experiments, both with kites and balloons. The use of balloons for astronomical observations was also discussed, and recommended for observing the Leonid showers in November next. This method was successfully used under M. Janssen's directions by M. Hausky, in 1898, and was adopted by other countries in the following year.

THE U.S. pilot chart of the North Atlantic Ocean for October shows the track of the Galveston hurricane. The storm was first noted to the east of Martinique on August 30. Next morning its centre passed slightly to the northward of Antigua, where the barometer fell to 29·84 inches; it traversed the southern portion of Haiti on September 1, and reached the southern part of Cuba on the 3rd. The barometric depression, which had been quite shallow, began to deepen over western Cuba, where the barometer read 29·79 inches on September 5. To the west of southern Florida the storm increased rapidly in area and strength, a reading of 28·10 inches and gales of hurricane force being noted on September 7 in lat. 26° 40′ N., long. 90° W. The storm-centre passed slightly southward of Galveston on September 8. The destruction of life and property at and near this city was unprecedented in the history of West India hurricanes. The strength of the storm decreased rapidly to the northward of Galveston, again increasing in the region of the Great Lakes, Newfoundland and the Grand Banks, where it attained great violence, force 12 being frequently reported. The storm moved to the north of the 60th parallel in about 20° W. on September 16. The recurving so far westward, long. 98°, is quite unusual. Before recurvature, the storm moved in a W.N.W. direction, and after recurving it took an E.N.E. course, its progressive movement increasing greatly in velocity.

NATURALISTS will read with much interest a paper by Mr. R. Hall in the October number of the *Zoologist*, describing his experiences among the elephant seals of Kerguelen Island. The visit took place during the winter of 1897–98, when Mr. Hall ound these huge animals in great numbers. He believes that they arrive in August on the island, whence, after breeding, they depart in February or March. A large male may measure as much as 20½ feet in length, and the weight of many of the animals is estimated at between two and six tons. The finest herd seen included a couple of dozen males averaging about 19 feet in length. In disposition these seals are sluggish and peaceful, although when attacked many of them will show fight. On several days from sixty to seventy were killed, but forty *per diem* was considered a good average. It is to be hoped that steps will be taken by Government to prevent the extermination of these remarkable seals. Mr. Hall gives a characteristic photograph of a group on shore. In the same journal, Mr. E. Selous brings to a close his diary of the habits of the thicknee, or great plover (*Œdicnemus crepitans*), in the course of which he notices that these birds indulge in dances comparable to those so graphically described by Mr. W. H. Hudson in the case of an Argentine plover.

THE latest issue (vol. xiii. pt. 2), of the *Journal* of the College of Science at Tokyo, contains a coloured plate and description of a gigantic and gorgeously coloured medusiform hydroid recently captured in deep water off Misaki. It is identified by its describer, Mr. Miyajima, with a form obtained in Japanese waters during the *Challenger* expedition, and named by Prof. Allman *Monocaulus imperator*, the generic title being now changed to Branchiocerianthus. There are, however, certain differences from the type-specimen of the latter, and other examples are much needed in order to determine the value of these variations.

THE Yorkshire College, Leeds, together with the conjoint Agricultural Council of the East and West Ridings, have just published a pamphlet on sheep-breeding experiments in the county, forming No. 13 of their series. It is a common custom in Yorkshire to cross ordinary ewes with pedigree rams of other breeds; and the object of the experiments has been to ascertain whether such crosses are profitable, and which are the best. The results are tabulated in the pamphlet.

THE October number of the *Biologisches Centrablatt* includes a paper by Herr Stempell on the formation and growth of the shells of molluscs; and another, by Herr Wesenberg-Lund, on the relation between the fresh-water plankton and the specific gravity of the water in which it occurs.

WE have received from the Trustees of the Indian Museum, Calcutta, a fasciculus of the "Illustrations of the Zoology of the R.I.M.S. *Investigator*," containing the plates to Fishes (Part vii.) and Crustacea (Part viii.), and also the index to Part i. (1892–1900).

THE U.S. Department of Agriculture, in *Bulletin* No. 24, has just issued a list of works on North American entomology, compiled by Mr. N. Banks. With the exception of a few dealing with the general subjects, the various memoirs are catalogued under the headings of the different groups to which they refer.

WE have received from Prof. Jamshedje Edalji a paper on "Reciprocally related figures and the principle of continuity," which is remarkable as a collection of exercises in polar reciprocation. It contains reciprocal theorems corresponding to the properties of the circle contained in Euclid's Third Book, as also to many of the exercises in Todhunter's Euclid.

IN the *Berichte der naturforschenden Gesellschaft* (Freiburg i. Br), Dr. Otto Berg discusses the significance of kathodic rays in connection with the mechanism of discharge. In connection with the heating effects produced when kathodic rays fall on a solid body, experiments with a thermo-element show that (1) for given potential the heat produced is proportional to the quantity of electricity carried over; (2) the ratio of the quantities of heat and electricity decreases as the potential increases. The same journal also contains a paper by Dr. F. Himstedt on observations with Becquerel and Röntgen rays. Dr. Himstedt has observed no action of radium on a coherer, but has found a noticeable reduction of resistance of a selenium cell due to these rays. A similar diminution of resistance amounting to as much as 50 per cent. is produced when Röntgen rays fall on a selenium cell, and this effect might be conveniently used to measure the intensity of Röntgen rays. The same action is also produced by ultra-violet, but not, according to Dr. Himstedt's experience, by ultra-red light.

THE *American Naturalist* states that the discontinuance of the Italian scientific journal *Erythea* has been immediately followed by the reappearance of *Zoe*, a journal of very much the same scope, after a suspension of several years.

AN interesting report is printed by the U.S. Department of Agriculture (Division of Vegetable Physiology and Pathology) by Mr. Hermann von Schrenk, on two diseases of the red cedar (*Juniperus virginiana*), caused by the attacks of two parasitic fungi, *Polyporus juniperinus* and *P. corneus*, the former new to science. The paper is copiously illustrated by seven plates.

PROF. F. PÉCHOUTRE, of the Lycée Buffon, Paris, contributes to the *Revue générale des Sciences* (for September 30) a very interesting epitome of recent researches in vegetable cytology and the process of impregnation in flowering plants. A very useful summary is given of all the most important papers—and they have been very numerous—published on the Continent, in England, in Japan, and in America, during the last three years, under the following heads:—Centrosomes and blepharoplasts; Chromatic Reduction; Centrosomes and kinetic centres; the influence of organic substances on the action of nitrifying microbes; the Antherozoids of Angiosperms and double impregnation; the phenomenon of *Xenia* and the hybrid impregnation of the endosperm. Under the last heading the

observations of De Vries and Correns are referred to, but not the most recent ones by Webber; and several of the sections are illustrated by excellent wood-cuts.

MESSRS. C. BAKER, of High Holborn, send us their illustrated catalogue of microscopes and accessories, and stains, reagents, &c., for use in pathological and bacteriological research, including necessaries for the study of tropical diseases and examination of blood. The slide-lending department existing in connection with this firm appears to meet a distinct want.

THE Hampstead Astronomical and Scientific Society encourages interest in natural knowledge by popular lectures and instructive papers on scientific subjects. A course of six lectures upon the astronomy of the spectroscope and photographic camera will be delivered on Monday evenings at the Hampstead Library by Mr. P. E. Vizard, commencing on November 12. The programme of papers to be read at the meetings is an attractive one, and should be the means of increasing the membership of the Society.

FOUR public lectures will be given in the library of the Sanitary Institute under the auspices of the Childhood Society, which exists for the scientific study of the mental and physical conditions of children. The lectures will be as follows: "Treatment of Feeble-Minded Children in Asylums," by Rev. T. W. Sharpe, C.B.; "The Training of Teachers," by Prof. W. H. Woodward; "Physiology for Teachers," by Prof. C. S. Sherrington; "Causes of Failure in the Health of School Girls," by Mrs. D. Colman.

THE list of announcements of the firm of Gebrüder Borntraeger, Berlin, has just reached us, and is as follows:—"Sammlung geologischer Führer": vol. v. Elsass (Vogesen), by Drs. Benecke, Bücking, van Werveke and Schumacher; vol. vi. Riesengebirge, by Dr. Gürich; vol. vii. Schonen (Schweden), by Dr. Hennig; "Lehre von den Erzlagerstätten," by Prof. R. Beck (Part i.); "Flora der Deutschen Schutzgebiete in der Südsee," by Drs. C. Lauterbach and C. Schumann; "Werden und Vergehen," by Carus Sterne, fourth edition, vol. ii.

THE British South Africa Company has issued a pamphlet on the rubber industry of its territories. The rubber-producing plants of the territory are described as being mostly gigantic creepers belonging to the natural order Apocynaceæ. The pamphlet is chiefly occupied with hints on the administrative policy desirable for the protection and encouragement of the industry. Apparently no serious effort has yet been made either to ascertain the rubber-producing value of the native trees and shrubs, or to encourage the cultivation of those species which are found to be most valuable.

THE edition of Darwin's "Origin of Species," just published by Mr. John Murray for half-a-crown, is the cheapest scientific book we have had before us for many a day. The volume is clearly printed, has more than seven hundred pages, and a collotype portrait of Darwin appears as a frontispiece. The first edition of the work was published on November 24, 1859, so the copyright will shortly expire, and probably other editions will be issued by various publishers, but the book which Mr. Murray has brought out will be able to hold its own against all that follow it. If there is a person who claims to be a naturalist, or even to have an interest in natural history, and does not possess a copy of Darwin's immortal work, he should make haste to add the new book to his library.

THE Cambridge Scientific Instrument Company have issued a list of apparatus designed and used by Prof. Ewing, F.R.S., for the teaching of mechanics in engineering laboratories, and now manufactured in their works. Several of these pieces of apparatus relate to experiments on the elasticity of materials, and to measurements of the moduluses of elasticity, by various methods. Amongst these are the latest forms of Prof. Ewing's microscope extensometer. The remaining instruments and devices are designed to enable students to make quantitative experiments in mechanics. The importance of such mechanical laboratory work, carried out by the students themselves, as a supplement to their study of theoretical mechanics by books or lectures, is now generally recognised. Well-made instruments such as are supplied by the Cambridge Company are essential to ensure accurate work by advanced students.

IN the last number of the *Berichte*, E. Fischer gives an account of further investigations on the division of racemic amido-acids into their optical components. He found previously that by replacing hydrogen in the amido-group in these acids by a benzoyl group, compounds of much more strongly marked acid characters are produced, which are capable of forming well crystallised salts with bases. By crystallising such salts of the active alkaloids, strychnine, brucine, cinchonine, the amido-acids in the form of their benzoyl derivatives have been divided. Alanine, aspartic acid and glutaminic acid were the first to be resolved by this method, and these have now been followed by leucine, amidocaproic acid, phenylalanine and α-amidobutyric acid.

IN the same journal, v. Baeyer and Villiger discuss the action of permanganate on hydrogen peroxide and assail the views of Berthelot and Bach on the existence of oxides of hydrogen higher than the dioxide. Berthelot found that at a low temperature permanganate is decolourised without evolution of oxygen, which he ascribes to the formation of hydrogen trioxide (H_2O_3). The authors, on the other hand, find that at $-16°$, though more slowly, the same volume of oxygen is evolved as at the ordinary temperature. Bach concluded that, as an excess of oxygen above the calculated quantity was evolved with permanganate, "Caro's acid" (hydrogen peroxide in sulphuric acid) contained hydrogen tetroxide. The authors find this observation correct, but the interpretation at fault. They ascribe the decomposition to the catalytic decomposition of Caro's acid, due to the presence of manganous sulphate. Of the nature of the process which occurs when hydrogen peroxide and permanganate react, the authors bring facts in support of the view of Weltzien and M. Traube, who consider that the permanganate oxidises the hydrogen of the peroxide, thereby liberating the oxygen of the latter, and not that the free oxygen is made up of oxygen atoms derived from both peroxide and permanganate.

THE additions to the Zoological Society's Gardens during the past week include a Patas Monkey (*Cercopithecus patas*) from West Africa, presented by Mrs. Creighton Hall; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Mr. Cecil T. Reaney; a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. Anthony J. Smith; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. G. H. Jalland; two Muscat Gazelles (*Gazella muscatensis*) from Arabia, an Indian Desert Fox (*Canis leucopus*) from India, presented by Mr. P. Z. Cox; a Bonnet Monkey (*Macacus sinicus*) from India, a Sooty Mangabey (*Cercocebus fuliginosus*) from West Africa, a Ruffled Lemur (*Lemur varius*), a Black-headed Lemur (*Lemur brunneus*) from Madagascar, a Short-tailed Wallaby (*Macropus brachyurus*), a Great Kangaroo (*Macropus giganteus*), four Brown's Parrakeets (*Platycercus browni*) from Australia, a Blue-necked Cassowary (*Casuarius intensus*), two One-Wattled Cassowaries (*Casuarius uniappendiculatus*) from New Guinea, seventeen Speckled Terrapins (*Clemmys guttata*), three Painted Terrapins (*Chrysemys picta*), ten Alligator Terrapins (*Chelydra serpentina*) from North America, an Elephantine Tortoise (*Testudo elephantina*) from the Aldabra Island, an Oldham's Terrapin (*Cyclemys dhor*) from the Malay Peninsula, a Missel Thrush (*Turdus viscivorus*), European, deposited.

OUR ASTRONOMICAL COLUMN.

EPHEMERIS FOR OBSERVATIONS OF EROS:—

1900.	R.A. h. m. s.	Decl. ° ′ ″
Oct. 25 ...	2 27 27·35 ...	+52 36 52·0
26 ...	25 52·13 ...	52 49 53·2
27 ...	24 13·05 ...	53 2 9·2
28 ...	22 30·39 ...	53 13 38·2
29 ...	20 44·30 ...	53 24 18·5
30 ...	18 55·10 ...	53 34 8·5
31 ...	17 2·99 ...	53 43 6·5
Nov. 1 ...	2 15 8·32 ...	+53 51 11·3

OPPOSITION OF EROS.—M. Loewy has distributed a fifth circular containing additional information intended to secure uniformity of observation among the many institutions which have now commenced their work of determining the parallax of Eros. It is advised that the positions relative to neighbouring stars be measured in rectangular co-ordinates, and also that the eleventh magnitude be adopted as the inferior limit of brightness for the comparison stars. For those undertaking photographic determinations, it is recommended—

(1) That on each plate there be made two exposures of different length, so that each star may be recorded by two images some twenty seconds of arc apart in declination. This procedure will fulfil the two functions of eliminating spurious stars, and of enabling two series of measures to be made on star-discs of very different diameters, so that the photographic spreading effect may be allowed for to some extent. For instruments of the type employed for the international chart (0·33 metre aperture), exposures of six and three minutes are recommended.

(2) On the plates especially for the planet's position, two exposures should also be made, one while the guiding star is accurately followed, the other keeping the planet on the cross wires, or if this be too difficult on account of its faintness, the guide star should be given a motion equal, and in the contrary direction to that of the planet. The result of these operations will be two images of Eros, one showing as a short faint line, the other as a circular patch. This is now known to be quite possible, as the planet has recently been photographed, October 4 and 6, both at Paris and Algiers, in three minutes, the magnitude being estimated at 10·5. Prof. Joly also states that with the 15-inch reflector at Dublin, images were obtained with exposures of six and two minutes.

Another list of comparison stars is provided, and the ephemeris extended to March 1901. The brightness of Eros is now slowly increasing, being 9·81 magnitude on October 29, reaching its maximum of 9·02 on December 18, and then decreasing to 10·48 in March at the close of the time of these special observations. M. Loewy asks all collaborating in the enterprise to forward regularly the successive progress made in the various sections.

NEW DOUBLE STARS.—In the *Astronomische Nachrichten* (Bd. 153, No. 3668), Mr. R. G. Aitken gives the particulars relating to 62 new double stars discovered by him with the 12-inch equatorial of the Lick Observatory. This list is supplementary to that previously published in *Astronomische Nachrichten*, No. 3635. Each star after discovery has been measured with the 36-inch telescope on at least one night; 39 of the pairs are under 2″ distance, 24 under 1″, and twelve under 0″·5. The list has been checked by comparison with Prof. Burnham's General Catalogue of Double Stars.

ASTRONOMICAL WORK AT DARAMONA OBSERVATORY.—We are in receipt of an interesting volume from Mr. W. E. Wilson, containing reprints of the astronomical and physical researches made at his observatory at Daramona, Westmeath, since 1892. Mr. Wilson started in 1871 with a 12-inch equatorial, by Grubb, but did little more with this instrument than lunar photography with wet plates and determinations of solar radiation. In 1881, however, he built the present large observatory attached to the house, and installed therein a new 24-inch silver-on-glass mirror of 10 feet 6 inches focus. The old 12-inch mounting proving too light for the extra load, it was replaced in 1892 by one of the best pattern with Grubb driving clock and electrical control. In 1889, an additional laboratory was added for the physical investigations which have formed so large a portion of the observer's programme.

The purely astronomical work with the 24-inch has practically been confined to the photography of star clusters and nebulæ. Very beautiful reproductions in collotype of some of these are included at the end of the volume.

The astrophysical portions deal with experimental investigations on the heat of the sun, absorption of heat in the solar atmospheres, thermal radiation of sun (both photosphere and spots) and electrical measurement of starlight.

HISTORICAL ASPECTS OF THE DISCOVERY OF THE CIRCULATION OF THE BLOOD.[1]

THE discovery of the circulation of the blood by William Harvey is commonly regarded among scientific discoveries as eminent if not unique; and this in the judgment not of Englishmen only. My purpose to-day is to show that at any rate it was made against enormous difficulties.

To put this discovery in right perspective we must have some vision of the history of philosophy, science and medicine. Medicine, herein in contrast with Theology and Law, had its sources almost wholly in the Greeks; from them for good or evil it took its first scheme of thought; and in the schools of Hippocrates and of Alexandria it was based, more soundly, on natural history and anatomy. The noble figure of Galen, the first physiologist and the last of the great Greek physicians, portrayed for us by Dr. Payne in the Harveian Oration of 1896, stood eminent upon the brow of the abyss when, as if by some convulsion of nature, Medicine was overwhelmed for fifteen centuries. Galen practised the method of verification by experiment, first introduced perhaps by Archimedes, but after him it was lost till the time of Gilbert, Galileo and Harvey.

In the growth of societies small civilisations have been sacrificed to the formation of larger aggregates, whereby stable equilibrium may be attained for the highest ends. Perhaps because of her very freedom of thought Greece never became a nation. Even the Roman peace, bought as it was at the cost of learning and the arts, was but a mechanical peace. In the wilder regions of the empire the bodies but not the wills, of men were in subjugation, and even in Rome itself the sanction of patriotism was failing. Under the Frankish invasion the very traditions of learning and obedience seemed to be broken up. Then Europe was saved by the inspiration of the Christian religion which, entering as a new element into the ancient fabric of Roman empire, was now to hold men's service in heart and soul as well as in body; but to this end no mere mystic or personal religion could suffice; clothing itself with the political and ritual pride, and even with the mythology of the pagan empire, it inspired a new adoration; but it imposed upon men also a universal and elaborated creed. In the third century philosophy was born again in neo-platonism, the offspring of the coition of East and West in Alexandria, where all religions and all philosophies met. The world and the flesh were crucified that by the spirit man might enter into God. Pure in its ethical mood, neo-platonism, says Harnack, led surely to intellectual bankruptcy; the irruption of the barbarians was not altogether the cause of the eclipse of natural knowledge. Yet even then, as again and again, the genius of Aristotle came to save the human mind. Proclus, ascetic as he was, was also versed in Aristotle; he compelled the Eastern mysteries into peripatetic categories, and bequeathed a formal philosophy to the faith. Thus the first Scholastic period was fashioned, and the objects and methods of inquiry were determined for thirty generations. Rationalised dogma lived upon dialectic, and conflicted with mysticism; but logic, dogma and mysticism alike disdained experience. The Faith, then, was the first adversary of Copernicus, Galileo and Harvey.

It was the fortune of the Faith that, of all the treatises of Plato, the Timæus, the most fantastic and least scientific, should have survived to instruct the mediæval world; while those works of Aristotle which might have made for natural knowledge fell out of men's hands: moreover, the Categories and the "Interpretation" made for more than Aristotelian nominalism, and turned men's minds rather to rhetoric and dialectic than to natural science. Thus Plato's chimæra of the human microcosm, a reflection of his theory of the macrocosm, stood beside the Faith as the second great adversary of physiology.

The influence of authority, whereby Europe was to be welded together, penetrated into all human ideas. As was

[1] Abstract of the Harveian Oration of 1900, delivered by Prof. Clifford Allbutt, F.R.S.

the authority of the Faith, so was that of Plato; and, in the second period of the Middle Ages, of the Arabian versions of Aristotle and Galen. It is not easy for us to realise a time when intellectual progress, which involves the successive abandonment of provisional syntheses, was unconceived; when truths were regarded as absolute; when reasons were not tested but counted; when even Averroists found final answers either in Aristotle or in Galen. Thus in the irony of things was Harvey withstood by the dogma of that Galen who, in his own day, had earnestly appealed from dogma to nature.

In the Isagoge of Porphyry is set forth distinctly a problem, which during the Middle Ages rent Western Europe asunder; a problem, says John of Salisbury, which engaged more of the time and passions of men than for the house of Cæsar to conquer and govern the world; a problem, indeed, which in our own day is not wholly resolved. This was the controversy of the Realists and Nominalists, first brought to a clear issue by William of Champeaux and Roscellinus respectively. Now Plato held ideas not as mere abstractions but as creative forces; and we shall see how potent was this function in mediæval thought. Every particular, every thing, was regarded by the realist as the product of universal matter and individual form. Now form might be regarded, and variously was regarded, as a shaping, determinative force or principle, pattern or mould, having a real existence apart from stuff; or, on the other hand, as an abstract principle or pattern having no existence but as a conception of the mind of the observer. And for the Realist, not individuals only, but genera and species also have their forms; either pre-existent (*universalia ante rem*) or continuously evolved in the several acts of creation (*universalia in re*). For instance, the Church for the Realist is a thing apart from the wills of successive generations of individual men; Man has fallen, not only in many or all individual cases, but also as a kind—a kind having an independent existence; in the Sacraments again there may be a change of hypostasis without change in sensible matter. Now, if forms pre-exist (*ante rem*), the will of God must be predetermined; or if form be an immanent function acting in *re*, we are landed in pantheism. Thus Erigena, the brilliant prophet and protestant of the first period of the scholastic philosophy, was virtually a pantheist, as Spinoza was the last great realist. Aquinas, who determined the philosophy now ruling in Rome, brought about a compromise, which covers up rather than solves the difficulty. The problem, it is evident, was no hair-splitting; it dealt with the very nature and origin of being, and it agitated the minds of earnest men at a time of fervid and widespread enthusiasm for knowledge.

Now closely allied to the argument concerning universals was that concerning "matter and form." Whether the terms used were "form and matter," "force, energy or pneuma and matter," "soul, archæus or life and body," "determinative essence and determinate subsistence," "male principle and female element," "the potter and the clay of the potter"; or whether again they were "effect and cause," "nature and law," "being and becoming," the riddle lay in the contrast of the static and dynamic aspects of things; in the incessant formation of variable individuals in the eternal ocean of existence. Even Francis Bacon never got out of the tangle of Form, Cause and Law. It has been the temptation of philosophers of all times, and even of Harvey himself, than whom none had put better the conditions of scientific method, to suppose that by means of abstraction kinds may be apprehended; that thus they may get nearer to the inmost core of things; that by purging away the characters of individuals they may detect the essence and the cause of individuation; not perceiving that the content of notions is indeed in inverse proportion to their universality. We see this error continually to-day. For instance, we may discuss the causes of typhoid fever, and bewilder ourselves by forgetting that there is no such thing as typhoid fever, and that the only causes of a general notion are the psychological causes of its generation in the mind of the thinker at the time; that which is due to objective causes is of course not the notion, but the particular case—a very different affair.

Before motionless stuff—before the problem of the "primum mobile," even Harvey himself, when he had come to the end of his admirable experiments and began to indulge in contemplation, stood helpless. In his need for a motor for his machine he was not able to divest himself of the language nor even of the philosophy of his day. In his day he could not help regarding rest and motion as different things, and motion as a superadded quality. The motion he attributes, not to a property of the heart, but of the blood—to its "innate heat," which is as far as he could possibly have got. But, by way of explanation, he adds that the innate heat of the blood "is not fire, nor derived from fire"; nor is the blood occupied by a spirit, but is a spirit; it is also "celestial in nature, the soul, that which answers to the essence of the stars . . . is something analogous to heaven, the instrument of heaven." In denying that a spirit descends and stows itself in the blood or elsewhere, as an "extraneous inmate," he bravely says: "I cannot discover this spirit with my senses, nor any seat of it"; and yet, in the treatise "De Generatione," he propounds a theory of the impregnation of the female, not by any material from the male, but by the influence upon her of a "general immaterial idea"; which, even for his own time, was very substantial realism. The riddle which oppressed the great thinkers, from the Greeks to Lavoisier, was, then, the nature of the "Bildungstrieb"—of the "impetum faciens." What makes the ball to roll? Does heart move blood, or blood move heart? and, in either case, what bestows and perpetuates the motion? Telesius, the first of the brilliant band of natural philosophers in Italy of the sixteenth and seventeenth centuries, still sought this principle of nature in the "form" of the peripatetics. Gilbert regarded his magnetic force as "of the nature of soul, surpassing the soul of man." Galileo, although willing to conceive circular motion as perpetual, and even self-existent, was unable thus to conceive rectilineal motion. All these naturalists, including Harvey, and even Descartes, followed the mediæval world and Aristotle in deriving the source of motion directly from that of the spheres—from the quintessence (*vid.* Arist. De Coelo; and Met. xii.). Till Copernicus transfigured the cosmos, and Galileo and Newton carried terrestrial physics into the celestial worlds, the heavenly bodies were regarded as animated beings, themselves active, and, by propagation from sphere to sphere, animating all "sublunary" matter, wheels within wheels, even to its innermost particles.

Of the origin of energy we have not solved the riddle; we have given it up; but instead of finding its sources without we find them within. Harvey's contemporary, Francis Bacon, sagaciously guessed that heat is an expansive motion of particles; but he regarded heat and cold as two contrary principles. Almost in the same generation the brilliant John Mayow perceived a substance in the air "allied to saltpetre," which passed in and out of the blood by the way of the lungs or placenta. So innate heat gave way to phlogiston, and soon afterwards oxygen and the conservation of energy turned out to be the "form" "spirit," "essence," "primum mobile," "causa efficiens," "potentiality," and the rest of them; so by Lavoisier, a vast pile of metaphysics was blown into the air. But to kill a strong theory outright takes many a generation; realism, shaken by Abelard, and scotched by Hales and Ockham, not only survived to mislead Harvey, but it stretches its withered hand over us still—in the nursery, in the schoolroom, in the university, and in the great arguments of life.[1]

As strong as realism was a third adversity—the pride of the human mind. The asceticism derived from the East, disdainful of carnal things, brought the dualism of matter and spirit into monstrous eminence; and in respect of medicine, in a few generations it turned the cleanest people in the world into the most filthy.[2] Almost to this day the mechanical arts, presumably concerned with lower categories, have been regarded as base; and the crafts, even of the laboratory, as unworthy of great souls.

Anatomy had to labour also against both ecclesiastical and popular antipathy; chemistry and mechanics were gross pursuits unless endowed with the perilous distinction of alchemy and sorcery. Unfortunately, this charge upon the dignity of man was made heavier rather than lighter by Petrarch and the humanists of the Renascence; and in Oxford of the seventeenth century we find that Boyle was bantered by his friends as one "given up to base and mechanical pursuits." In a certain important respect medicine suffered greatly from this prejudice. It is obvious that, speaking generally, medicine would find its most positive and direct control in those diseases and in those

[1] The readers of NATURE know how effectively this mischievous survival has been attacked recently by Prof. Perry, Mr. Heaviside and other contributors. But even greater men, whose blows still resound through the centuries, have attacked it in vain.

[2] Those curious in such things will notice that the mediævalising clergy of our own day have discarded in their persons that fair linen which in their fathers was the emblem and example of cleanliness.

therapeutical experiments which are manifest on the outside of the body. Yet surgery fell under the proscription of a handicraft, and as such was eliminated from the colleges of physicians both in London and Paris. Thus the genuine work of such men as Paré and Gale were without influence upon medicine, and thus it came about that Francis Bacon said of the physicians of Harvey's day that they saw things from afar off, as if from a high tower. From Erasistratus to Celsus, physicians practised medicine as one art. Galen taught, not the simplicity, but the unity of medicine; and Littré points out that this unity is consistent in the Hippocratic writings. Surgery, by virtue of its imperative methods, was kept clear of philosophy on the one hand and of humanism on the other. Fortunately for Harvey, his master, Fabricius, was as great a surgeon as anatomist; and such was Fallopius. Thus it was that medicine, at the end of the Middle Ages, had not recovered the standard of Alexandria. And against this adversity, also, had the founder of physiology to contend.

Happily the Arabian scholastic philosophy took its root in Alexandria when neo-platonism had veered towards Aristotle, and it was therefore more uniformly peripatetic than the Christian scholasticism. It is one of the signs of the greatness of Aristotle that, thus garbled and glossed, his power made itself felt in the thirteenth century, chiefly by the great Franciscans Alexander Hales, Roger Bacon, and William Ockham—Roger Bacon, whom we may call the first of the natural philosophers of the West. This former renascence determined the second period of the Middle Ages: the period distinguished by the Arabian version of Aristotle, by a check to the chimæras of realism, by some liberty of secular knowledge—for even bishops came out of the school of Toledo—and again by the coming of the Friars, whose influence upon the thought of the Middle Ages was a curious proof that, as all ways are said to lead to Rome, so all systems of thought, in spite of the thinkers, led to natural science. The logic and rhetoric of the Dominicans, by their rationalism, defined, and in defining restricted, the dominion of the Faith. Men got used to reason, and made a language for thought. And in the history of the unlearned Friars Minors we find, as elsewhere in history, that mysticism is more favourable to natural knowledge than the passionate dogmatism of Clairvaux or the dogmatic rationalism of St. Thomas. The Victorians, as Gerson after them, despised reason rather than feared it; mysticism makes for individual religion, as in Glisson and Newton, rather than for the Church. Hence it may have been that independent thinkers, like Hales and Bacon and Ockham, entered the Franciscan Order. The former renascence bred also a more tolerant spirit. Albert of Cologne owed as much to Avicenna as St. Thomas to Averroes: sages technically damnable, yet "mighty spirits," worthy of reverence. Dante put in hell, but on green meadows, in an open place, lofty and luminous, not only Aristotle, Plato and Socrates, but also Euclid, Ptolemy, Hippocrates, Avicenna, Galen and "Averroes who made the great commentary." Universities were founded in France, England and Italy. But the natural science which made the second renascence irresistible was absent from the former; and at the end of the century a reaction set in. During the two following centuries in Spain freedom of thought was crushed out by the Church; but in the conflagration of books of philosophy, medical works, such as the "Colliget" and the Commentary on Galen of Averroes, were largely spared; yet in the fourteenth and fifteenth centuries the very name of Averroes, "the mad dog that barked against the Christ," not only became ecclesiastically accursed, but also began to signify loose life as well as free thought; a resentment of which there was no trace in Albert or Aquinas.

Averroism, however, held its ground at Padua, which had become celebrated for medicine as Bologna for law; and although Averroism, like any other philosophy taught as a separate study, decayed, yet, effete as it was, it kept the ground open at a time when the tide was turning against free thought; when the commercial supremacy of Venice was declining, when the Spanish Inquisition was established in Rome, and when even the influence of the Florentine humanists was rather against natural knowledge than for it. No doubt the coarse and disingenuous scepticism of the physicians of North Italy and their pretentious manners alienated the humanists, not only from themselves, but also from natural philosophers such as Telesius and Galileo; and Averroists and humanists alike stood by at the burning of Bruno. Harvey entered Padua at a fortunate time; he found Galileo engaged in teaching, and also in methodical research; and Galileo was not only a great discoverer, but was the first to formulate fully and clearly that method which we know under the name of the inductive method. The discovery of Greek texts had destroyed the conventional Aristotle and the conventional Galen; Gregory, by the reform of the calendar, had put the axe to the root of astrology; Newton was soon to carry terrestrial physics into celestial spheres; and Boyle was soon to create chemistry; while anatomy was fully awake already. In England, moreover, with the accession of Elizabeth more spacious times were assured, and Charles protected Harvey. Clinical teaching had been established at Padua by Fracastorius and Montanus, to be pursued in Heidelberg, Leyden and Vienna. Physiology, however, awaited Harvey. Servetus had buried his conception of the lesser circulation under a pile of theology; Columbo and Fabricius had prepared the way, not so much by the value of their discoveries as by their practice of the experimental method in this science; for the anatomists, Galenists to a man, had done next to nothing for physiology.

The genius and courage required to make discoveries like that of the circulation of the blood cannot be measured directly; there is no method of determining the specific gravity of such adventures; I have tried, however, to shadow forth the weight of the social systems, opinions, prejudices and habits against which Harvey's gigantic effort was made. Almost in the year of the publication of the "De Motu Cordis" (A.D. 1628), the Parliament of Paris issued an edict that no teacher shall promulgate anything contrary to the accepted doctrines of the ancients. Under such conventions Harvey's discovery burst like an earthquake; under corrupt Galenism, venerable sophistries, current abstractions bequeathed by realism, and long-winded dialectics on critical days, coctions, derivatives or revulsives, and dogmas based on uncritical subservience to texts. His work stood out even more ascendant against a lurid background of folk superstitions—of vampyres, witch-burning, magic, cabbalism, astrology, alchemy, chiromancy and water-casting. In terrestrial and celestial physics, Galileo, persecuted as he was, had some strong current with him; Copernicus was before him, Kepler was beside him: but in physiology upon the path of Galen the waters had closed as upon the track of a great ship, and among Harvey's contemporaries and immediate forerunners there was none to claim a share with him in the discovery of the central fact of physiology, or in his application of the method which opened the way to Pecquet, Glisson, Steno, Wharton, Willis, Haller and Bernard.

THE ANNUAL CONGRESS OF THE GERMAN ANTHROPOLOGICAL SOCIETY.

THE thirty-first Congress of the German Anthropological Society was held in the University town of Halle from September 24–27. In addition to its rich University collections, a special interest is attached to Halle as being the seat of the oldest German society for encouraging the study of natural science, viz. the Leopoldina-Carolina Academy, which is thus comparable to the Royal Society in this country. To students of prehistoric archæology, the Prussian province of Saxony is chiefly interesting from the fact of the existence of copper-mines at Eisleben, some little distance from Halle. The meetings were held under the presidency of Prof. Virchow, assisted by Prof. Ranke. At the opening session on Monday, September 24, the presidential address (dealing with the general progress of anthropological study and teaching) was followed by a series of addresses from representatives of the University and town of Halle, of which that of the local secretary, Dr. Förtsch, is particularly noteworthy as containing a sketch of local prehistoric archæology, a field of research in which Dr. Förtsch has been particularly active, and which he has popularised with evident success. Of the subsequent communications to the Congress, the majority of which dealt with archæology, there appear to us most worthy of mention the discussion opened by Prof. Virchow on the "Earliest appearance of the Slavs in Germany," and the account (illustrated with excellent lantern slides) given by Dr. Birkner (Munich) of the investigation of the graves of the German Emperors in Speyer. Prof. v. Fritzsch (Halle) and Dr. Lehmann-Nitzsche (La Plata) rendered interesting accounts of discoveries of prehistoric man in Thüringia and in the Argentine respectively, the latter record

being still the subject of investigation as regards the exact antiquity (Tertiary period) claimed for the find.

It is a matter of some surprise that the department of Physical Anthropology should not have been the subject of more papers than were actually presented at Halle, which University claims the two Meckels and Welcker among its former professors of anatomy. The chief contributions to this subject were those of Dr. Schmidt-Monnard (Halle) on the relation between the growth and the weight of children of both sexes; of Dr. Eisler (Halle) on the *Musculus sternalis*; and of Prof. Klaatsch (Heidelberg) on the method of research adopted by anatomists, illustrated specifically by observations on the "short head" of the Biceps femoris muscle in the mammalian series.

The chief excursion of the Congress was made on Wednesday, September 26, to Eisleben, where the copper-mines already referred to were visited, and demonstrations of copper-smelting were given by representatives of the Mansfeld Co. Subsequently the local collection of prehistoric pottery, &c., was inspected.

The concluding session was held on September 27, when the presidency (for the ensuing year) was assumed by Prof. Waldeyer (Berlin). It is a matter of interest to note that the Congress was made the occasion of circulating "special inquiry" sheets regarding the structure and building of boats in all parts of Germany. General proposals regarding cartography and systematic records for provincial localities were brought forward by Dr. Voss (Berlin).

In addition to the anthropologists already mentioned in the foregoing notes, there were present Freiherr v. Andrian-Werburg (Vienna), Prof. Hein (Vienna), Prof. Montelius (Stockholm), Prof. Koganei (Tokio), and others to the number of about one hundred and twenty.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

THE Section of Anthropology had a very successful session under the presidency of Prof. Rhys; indeed, it was one of the very best meetings of Section H in the history of the Association. Nearly every department of the subject was represented and that too by new and original contributions. It is interesting to note the different lines which members of the Universities of Oxford and Cambridge are at present taking up. The field of Classical Archæology is offering rich prizes to Arthur Evans, Hogarth, and Myres; while the expeditions of Hose, Stanley Gardiner, Haddon, Skeat, and others are providing material for a more complete knowledge of primitive peoples.

I.—PHYSICAL AND EXPERIMENTAL ANTHROPOLOGY.

(1) *Somatology.*

Dr. John Beddoe, in a short paper on the vagaries of the cephalic index, described two long-headed skulls which had the general characters of dolichocephaly, but the one that appeared the more typical had a latitudinal index (living) of 82·3, owing to retarded ossification of the posterior part of the temporo-parietal suture; but for this the author thought the index would not have exceeded 77. Prof. Macalister, as at the last meeting of the Association, deprecated the importance usually ascribed to the cephalic index.

Prof. A. Francis Dixon read a paper, entitled "On certain markings on the frontal part of the human cranium and their significance." An examination of the frontal region of the cranium shows that, in many cases, grooves or channels are present on the bone, corresponding to the branches of the supra-orbital nerves. Their presence indicates a want in proportion between the growth in length of the nerves and the amount of expansion of the underlying part of the cranium. The nerves might be looked upon as constricting cords which become depressed in the developing bone as the cranium expands. In races in whom the grooves are common, and strongly marked, we would expect the presence of a tendency towards increased development and capacity of the frontal part of the cranium; while, on the other hand, in races in whom the grooves do not occur, or are rare, and but feebly marked, we would expect to find much uniformity in the shape and size of the cranium, indicating that none of its various parts are tending towards an increased development. In this connection it is interesting to note that the frontal grooves are almost never found in Australian and Tasmanian skulls, that they are rare among Melanesians, slightly more common among Polynesians, while among Bushmen and negroes, especially in Zulus and Kaffirs, they are very common, and often extraordinarily well marked.

Mr. W. L. H. Duckworth described nine crania collected by Mr. J. Stanley Gardiner in his expedition to Rotuma. As might have been expected from the position of the island, the skulls could be resolved into two types, one of the form of cranium usually found among Polynesian peoples, though possessing something of a Mongolian aspect; the other was of distinctly Melanesian affinities. The paper was well illustrated with lantern slides.

A second paper by Mr. Duckworth was on some anthropological observations of the Pangan tribe of aborigines in the Malay Peninsula made by Mr. J. Laidlaw in the Skeat Expedition. Mr. Duckworth measured one adult male skeleton the stature of which was about five feet, which is the average height of the men measured by Mr. Laidlaw. The latter describes the people as having a skin colour of varying shades of dark brown, and the black hair is in some cases frizzly and in others more or less curly or wavy. Mr. Duckworth regarded the skull as of a negroid type with infantile characteristics. It is probable that the skeleton in question belonged to a half-breed Negritto and Malayan individual.

The developmental changes in the human skeleton from the point of view of anthropology were described by Dr. David Waterson. A comparison was instituted between the bones of the embryo and those of the lower races of mankind and of the higher apes, both as regards their relative length and their characters. As it has been shown that the curvature of the spine in the lumbar region is a post-natal development, and one adapted to the assumption of the erect attitude by the infant, it can also be shown that in a similar way the configuration of the bones of the lower extremity alters after birth, before the infant can stand erect.

Prof. A. Macalister discoursed on perforate humeri from ancient Egyptian skeletons. In examining those from Libyan graves, he was struck with the large number of humeri which had a supra-articular perforation, the proportion of such among these old Egyptian remains being much greater than among other races. He found that these perforations reached 57 per cent. among the ancient Egyptians, whereas among average English people they ranged about 3 per cent., and 10 per cent. among Neolithic skeletons, while the percentage rose to 53 in the skeletons of Indians from Arizona.

A paper on the sacral index was read for Prof. D. J. Cunningham. Inasmuch as the true length of the sacral portion of the vertebral column is not indicated by the shortest distance between the apex and base of the sacrum, but rather by the length of the curve formed by the sacral vertebræ, it is proposed that, in making measurements for the determination of a sacral index, "length" should be measured by using a tape along the concavity of the sacral curve, and not by calipers, one limb of which is placed upon the base and the other on the apex of the sacrum. Breadth (measured by calipers in the ordinary manner) multiplied by 100 and divided by length, measured in the manner indicated, gives the true sacral index. The curvature of the sacrum may be conveniently plotted by taking a tracing from a strip of soft metal which has been previously adapted by pressure to the front of the sacrum along its middle line. The index of curvature may be expressed by the number derived by multiplying the height of this plotted curve by 100 and dividing by the number corresponding to the true length of the sacrum.

Dr. Cunningham communicated a second paper on the microcephalic brain, which also was read by Dr. Dixon, and illustrated with a large number of lantern slides. The brain of the microcephalic idiot may exhibit features which do not merely represent a "fixed" embryonic condition. In one specimen the arrangement of the fissures and sulci is found to approach more closely the ape than the human type, and in almost every furrow some simian character can be detected. These simian characters must not be considered mere fœtal conditions rendered permanent. The ape-like condition existing in this brain does not as a whole correspond to that of any one ape, or group of apes, but there is a complicated mixture of features some of which are characteristic of high apes, while others find a parallel in the brain of low apes. The microcephalic brain may be regarded as a partial "atavism." So far as its surface markings are concerned, the specimen noted has reverted in part, or wholly, to an arrangement which, in all probability, existed in some early stem-form of man

Dr. J. G. Garson read a paper, with lantern illustrations, on a system of classification of finger-prints.

(2) *Psychology.*

Prof. G. J. Stokes read a paper on the sense of effort and the perception of force, and Prof. Marcus Hartog contributed another on interpolation in memory. In the discussion on the latter paper, Prof. Lloyd Morgan contended that psychologists had not so completely overlooked the practical perceptual judgment as Prof. Hartog seemed to suppose.

Mr. E. W. Brabrook presented the final report of a committee which has been acting in conjunction with the Childhood Society for the scientific study of the mental and physical conditions of children.

II.—ETHNOLOGY.

(1) *Sociology.*

Mr. E. S. Hartland read a paper that attracted a good deal of attention, on the imperfection of our knowledge of the black races of the Transvaal and Orange River Colonies.

(2) *Technology.*

Dr. A. C. Haddon read a paper, illustrated by lantern slides and specimens, on the textile patterns of the Sea-Dayaks. The Sea-Dayak women weave short cotton rep petticoats and cotton sleeping wraps which are covered with beautiful and often intricate patterns. The patterns are made in the following manner: the warp is stretched on a frame, the woman takes the first fifteen to thirty strands and ties them tightly with strips of leaves at irregular intervals, according to the design, which she carries in her memory. The next fifteen to thirty strands are similarly tied, and this process is repeated until all the threads have been utilised. The warp is then removed from the frame and dipped in a reddish dye, which colours the free portions of the warp, but the tied-up portions remain undyed; thus a light pattern is left on a coloured background, when the lashing is untied. If a three-colour design is required, as is usually the case, the first lashing is retained, and various portions of the previously dyed warp are tied up; the whole is immersed in a black dye, and then both sets of lashing are untied. The pattern is thus entirely produced in the warp. By far the greater number of these designs are based upon animals, whereas most of the patterns carved by the men on wooden and bamboo objects are derived from plant motives. The decorative art of the Sea-Dayaks of Sarawak differs in character from that of the Kayans, Kenyahs, and other inland tribes.

A paper was read by Mr. W. Rosenhain on the making of a Malay "Kris." This, it was explained, was a species of native sword, and the paper dealt with some specimens of Malay metal work which had been submitted to the writer for microscopic and other examination by Mr. W. W. Skeat. By means of many lantern views Mr. Rosenhain exhibited samples of this kind of weapon, showing especially the "damask" pattern of the "Kris." Swords of this description were composed of many strands of two kinds of metal. The body of the blade was made of steel, a layer of laminated "damask" iron was welded upon each side of the central layer. A thin layer of steel was then welded on, outside the "damask" iron. The author was of opinion that the striated "damask" effect was due to the opening of the loose welds in the "damask" iron during the forging of the blade, steel being driven between the laminæ. The outside layer of steel was entirely ground away during the process, and when the compound surface so produced was "etched" by the pickling process employed, the more readily corroded steel was attacked, leaving the edges of the layers of iron as a series of narrow projecting ledges. The tools of the Malay goldsmith were then carefully described, and subsequently a description was given of the micro-structure and composition of Malay bronzes. The concluding part of the paper dealt with the Malay method of producing chains by casting, a practical illustration of the method being given by Mr. Rosenhain on the platform.

Prof. Macalister said that the older Universities of this country were frequently reproached for not doing anything practical. He felt, however, that Mr. Rosenhain had that afternoon removed a great deal of that reproach by practically demonstrating for them the process of casting metal chains practised by the Malays.

Prof. H. Louis read a "Note" on the "Kingfisher" type of a Malay "Kris," which was illustrated by specimens.

This was a type of "Kris" used only in a very limited area in the north-east of the Malay Peninsula; it was, however, rare even in its own home. The Malay legend of its origin, he remarked, was that a party of Malays from the Bugis Islands invaded that portion of the Peninsula many centuries ago. One of their leaders was known as "the Kingfisher"—presumably on account of his rapid movements. The invasion was successful, but the leader fell in one of the last engagements, and after his death his followers carved their Kris handles into shapes resembling the Kingfisher's head and beak. Under Chinese influence the pattern became more and more ornate, being modified by the Chinese "Dragon," until it reached the present fixed type.

Dr. Haddon gave an afternoon lantern demonstration on the houses and family life in Sarawak. He exhibited a series of about fifty lantern slides of photographs taken during his recent expedition to Sarawak, selected to illustrate the type of houses common among the settled inland tribes of Borneo and the everyday life of the people.

Mr. W. Law Bros delivered an afternoon lantern lecture on some Indian monuments, illustrated by numerous beautiful slides taken by himself.

A paper, with lantern illustrations, on permanent artificial skin marks was read by Mr. H. Ling Roth. Whatever might have been the original idea, ultimately its objective became manifold. Mr. Ling Roth described four systems or methods of tattooing. The Tahitian method of "tattaow" was performed by pricking or tapping with pigment, and produced the smooth result such as was seen in our soldiers and sailors. The Maoris of New Zealand adopted this pricking method, and also a cutting method performed with a sharp, adze-like edge like a narrow chisel. This produced slight but permanent grooves in the skin. The third method was that adopted in West Africa, and was similar to the second, but the grooves produced were deeper and wider, and generally no pigment was used. Lastly, there were the curious raised marks of the Tasmanians, Australians and Melanesians generally, and the Central African tribes. In this case the cuts were made with sharp edged stones, and were continually reopened or irritated by the insertion of vegetable juices or sand. Hence was produced an abnormal amount of reparative action, and the wounds did not heal naturally as healthy concave scars, but developed into nodulous growths of sometimes considerable size. For these four methods Mr. Ling Roth suggested a nomenclature—namely, tatu, moko, cicatrix and keloid.

Mr. Davis read a paper on the system of writing in ancient Egypt for Mr. F. Ll. Griffith, and whilst doing so illustrated his remarks with very clever sketches on the blackboard. Egyptology has now reached a position among the sciences from which it may contribute trustworthy information for the benefit of kindred researches. Egyptian writing consists of Ideographic and Phonetic Elements, the signs serving as:—(1) Word-signs; (2) Phonograms; (3) Determinatives. The highest development shown is an alphabet, which, however, is never used independently of other signs: it is apparently not acrophonic in origin; it represents consonants and semiconsonants only, vocalisation not being recorded by Egyptian writing. No advance can be detected in the system from the beginning of the historic period to the end, notwithstanding some improvements in practical working which facilitated the use of cursive writing. Phonograms derived from word-signs. The end of the native system was brought about by the gradual adoption of the Greek character—beginning, perhaps, in the second century A.D. If any radical improvement was ever made in the Egyptian form of writing, that improvement must have taken place at or after adoption by another people: *e.g.* some have supposed that our alphabet was derived by the Phœnicians from Egypt; but any such derivations are at present entirely hypothetical.

A paper was read by Mr. Arthur J. Evans on the new scripts he has recently discovered in Crete; an account of his researches has already appeared in NATURE (p. 526).

(3) *Religion.*

Some peculiar features of the animal-cults of the natives of Sarawak, and their bearing on the problems of totemism, were discussed in a paper by Dr. C. Hose and W. McDougall.

Customs had previously been observed that seemed to indicate the existence of a well-developed totemism, either at the present time or in recent times, among the natives of Sarawak. Information bearing on this subject was therefore collected as diligently as possible from various tribes.

A great number and variety of peculiar rites and customs were

found to be observed by the people of the different tribes in their dealings with animals and plants. This paper was confined to giving (1) a general account of the customs of one of the inland tribes, the Kenyahs; (2) to describing the "Nyarong," or spirit-helper of the Sea-Dayaks, and some similar institutions among the other tribes; and (3) to pointing out the bearing of our observations on the totem problem.

The Kenyahs are a warlike, agricultural people living as isolated communities of twenty to fifty or more families, each community inhabiting a single long house built on the river-bank. Their religion is peculiar, in that they believe in a beneficent Supreme Being and a group of departmental deities, while they attribute to every agent that affects their lives a spirit that must be properly respected and, if necessary, propitiated. Most important to them of all the animals is the common white-headed hawk. He brings messages of warning and advice from the Supreme Being to those who know how to read the signs he gives, and he is consulted before every undertaking of importance, and sacrifices of fowls and pigs are made to him. A wooden image of the hawk stands before every house. Several other birds give them omens of lesser importance, and none of these may be killed or eaten. The domestic fowl is killed as a sacrifice to the hawk or other powers, and its blood is sprinkled on the altar-posts of the gods and on the persons taking part in various ceremonies, especially peace-making ceremonies. The domestic pig is sacrificed in much the same way. The spirit of a pig is always charged with some prayer to be carried to the Supreme Being, and the answer is read from the markings of its liver. The crocodiles are regarded as a friendly and allied tribe, and may be killed in retaliation only. No Kenyah will kill a dog, and the dead body of a dog is regarded with fear. Kenyahs will not eat the flesh of deer or horned cattle, and there are many restrictions on touching or using any parts of them Only old or renowned warriors will wear or touch the skin of a tiger. One house is decorated with carvings of the gibbon on every large beam, and all Kenyahs have a dread of the Maias and the long-nosed monkey. There thus seems to be every degree of regard paid to the different beasts, from the mere uneasy feeling in the presence of the uncanny, long-nosed monkey to the elaborate cult of the hawk, and the nature of the respect paid to any species seems in nearly every case to be the direct expression of the impression made on the barbarian's mind by the behaviour of the beasts.

The Spirit-Helper.—Every Sea-Dayak hopes to be guided and helped all through his life by a spirit which announces itself to him in dreams and takes up its abode in some peculiar natural object or in some animal. In the latter case the Dayak will never kill or eat one of the same species of animal, and will lay the same prohibition on all his descendants, so that a whole family may come to pay especial regard to one species of animal for many generations. A similar institution occurs, though less commonly, among the other tribes. In such cases we seem to be able to trace sometimes the actual origin and growth of a totem; but neither among the Sea-Dayaks, nor the inland tribes of Sarawak, could the people be said to be in a totemistic stage of culture, nor was there sufficient evidence of an earlier totemistic cult. Mr. Hartland complimented the author on his caution and carefulness. He agreed with Dr. McDougall in regarding these animal cults as affording little proof of totemism as a stage in social or religious custom.

Dr. E. B. Tylor read a paper, by Mr. W. G. Aston, on the Japanese *gohei* and the Ainu *inao*." The leading idea of the paper was the illustration of the principle in religious development by which an object which was in the first instance simply an offering to a god has in the lapse of time been conceived as the embodiment of the god, or even as a distinct and independent deity. In ancient Japan the offerings to the gods were hemp and bark fibre, with cloth made from these materials. In later times there was substituted a small quantity of paper made of the same bark material and attached to a wand in the form known to us as the *gohei*. With the change of form the original character of the *gohei* as offerings was forgotten. They were looked upon as receptacles of the god, or embodiments of him, and honour was paid to them accordingly. At festivals it was supposed that the god descended into the *gohei* on a certain formula being pronounced by the priest. Hypnotic practitioners also used these objects, through which the deity who inspired them was supposed to enter their bodies. In other cases the devotees went further, and constituted the object which was originally an offering into a distinct and independent deity. The Ainus of Yezo use in their worship whittled sticks called *indo*, which have a general resemblance to an old form of the *gohei*, and are doubtless a cheaper substitute. The *inao*, like the *gohei*, are primarily offerings, but in some cases they ultimately gain direct worship as gods, having become, in short, genuine fetishes. Another link between the *inao* and the *gohei* is found in certain whittled sticks which a century ago were in use in Northern Japan for striking women with, as at the Roman *Lupercalia*, in order to secure fertility. Similar sticks, after consecration by the Shinto priests, were formerly used at Kiota to kindle the household fire at the new year to avert possible pestilence.

Mr. David Boyle, curator of the Toronto Museum, read a paper on the paganism of the civilised Iroquois of Ontario. Notwithstanding the contact of the Iroquois, or Six Nation Indians, with white people for more than three hundred years, a very considerable number of the former have retained many of their old-time beliefs with the appropriate ceremonies. Of four thousand Caniengas (Mohawks), Senecas, Cayugas, Onondagas, Oneidas and Tuscaroras now residing in the Grand River Reserve, within sixty miles of Toronto, Ontario, fully one-fourth continue to observe the ancient feasts or dances connected with the growth and ingathering of corn and fruits, and for desired changes in the weather, as well as for the curing of disease. Some modification in the ceremonies was made about a century ago by an Onondaga named Ska-ne-o-dy-o, who announced himself as a prophet who had paid a visit to the abode of the Great Spirit. The changes introduced by him, however, have not by any means removed the pagan character of the native beliefs, although he certainly did attempt to imitate some Christian observances. Still the addresses of the medicine-men retain most of the old-time forms, although their significance in many cases is lost and even the meaning of numerous words is no longer known. The leading idea of the present form of worship is that of a great spirit; but this has been acquired from missionary sources, and although the Indians have adopted the idea of a heaven, they do not believe in any hell. The quoted examples of petitions addressed to Rawen Niyoh, the Creator, illustrated the lack of assimilation of the old and new forms. One of the most characteristic ceremonies connected with the Iroquois paganism is that of the sacrifice or burning of the White Dog at the new year feast during the February moon, when the spirit of the dog, accompanied by offerings of tobacco, conveys to *Niyoh* information respecting the condition of his "own people" on the Grand River Reserve.

III.—ETHNOGRAPHY.

The Anthropology of West Yorkshire was the subject of a communication by the venerable Dr. John Beddoe. He remarked that the most striking qualities of typical Englishmen had been thought to be strongly developed in Yorkshire. Among these, he feared, was the defect of imagination so often found in those who called themselves, with some pride, practical men. Such men entertained a positive dislike, and even contempt, for knowledge of which they did not see the immediate use. This character was not British, Celtic, or Welsh.

Dr. Beddoe's impression, acquired by simple inspection, is that in the central parts of the West Riding, and notably at Leeds, a prevailing type is characterised by an oblong, or rather trapezoidal, head, inclining to be broad rather than narrow, with a vertical forehead, smooth and not prominent brows, and a straight profile, with a straight or sometimes concave nose. The smooth brows dissociated this type from that of the Bronze race and the squareness from the smoothly elliptic or oval one of the Southern Saxon. He was inclined to call it Anglian. Light hair was prevalent hereabouts, and also in the mountainous regions to the north and south.

On the whole, he thought the eastern and central regions of Yorkshire, judging by physique, less purely Teutonic than Teesdale or the Wapentake of Morley, though more so than Craven.

The author discussed the question whether any considerable British or pre-Anglian element remained in the country around Bradford. Without coming to any positive conclusion, he was disposed to consider the inhabitants of these parts as mainly Anglian in type. More British blood remained further north, in Craven. A prevalent type about Leeds seemed to him to resemble the Burgundian Belair type of His and Rütimeyer.

Mr. J. Gray read a paper on physical characteristics of the

population of West Aberdeenshire from observations made and statistics compiled by himself and Mr. J. F. Tocher. These observations, he said, were made at a Louach gathering in Strathdon, an isolated district lying right at the head of the Don Valley, with the principal object of ascertaining if any difference existed between the people in the upper ends of the river valleys and those on the eastern seaboard. It was reasonable to conclude, from the anthropological statistics compiled, that in Aberdeenshire at some distant date an early, tall, broad-headed, dark-haired and blue-eyed people, descendants of men of the Bronze age, who had perhaps come from South-east Europe, had been driven inland to the upper ends of the valleys and hills by later immigrants from North Germany who were shorter, had narrower heads, and were of a blonde type.

Mr. J. L. Myres then read a communication from Mr. D. Randall-MacIver on the present state of our knowledge of the modern population of Egypt, in which it was pointed out that whereas we had from statues and paintings, and especially from the skeletons found in recent excavations, a very fair idea of the composition and changes in the ancient population of Egypt, the interpretation of that evidence and of the problems in Egyptian history which it might be expected to solve was seriously hampered by the absence of corresponding evidence in regard to the modern population.

The Committee for the Ethnological Survey of Canada continue its most useful and necessary work, the report presented at this meeting being of exceptional value. The work of the past year has furnished conspicuous evidence of the great importance of securing ethnological data with as little delay as possible. While this is eminently true with respect to the white population, which is experiencing new and marked changes almost every year, in consequence of the introduction of foreign elements, often in large numbers, it is more particularly true with respect to the native Indian population. In many localities the original blood has become so diluted by intermarriage with whites that it is often a matter of great difficulty to find an Indian of pure blood. Proximity to settlements of white people has resulted in a more or less profound impress upon the social life and tribal customs, which are fast becoming obsolete and forgotten. The old chiefs who have served as the repertories of traditional knowledge are rapidly passing away, and with their death there disappears the last possibility of securing reliable data of the greatest value. Conspicuous instances of this kind have been brought to notice during the past year, especially in the case of the British Columbia Indians, whose ethnology is of the greatest interest and importance in consequence of their possible connection with the people of Eastern Asia. At present the great difficulty of securing competent and willing investigators is one of the most serious obstacles to be contended with, and it is believed that the often considerable expense involved in the prosecution of such work is largely accountable for this condition of affairs.

It is gratifying to note that the Department of Education for Ontario has taken a very practical and active interest in ethnological studies in that province, and that it provides for the publication of the results of research in its annual reports. Evidence has latterly been accumulating to indicate the presence at one time of numerous aboriginal settlements in localities which were very sparsely inhabited when first visited by the white explorers.

The committee appointed to carry out investigations on the natural history and ethnography of the Malay Peninsula presented their report, which had been drawn up by Mr. W. W. Skeat, the leader of the expedition.

The expedition itself was composed of members of the Universities of Oxford and Cambridge. The objects of the expedition were to carry out a scientific survey, in which ethnology, zoology, botany and geology should be included, of the little known Malay provinces of Lower Siam. The report stated that some very curious racial problems were found in the district arising out of the fusion of two antagonistic race elements. The most interesting problems were found in connection with the very primitive jungle tribes of the interior, concerning which much valuable information was obtained. The inhabitants were found to be for the most part Malay, who had become subject to Siamese influence. One little known tribe—the sacred tribe of the Prams—claimed to have come from India, and to have established themselves in the country previous to the coming of the Malays. The expedition was successful in obtaining a copy of their sacred book, from which it is believed an account of the origin of the tribe may be obtained. One small jungle tribe of Pangans was heard of, but though a forced march was made to reach them, the wild men had heard of the approach of the expedition, and had taken flight. Their late dwelling-place, a cave under a projecting rock, was photographed, as also were the very curious "tree-graves" used by the Siamese. This "tree-grave" burial, however, was now condemned by the Bankok authorities, and would become extinct before long The most interesting of Malay industries observed was the manufacture of damasked "krisses." Near the head-waters of the Muda a tribe of from twenty to thirty individuals was found living in a long barrack-like shelter of palm leaves. From them and from a neighbouring tribe valuable information as to their manners, customs and language, as well as full measurements of a few individuals, and some probably unique phonographic records of their songs, had been obtained, which were of an extremely simple and primitive character. It was found also that many of the leading Malay industries were being rapidly modified by the introduction of European methods and appliances, and it was now the rarest and most difficult thing to obtain cloth actually made of home-spun thread, the use of Singapore silk and aniline dyes being already the fashion everywhere.

IV.—ARCHÆOLOGY.

Mr. A. M. Bell then contributed a paper on the occurrence of flint implements of palæolithic type on an old land-surface in Oxfordshire, near Wolvercote and Pear-tree Hill, together with a few implements of various plateau types. He stated that a large section of the quaternary river-gravel there produced the usual fauna and many fine implements of human workmanship. This gravel cut into and was therefore newer than a previous land-surface, a portion of which was found at Wolvercote and another within half a mile at Pear-tree Hill. In both places flint instruments of palæolithic type, together with bulbed flakes and a few implements of plateau-type had been found. In every case these flints were vitreous, a point which distinguished them from those belonging to the river-gravels at Wolvercote. The older surface has been previously described as Northern Drift. Mr. Bell said he supposed it to be a *remaniement—i.e.* a re-handling or working over of the true Northern Drift, but deposited under semi-frozen conditions. It must be anterior to the river-valley, and consequently its relics of man were the oldest as yet obtained from the Thames valley. The drift in question most resembles the drifts of Caddington described by Mr. G. Worthington Smith and some sections on the Lower Greensand near Limpsfield, both of which are implementiferous, and the author would correlate the Wolvercote and Pear-tree Hill surface with these drifts.

A paper by Mr. J. Paxton Moir on stone implements of the natives of Tasmania, was read by Prof. E. B. Tylor. Examples of tools prepared with the help of grinding, and furnished with handles, were very rare, and were evidently of Australian origin. The Tasmanian implements were variously used—as, for example, by the women to cut notches in the bark of trees as an assistance in climbing; in the making of the Tasmanian spear, by scraping it straight and smooth; in grooving the handle of the Tasmanian club; and in sawing bones.

Prof. Tylor then proceeded further to add his own views on the Stone age in Tasmania as related to the history of civilisation. Inasmuch as the stage of civilisation attained by any people was of necessity closely associated with the nature of the implements in their possession, we might fairly assume that the development and habits of Europeans of the earliest authentic Stone age were essentially similar to those of the Tasmanians. What then, could we infer as to the earliest human races—the earliest, that is, after we had crossed the great gulf of the unknown which, on the evolutionary hypothesis, existed between the animal and the man? We found, taking the Tasmanians as representative of the earliest grade of society, that these people had no bows and arrows or throwing stones, but they had spears and clubs. They had houses and boats, but of the rudest imaginable type. They knew of fire, and could make it by the fire stick. With their stone implements they prepared and utilised the skins of animals. They made basket-work—in fact, the basket-weaving art had not substantially advanced from the earliest ages of which we had any knowledge until the present. They

had a mythology, with a Greek-like legend, as to the origin of fire; and lastly, they had religious ideas, lower and ruder than those of the North American Indians, but on substantially the same lines. This circumstance—that the Tasmanian natives represent the most ancient known beginnings of human civilisation, while at the same time they were so recently a real, living and known people—rendered all knowledge which could be acquired concerning them a contribution of priceless value to the history of mankind.

Mr. H. Ling Roth said that some eighteen months ago he had received from a Yorkshire gentleman, Mr. J. Backhouse Walker, an account given by an old Australian settler, who in his youth had come across a group of black fellows whilst they were actually engaged in making these stones. The first process was simply to split them by hurling them violently on the rocky ground, and some stones were at once used in this rough shape for cutting up kangaroo meat, whilst other stones were prepared by chipping. At one period, doubtless the Tasmanians covered the whole of Australia; and they were subsequently almost swept away—only scattered representatives being left in small areas—by another race.

Dr. A. C. Haddon made a communication on relics of the Stone age of Borneo (illustrated by lantern slides and specimens). Dr. C. Hose, the Resident of the Baram District of Sarawak, obtained numerous examples of stone implements from various interior tribes in his district; these he has generously presented to the University of Cambridge. The implements are made of various rocks, including fibrolite, impure sandstone, arkose, silicified limestone, shale, andesite and chalcedony. The form, too, varies greatly; some are obviously axe heads, others adze blades, while certain cylindrical forms, with a more or less cup-shaped cutting end, were probably used to extract the pith from the sago palm. In the collection are several stones of irregular form; the former use of some of them is problematical, but they have recently been used as touchstones. The natives have a high regard for these stone implements, which have in their eyes a sacred character, and it is very difficult to persuade their owners to part with them. In all cases fowls had to be sacrificed to appease the spirits. The implements are stored with other sacred objects, and most of them are believed to be teeth, or toe-nails, of Baling Go, the Thunder God.

Mr. Butler Wood read a paper, with a map illustration, on the Prehistoric Antiquities of Rumbald's Moor, between Bradford and Ilkley. The stone implements found there, he said, consisted of axe-heads, arrow-heads, awls, spear-heads, knives and scrapers. Several fine specimens were exhibited. Baskets full of flint chippings scattered about in a very limited area seemed to prove that it was a place of fabrication of flint instruments, for flint *in situ* was not found within fifty miles. About half a dozen bronze axe-heads had been found at lower elevations. So far as evidences of interment went, the barrows were unsatisfactory. There was a double stone circle within four miles of Bradford Town-hall containing in the centre a boulder with a cup and ring mark on it. He hoped the Corporation of Bradford would not permit it to continue neglected, but would preserve it as a valuable specimen of antiquity. Mr. Wood also briefly mentioned the earthworks and the so-called pit dwellings which seemed to have been attempted excavations for iron. Springs of water were always found near these excavations.

Dr. Haddon emphasised Mr. Wood's observation as to the necessity for the preservation of local antiquities. It was the duty of the section to bring to the notice of local authorities the fact of the existence of valuable archæological remains in the district, and he hoped the Press would help him to insist upon the fact that it was the duty of all the local authorities to preserve their antiquities as well and as long as possible. It had been observed by Mr. Wood that if steps were not taken the double stone circle would soon be worn away and disappear owing to pedestrians walking recklessly over and about it; and he hoped that as a result of this paper and of the feeling expressed by the section, the proper authorities would take such steps as would effectually preserve this ancient stone structure. He also thought it a pity that the three Saxon crosses at Ilkley were not placed inside the parish church, and the cup and ring markings on boulders preserved at Ilkley would be better protected if a light shed was erected over them.

An excellent paper by Mrs. Armitage on some Yorkshire earthworks describes a particular kind of earthwork, very common in Yorkshire and in other parts of England, consisting of a moated hillock with a banked and moated court attached. This type of fort has been attributed in turn to the Britons, Romans, Saxons and Danes, with equal improbability. The theory most general at present is that it is Saxon. But Saxon strongholds were built to shelter all the people of the neighbourhood, and were therefore of large area, while these earthworks are evidently intended to protect some individual chieftain and his personal following, as is shown by their small area. There is positive evidence that the Normans built earthworks of this kind in the eleventh century as the bases of wooden castles, and these moated hillocks are still very numerous in Normandy. They are called *mottes* in Norman-French, and this word is found in various parts of England in the form *mote*. An inquiry into the castles known to have been built by the Normans when they first came to England shows that almost all these castles had mottes, while the *burhs* or *boroughs* built by the Saxons never have these appendages, unless a Norman castle-builder has been at work there. The recognition of the Norman origin of these castles would help to solve an historical puzzle—how the Normans were able to hold England down. It was by a system of small fortified posts scattered all over the country that the action of the central machinery was carried into the remotest parts of the kingdom.

Mr. D. G. Hogarth read a paper on the cave of Psychró in Crete, which was copiously illustrated by excellent lantern slides. It has been known for some years that a large cave above the village of Psychró, in the Lasithi district of Crete, was a repository of primitive votive objects in bronze, terra-cotta, &c. As this cave is situated in the eastern flank of the mountain which dominates the site of ancient Lyttos, and is the only important cave known in the neighbourhood, it was conjectured that it was the Lyttian grotto connected with the story of the infancy of Zeus in the legend, whose earliest version is preserved by Hesiod. A thorough exploration of it has served fully to confirm this view. The cave is double. A rude altar was discovered in the middle of the upper grotto, surrounded by many strata of ashes, pottery and other refuse, among which many votive objects in bronze, terra-cotta, iron and bone were found, together with fragments of some thirty libation tables in stone, and an immense number of earthenware cups used for depositing offerings. The lowest part of the Upper Grotto was found to be enclosed by a wall partly of rude Cyclopean character, and partly rock-cut; and within this Temenos the untouched strata of deposit ranged from the early Mycenæan age up to the Geometric period of the ninth century B.C. or thereabout. Only very slight traces were found of later offerings. The earliest votive stratum belongs to the latest period of the pre-Mycenæan age, that marked by the transition between the "Kamáraes" fabric of pottery and the earliest Mycenæan lustre-painted ware. But below all is a thick bed of yellow clay, containing scraps of primitive hand-burnished black and brown pottery, mixed with bones of animals. This bed seems to be water-laid, and to be prior to the use of the cave as a sanctuary.

The southern or Lower Grotto falls steeply for some 200 feet to a subterranean pool, out of which rises a forest of stalactite pillars. Traces of a rock-cut stairway remain. In the chinks in the lowest stalactite pillars, a great many of which were found still to contain toy double axes, knife-blades, needles, and other objects in bronze, placed there by dedicators, as in niches. The knife-blades and *simulacra* of weapons are probably the offerings of men; the needles and depilatory tweezers of women. The frequent occurrence of the double axe, not only in bronze, but moulded or painted on pottery, found in the cave, leaves no doubt that its patron god was the "Carian" Zeus of *Labranda*, or the *Labyrinth*, with whom perhaps his mother, the Nature goddess, was associated, and the statuettes probably represent the two deities. Here was the primitive scene of their legend, afterwards transferred in classical times to a cave on Mount Ida.

Mr. Arthur J. Evans remarked that the cave was one of the most ancient shrines of the classical world bound up with the earliest cult of Zeus. Mr. J. L. Myres suggested that the eras of Cretan civilisation covered by the objects found in the cave might go back, at furthest, to the twelfth Egyptian dynasty, and extend down to the eighteenth dynasty.

A report of the committee appointed to co-operate with the Silchester Excavation Fund Committee was read by Mr. E. W. Brabrook.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. J. Larmor, F.R.S., has been appointed a member of the General Board of studies. Mr. F. C. Kempson and Dr. G. F. Rogers have been appointed demonstrators of anatomy; Mr. C. T. R. Wilson and Mr. J. S. E. Townsend have been appointed demonstrators of physics.

The Gedge Prize for physiology has been awarded to Mr. J. Barcroft, King's, and Mr. H. H. Dale, Trinity.

The Biennial election to the Council of the Senate will take place on November 7. Dr. Hill, Mr. Austen Leigh, Sir Richard Jebb, Dr. Kirkpatrick, Dr. Langley, F.R.S., Mr. Mollison, Mr. Shipley, and Dr. Keynes are the retiring members. In the absence of any acute issue it is not unlikely that most of these may be re-elected.

A syndicate is about to be appointed to consider what steps, if any, should be taken towards the better organisation of instruction in military subjects within the University. The question has been brought up by a memorial signed by a large number of influential residents in Cambridge, who desire the establishment of a closer connection between the University and the Army.

The High Court has issued an order varying the conditions of the Gedge Bequest for the encouragement of physiological research, whereby advanced students are admitted to the competition, provided they are of not less than three or more than five years' standing.

The examiners in sanitary science announce that sixteen candidates have, at the recent examination, become qualified for the University Diploma in Public Health.

On October 22, the number of freshmen who matriculated was 841, including fifteen advanced students. Last year the number was 883.

Prof. Darwin, F.R.S., has been elected a member of the Financial Board, Dr. Larmor a member of the Observatory Syndicate, Mr. Berry an examiner for the Mathematical Tripos Part I., and Prof. Lamb, Mr. Richmond, Mr. Baker and Mr. Macdonald examiners for Part II.

A VALUABLE address on "Famine in India" was given by Prof. Robert Wallace at Edinburgh University on October 18, to inaugurate the course of lectures on Colonial and Indian agriculture, specially endowed by Mr. Robert and Mr. John Garton, of Newton-le-Willows, Lancashire, and permanently attached to the chair of agriculture and rural economy in the University. The course is to be a part of the regular work to be done during the winter session of five months, and is to be delivered free to present and past students of the department of agriculture. As Prof. Wallace will be largely concerned with agricultural conditions in India and the Colonies, and their possible development, the subject of his inaugural lecture at what may be the closing epoch of the most prolonged, if not the most disastrous, of famines to which the Indian peoples have been periodically subjected was an appropriate one. "One of the greatest problems of the future," he remarks, "will be the supply of food for the rapidly-increasing, teeming millions of population. The haphazard method of production by which the accumulated resources of temporary fertility have been drawn upon as successive new unpopulated areas of virgin soil have been placed under requisition must sooner or later cease, and more scientific methods of cultivation and better systems of management must extract more bountiful results from new and improved breeds of plants and of domesticated animals. The expected era implies a more accurate knowledge of agricultural details, and a wider and more Imperial conception of the greater kindred questions than the present time affords."

THE museum which was opened by the Countess of Warwick at Stratford on October 18 will, we trust, lead to the establishment of many similar local museums. Prof. R. Meldola is largely responsible for the erection of the museum, for he advocated the formation of a collection of objects, and a permanent home for it, in his inaugural address to the Essex Field Club twenty years ago. The suggestion was taken up by the more energetic members of the Club, and specimens of scientific interest gradually accumulated, but it was felt that a museum building was essential to make the collections of wide value. By the munificence of Mr. Passmore Edwards, and the enlightened policy of the Town Council of West Ham, a building, which has cost about £4000, has been erected adjoining, and communicating with, the Municipal Technical Institute. This is the building which was opened by the Countess of Warwick last week. The Corporation has agreed to warm, light and provide for the care-taking of the building, and to make a grant of not less than £100 per annum towards the curatorial expenses. The county collections, cases and cabinets of the Essex Field Club (excepting the Epping Forest collections, which are to be retained in the Forest Museum at Chingford) are placed in the museum. The Club undertakes the selection and scientific control of the collections, and will devote a sum of £50 per annum towards the curatorial expenses. From a pamphlet by Mr. William Cole, the honorary secretary and curator to the Club, we learn that the plan and scope of the museum has been clearly defined, and will be rigidly adhered to in order to avoid the error of gathering together a miscellaneous collection of incongruous specimens. The museum will be a local (Essex) one, supplemented by short series having an educational value, and designed to show the place of the local forms in the general scheme of classification of animal and vegetable organisms. The promoters aim at its eventually fulfilling three main purposes: (1) The instructive recreation of the ordinary visitor by means of carefully arranged sets of the chief forms of life inhabiting the district, and examples showing the nature and meaning of fossils and geological formations. (2) Collecting and preserving authentic series of all forms of life, recent and extinct, occurring in Essex, as well as geological and anthropological specimens. This is a matter of really great scientific importance in view of the changes in our fauna and flora now so rapidly being brought about by the increase of population and the consequent effacement of natural conditions in many parts of the county. (3) Assisting students and field-naturalists in identifying and studying the groups in which they are interested. It would facilitate the advancement of education and natural knowledge if a museum of this kind were connected with every Municipal Technical Institute.

The parliamentary vote for the University of London for the year 1900-1901 was £18,840 gross, but it only amounted to a net payment of £10, the difference being received from fees paid by candidates presenting themselves for examination by the University. Viewed as a strictly business concern, therefore, the University is practically self-supporting. Many people both at home and abroad will be astonished at the trivial amount actually paid by the Government in aid of its greatest University.

SCIENTIFIC SERIALS.

American Journal of Science, October.—Notes on the Colorado Canyon District, by W. M. Davis. The Kaibab section of the canyon discloses the nearly even floor on which the horizontal Palæozoic strata rest. The floor is of complex structure. The fundamental schists with granitic dikes are overlaid in the eastern section by the heavy Unkar and Chuar series dipping eastward. The wedge in which the tilted formations terminate westward is a most remarkable geological structure, alike for its distinctness and for its significance.—Determination of minerals in thin rock sections by their maximum birefringence, by L. V. Pirsson and H. H. Robinson. The method described is an adaptation of Michel-Levy's colour diagram. The thickness of the rock section having been determined, the highest colour given in any of the numerous sections of the unknown mineral is observed, and by means of the diagonals the numerical value is noted which corresponds to the given colour in a section of the determined thickness. The maximum birefringence having thus been determined, the table of birefringences is referred to and the mineral usually found to be one of a group of several, among which it is easily distinguished by cleavage, colour and other optical properties. The authors add a table of birefractive powers, ranging from 0·287 (rutile) to 0·001 (chlorite).—Experiments on high electrical resistance, by O. N. Rood. An electric current travelling along a bad conductor has many analogies to a stream of pitch. It attains the end of the channel after a considerable interval, and if the resistance is very high, the potential at the end remains at zero. The author describes a number of experiments carried out with glass, silk, mica, jade, guttapercha, ebonite, amber and rosin. When glass, silk and mica were connected with one coating of a charged Leyden jar, it was found that within fifteen minutes the part farthest from the jar had assumed its potential. This was not the case with the other substances.

Ebonite showed a slight change of the opposite sign at the furthest end, probably due to prolonged inductive action.—New occurrences of corundum in North Carolina, by J. H. Pratt. The new occurrences are in an amphibole schist and a quartz schist respectively.—Products of the explosion of acetylene, and of mixtures of acetylene and nitrogen, by W. G. Mixter. Acetylene and ammonia yield hydrocyanic acid at a much lower temperature than is required to cause nitrogen to combine. It may be that ammonia is the first compound of nitrogen formed in the bomb, but the fact that a little ammonia is found among the products is not conclusive, as that may have resulted from the decomposition of hydrocyanic acid.

Annalen der Physik, No. 9.—Electric conductivity of pressed powders, by F. Streintz. Fine powders of platinum black, lampblack and graphite were prepared and subjected to great pressure. The resistance of 1 cubic mm. of platinum black was found to be 0·92 ohms at zero, as against 0·14 for ordinary platinum. The increase of resistance on heating was only half that of platinum. Lampblack showed a corresponding resistance of 40,000 ohms, and a very high negative temperature coefficient, therein resembling the electrolytes; while graphite, with its positive temperature coefficient, ranges itself among the metals.—Resistivity of bismuth in a variable magnetic field, by H. Eichhorn. Bismuth does not instantaneously lose the high resistance it acquires in a strong magnetic field. This is proved by mounting a bismuth coil on a rotating disc so that it traverses a magnetic field once during each revolution, and measuring, by means of contact pieces, the instantaneous resistance at various points of the orbit when at rest and in motion respectively.—Ratio of the thermal and electric conductivities, by E. Grüneisen. A very small proportion of arsenic added to copper suffices to reduce the thermal conductivity to one-tenth, and the electric conductivity to one-twelfth of its original value. In iron, the electric conductivity is much more sensitive to impurities than the thermal conductivity.—Reflection of kathode rays, by H. Starke. Kathode rays were made to impinge upon a metallic plate enclosed in a cylinder of the same metal, through a small opening in the end of which the rays entered. Another inner cylinder was used to measure the rays reflected by the plate and diffused by the gas, on the principle of Faraday's ice-pail. By putting the plate into two different positions, the diffusion and reflection could be separately estimated. The reflective power of aluminium was found to be 28·2, and that of copper 45·5.—Mechanical effect of kathode rays, by H. Starke. The author employs a kathode shaped like a propeller, but fixed. The rays impinge at an angle of 45° upon a thin plate of aluminium suspended above the kathode by means of a thin platinum wire. The results are negative so far.—Hardness of metals, by F. Auerbach. The author determines the hardness of metals by his method of finding the greatest pressure between a plate and a lens which the substance will stand without permanent deformation. Mild steel was found to have a hardness of 361, or that of quartz, hard copper 143 (like apatite), brass 107 (like fluorspar), gold 97, silver 91, aluminium 52, and lead 10.—Thermal conductivity of gases, by P. A. Eckerlein. The conductivities of air, hydrogen and carbonic acid are as 1 : 6·8 : 0·73, and the temperature coefficients are 0·00362, 0·00422 and 0·00352 respectively.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, October 3.—Mr. G. H. Verrall, president, in the chair.—Mr. G. C. Champion exhibited specimens of *Trogophloeus anglicanus*, Sharp, from Plymouth; *Pachyta sexmaculata*, L., from Nethy Bridge, and *Anchomenus quadripunctatus*, De Geer, from Woking. Mr. M. Jacoby exhibited an ichneumon from Blandford parasitic on *Sirex*—*Rhyssa persuasoria*, and Col. Yerbury said that he had met with the same species in some numbers in Scotland. One female observed in the act of oviposition had thrust her ovipositor, which is about the consistency of a human hair, through an inch of fir trunk. Col. Yerbury exhibited:—(1) a rare sawfly, *Xyphidria camelus*, taken in Scotland this year at Nethy Bridge. The species is mentioned in the old books as extinct in the United Kingdom, and there are no modern specimens in the South Kensington Museum collection. (2) Rare diptera from Scotland including (a) *Laphria flava*, from Nethy Bridge; (b) *Chrysaesyrphus scaevoides*, new to the fauna of Great Britain, from the Mound Sutherland, where it was common on Umbelliferæ under fir trees, one female also being taken on the path up Cairngorm near Glenmore Lodge; (c) *Microdon devius*; and (d) *Chilosia chrysocoma* at mountain-ash blossom, Nethy Bridge; (e) *Stomphastica flava*, two males from Golspie, September, 1900.—Mr. H. K. Donisthorpe exhibited (1) a specimen of *Drusilla canaliculata*, with the dead body of a *Myrmica* in its mouth, captured at Chiddingfold on July 17; (2) Specimens of *Myrmedonia collaris* and its larva taken in Wicken Fen with *M. laevinodis* in August, 1900.—The Rev. F. D. Morice exhibited a remarkable hermaphrodite of the bee *Podalirius* (= *Anthophora*) *retusus*, in which the male characters were confined to the left side of the head and genitalia, the right side of the thorax and the abdominal segments. The antennæ and hind (pollinigerous) legs were those of a female, and the genitalia half of each sex.—Dr. Chapman exhibited beetles of the genus Orina, some of them alive, and remarked on the fact that while some were viviparous others were oviparous, in the case of the former the larvæ being developed in the ovaries.—Mr. H. J. Elwes exhibited a collection of lepidoptera from Greece, taken this season in conjunction with Miss Fountaine in the Morea, and in the Parnassus region, including *Colias heldreichi*, *G. rhamni*, var. *farinosa*, and *Lycaena ottomanus*, with a var. of *L. semiargus*, probably a distinct species.—Mr. H. H. May exhibited a variety of *Strenia clathrata* not unlike *Syricthus alveolus* on the wing.—Mr. F. Enock exhibited a male bee *Stelis aterrima*, one of the bees parasitic in the nests of *Osmia fulviventris*, usually considered a rare insect.—Papers were communicated on "Descriptions of new species and a new genus of South American Eumolpidæ with remarks on some of the genera," by Mr. M. Jacoby, and on "Lepidoptera Heterocera from Northern China, Japan and Corea" (Part iv.), by Mr. J. H. Leech, &c.

PARIS.

Academy of Sciences, October 15.—M. Maurice Lévy in the chair.—Preparation and properties of the carbides of neodidymium and praseodidymium, by M. Henri Moissan. The oxides of neo- and praseodidymium heated with carbon in the electric furnace give crystallised carbides of the formula RC_2, like the carbides of cerium and lanthanum. These carbides are decomposed by cold water, giving a mixture of acetylene, ethylene and paraffins, the first-named predominating. At 1200° the carbides are superficially attacked by ammonia, some nitride being formed.—Observations of the planet Eros made with the large equatorial of the Observatory of Bordeaux, by MM. G. Rayet and A. Féraud. The planet is of about the ninth magnitude, and leaves a clear trace upon the photographic plate.—On the general equation which gives the integral of Jacobi as a particular case, by M. Gruey.—Observations of the Borrelly-Brooks Comet, made with the Brunner equatorial at the Observatory of Lyons, by M. J. Guillaume.—The problem of stationary temperatures, by M. W. Stekloff.—On the explosive mixtures formed by air and by hydrocarbon vapours of the principal organic series, by M. J. Meunier.—On the elimination of the harmonics from alternating currents by the use of condensers, and on the interest of this elimination from the point of view of security of human life, by M. Georges Claude.—On the accessory reactions of electrolysis, by M. A. Brochet. In the electrolysis of sodium hypochlorite, the loss of hypochlorite in four hours is much greater than that calculated from the current used; and in the preparation of chlorate yields greater than those calculated are obtained. The author traces these anomalous results to the fact that the immediate neighbourhood of the anode is always acid, and hence the hypochlorous acid in that region is transformed spontaneously into chlorate without using electrical energy, even when the bulk of the liquid is alkaline.—On isopyrotritaric acid, a new pyrogenous product from tartaric acid, by M. L. J. Simon. The ferric salt of this acid, the isolation of which was described in an earlier note, is highly characteristic, possessing a deep violet colour in solution. Pyrotritaric acid and similarly constituted furfurane acids do not give this reaction, which is so sensitive that it may be used for the detection of ferric salts and also as an indicator in acidimetry.—On the morphology of the respiratory apparatus of the larva of *Bruchus ornatus*, by M. L. G. Seurat. The larva of *Bruchus ornatus* presents some peculiarities in the morphology of its respiratory apparatus which clearly distinguishes it from the Curculionidæ, the most important being the rounded form of the stigmata, the existence of a prothoracic ring completely uniting the lateral trunks, and of ten transversal latero-ventral anasto-

moses, of which three are thoracic.—The proteolytic ferment of seeds during germination, by M. V. Harlay. The proteolytic ferment in lentils during germination is analogous in its behaviour to the animal ferment trypsine.—On early tuberculisation in plants, by M. Noel Bernard.—On the Cretacian of the *massif* of Abou-Roach (Egypt), by M. R. Fourtau.—Fixation by porous bodies of clay in suspension in water, by M. J. Thoulet.

NEW SOUTH WALES.

Linnean Society, June 27.—The President, the Hon. James Norton, in the chair.—Notes on some Australian and New Zealand parasitic Hymenoptera, with descriptions of new genera and species, by William H. Ashmead. Sixty-four species were represented in two collections brought together by Mr. W. W. Froggatt and Mr. A. Koebele, formerly of the U.S. Department of Agriculture. Of these forty-nine are described as new.—On the *Carenides* (Fam. *Carabidae*), Part iii., by Thomas G. Sloane. Nine species referable to the genera *Laccopterum*, *Carenum*, *Eutoma* and *Carenidium* are described as new, from Queensland, North-west, West and Central Australia. A synoptic table of the groups of species into which the genus *Carenum* may be subdivided is given, with notes thereon.—Descriptions of two new species of Diptera from Western Australia, by D. W. Coquillett. A species of *Phytomyza*, the larvæ of which mine the leaves of the beet, and one of *Myiophasia*, parasitic upon the Scarabeid *Anoplostethus opalinus*, Burm., are described. The second of these, founded upon male specimens, may indeed be congeneric with *Neophasia picta*, Brauer and Bergenst., founded on a female specimen without antennæ from West Australia.—Descriptions of two new blind weevils from Western Australia and Tasmania, by Arthur M. Lea. Only two species of blind Coleoptera have hitherto been recorded from Australia, namely, *Halorhynchus caecus*, Woll., from West Australia, and *Illaphanus stephensi*, Macl., from New South Wales, both dwelling close to sea-beaches. An additional species of *Halorhynchus* from the "outer beach" at Geraldton, Western Australia, is described in the present paper, together with an insect for which a new genus is proposed, and of which the type-specimen was found in the nest of a small red ant near Hobart.—The double staining of spores and bacilli, by R. Greig Smith. An improvement upon Klein's method of double staining spores and bacilli is described. The spore-bearing material is distributed in normal saline in a small test-tube, an equal volume of carbol-fuchsin is added and the mixture placed in boiling water for fifteen minutes. A loopful is then withdrawn, spread over a coverglass, dried and fixed in a flame. The bacilli are decolorised in 1½ per cent. (by volume) of alcoholic hydrochloric acid, washed in water and counterstained in methylene blue. Even the most refractory spores are stained deep red, the bacilli blue.

July 25.—The President, the Hon. James Norton, in the chair.—Descriptions of new Australian Lepidoptera, by Oswald B. Lower. Forty species, referable to the *Bombycina*, *Geometrina*, *Pyralidina*, *Tortricina*, *Tineina* (*Œcophoridae*, *Gelechiadae*, *Elachistidae*, *Tineidae*), are treated of, thirty-seven being described as new.—On *Didymorchis*, a Rhabdocœle Turbellarian inhabiting the branchial cavities of New Zealand crayfishes, by Prof. William A. Haswell, F.R.S. *Didymorchis* attracted notice during a search for allies of the *Temnocephaleae*, and is probably the nearest known relative of the group in question. The animal is about 1 mm. long and less than ½ mm. in greatest breadth; and as far as observed is practically an invariable companion of the crayfish *Paranephrops setosus*, though not occurring in large numbers. A remarkable feature is that cilia are developed only on a portion of the ventral surface of the body, and are entirely absent round the margin and on the dorsal surface. On the whole the animal seems to make a nearer approach to the *Vorticida* than to any of the other known groups.—Supplement to a monograph of the *Temnocephaleae*, by Prof. William A. Haswell, F.R.S. Three additional species of *Temnocephala* are described—*T. tasmanica*, allied to the much larger *T. quadricornis*, occurring in the branchial cavities, and occasionally on the external surface of *Astacopsis tasmanicus*; *T. aurantiaca*, found upon the lower surface of the abdomen of a Tasmanian Astacopsis, at present undetermined; and *T. coeca*, found upon the surface of the remarkable burrowing Isopod, *Phreatoicopsis terricola*, Spencer and Hall. The paper concludes with some remarks on certain points in the structure of the members of the family, mainly suggested by Monticelli's recent paper (*Bolletino della Soc. di Nat. in Napoli*, xii. 1898).—Observations on the Tertiary flora of Australia, with special reference to Ettingshausen's theory of the Tertiary cosmopolitan flora, Part i., by Henry Deane.—On the bacterial flora of the Sydney water supply, Part i., by R. Greig Smith. Thirty-two species of micro-organisms commonly occurring in Sydney water are described. These include six new species and four new subspecies.

DIARY OF SOCIETIES.

FRIDAY, OCTOBER 26.

PHYSICAL SOCIETY, at 5.—Exhibition of Experiments illustrating certain Phenomena of Vision: Dr. Shelford Bidwell, F.R.S.—On the Concentration at the Electrode in a Solution, with special reference to the Liberation of Hydrogen by the Electrolysis of a Mixture of Copper Sulphate and Sulphuric Acid: Dr. J. S. Sand.—Electromotive Force and Osmotic Pressure; Dr. R. A. Lehfeldt.

SATURDAY, OCTOBER 27.

ESSEX FIELD CLUB, at 6.30.—Contributions to the Pleistocene Geology of the Thames Valley. The Grays Thurrock Area, Part I.: Martin A. C. Hinton and A. S. Kennard.

THURSDAY, NOVEMBER 1.

CHEMICAL SOCIETY, at 8.—Dehydrohomocamphoric Acid and its Oxidation Products: Arthur Lapworth.—Derivatives of Ethyl α-methyl-β-phenylcyanglutarate: W. Carter and W. Trevor Lawrence.—The Nitration of Acetamino-*o*-phenylacetate (diacetyl-*o*-aminophenol)—a Correction: R. Meldola, F.R.S., and Elkan Wechsler.—Rhamnazin and Rhamnetin: A. G. Perkin and J. R. Allison.—(1) Luteolin, Part III.; (2) Genistein, Part II.: A. G. Perkin and L. H. Horsfall.—Colouring Matter of the Flowers of *Delphinium consolida*: A. G. Perkin and E. J. Wilkinson.—The Action of Alkalis on the Nitro-compounds of the Paraffin Series, Part II.: Wyndham R. Dunstan, F.R.S., and Ernest Goulding.—Hexachlorides of Benzonitrile, Benzamide and Benzoic Acid: F. E. Matthews.—The Influence of Solvents on the Rotation of Optically-active Compounds, Part I.: T. S. Patterson.—Note on Gallinek's Amidomethylnaphthimidazole: R. Meldola, F.R.S., and F. H. Streatfeild.—The Action of Heat on Ethyl-Sulphuric Acid: W. Ramsay and G. Rudorf.—The Amount of Chlorine in Rain-water collected at Cirencester: Edward Kinch.

RÖNTGEN SOCIETY, at 8.—Presidential Address: Dr. J. B. Macintyre.

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