THURSDAY, SEPTEMBER 29, 1898.

THE RETURN FROM IDEALISM.

The Metaphysic of Experience. By Shadworth H. Hodgson. 4 vols. Pp. xix + 459; viii + 403; viii + 446; viii + 503. (London: Longmans, Green, and Co., 1898.)

DR. SHADWORTH HODGSON'S first essay in metaphysic was made a generation ago, and his well-known "Philosophy of Reflection" dates from twenty years back. In the interval his work has undergone review and development, revealed from time to time in his presidential addresses in Albemarle Street; but it is in the present volumes only that the mature results of his courage and patience appear in their due perspective. It is a matter for general congratulation that so original a thinker should have been able to put forth his system in such relative completeness.

Neither empiricism which treats unanalysed concretes as ultimate, nor materialism and idealism which lay the stress on the facts of some one order only which we have somehow and in some sense come to know, can offer us an adequate explanation of the world as it exists for common-sense. Materialism fails to explain consciousness because matter is known for what it is only in terms of consciousness. Idealism fails to solve the problems of the material world as known to science because it hypostatises thought, imputes real agency to it. Nor is the compromise which makes the material and the conscious simply diverse aspects of the same reality less vicious in its use of unproven assumptions. There is but one way left—experientialism or the interrogation of consciousness by the analysis of its process-contents. Such analysis is what Dr. Hodgson calls metaphysic, and upon it may be built a constructive and complementary philosophy with unverifiable results. The analysis and construction together constitute philosophy as a whole.

If it is possible to reach to what is in any sense of the words beyond, and independent on, consciousness, it can only be so by making distinctions in the analysis of the contents of consciousness itself. Dr. Hodgson's first book and volume then is devoted to this analysis. What exactly do we find in consciousness? If we dismiss the prejudices due to system and incident to language, we have yet to face the fact that the analysis can only be taken in hand when one has long built up his common-sense world, and the conditions of past consciousness cannot fail to affect present. Dr. Hodgson's device to reach consciousness in its lowest terms is to introduce new facts into consciousness, a note, say, and then another struck on an unseen piano, and abstracting from our knowledge of their names, significance, and associations, to inquire what is present in the empirical moment of perception. He finds two distinguishable elements involved, time and feeling. The first note is felt to have receded, though retained in consciousness, as the second is struck. Further consideration shows that time must be taken as having duration and as continuous, and that even the first note must begin to recede from the point at which it begins to be felt. Thus all perception is retrospective or reflective. This fact is important as leading us at a later stage to contrast the reflective functioning of consciousness as a knowing with its forward movement as existent; to apprehend, as we compare retention with redintegration, the significance of the phrase "below the threshold of consciousness" familiar to the physiological psychologist; to learn without surprise that there is in antithesis to consciousness an order of real conditioning, in which the neuro-cerebral system is proximate condition of consciousness as its conditionate and evidence.

But for the present Dr. Hodgson riots in pure analysis—how we become aware of time future, how we distinguish objective thoughts and objects thought of, "what" and "that," nature and genesis, essence and existence; how and in what proportions tactual and visual perceptions give us our knowledge of that pre-eminently "common sensible," space; how the external world and the localisation of consciousness in our bodies become known, and the like. Peculiarly significant is the part played by desire and disappointed expectation in leading us to distinguish the phantasmagoria of objective thoughts from the order of objects thought of as really existing.

In actual achievement as well as in fruitfulness of suggestion this analysis is a veritable triumph. Its central thought is that the agent and subject is the organism, and not any immaterial Psyche or transcendental ego implied in consciousness. The interruptions of continuity in consciousness, and the part therefore assignable to the brain and other nervous system in the explanation of memory, lead us, if we can render matter, in some sense indifferent to consciousness, intelligible as a real existent, to a theory in which it is held that in and from the cognitive order we can infer to an order of real conditioning of which consciousness is the dependent concomitant. The point on which the critic who is not prepared to deny Dr. Hodgson's other main positions would be most likely to take issue is the Lockean doctrine, that percept-matter and physical matter are so related that matter is known as it actually is. Here, perhaps, the antithesis of noumenon and phenomenon might find rehabilitation.

The order of real conditioning is the field of the positive sciences, except psychology. This deals with consciousness as an existent in dependence on its proximate conditions in the neuro-cerebral organisation.

Book ii. deals with the positive sciences and contains admirable analysis of some of their fundamental conceptions. In this section Dr. Hodgson disclaims expertise, and supports himself on authorities; but his treatment of the ultimates of mathematics and physics is wholly admirable. Corresponding to his treatment of space in Book i., which was of quite palmary merit, comes an adverse criticism of the claims of non-Euclidean space-theories. His discussion of the Newtonian conception of matter leaves nothing to be desired. In chemistry he tends to follow "the new chemistry"; in the biological sciences, though interesting, he is discursive and too little "positive" to be convincing.

With Book iii. we pass to the science of practice and practical science, to the analysis of conscious action logical poetic or æsthetic, and ethical. And here the

analysis of volition, and the demonstration of the continuity of reasoning in logic and ethic are substantial contributions to speculation. It is probably in the sphere of practice and in especial in ethic and religion that Dr. Hodgson finds the true task of consciousness as something other than the fly upon the wheel of real conditioning. At any rate the denial of efficiency to consciousness and the attribution of real activity to the organism as such, to the conscious being and not to his consciousness, has not emptied morality of content. Conscience and personality have their meanings, and very full and rich ones in the new system. Conscience as self-consciousness in selective attention is no doubt wholly conditioned by the neuro-cerebral system, but it is the sole criterion of morality, its preferences are perforce imperatives, its judgments as to the anticipated effect of actions upon character are final in scorn of consequence. No system of prudence will satisfy Dr. Hodgson, but only a moral responsibility for character which requires free-will.

His treatment of this well-worn topic is somewhat unconvincing. Inward determination or self-determinism is freedom, and in this sense even the inorganic is partially free, and in each higher organisation of matter such freedom is intensified. And we are not to think that laws of nature "compel"; there is no necessity in the order of real conditioning.

So far, so good. But is this enough? The *de facto* presence of real alternatives in the order of real conditioning is what is required to justify responsibility on Dr. Hodgson's theory, and he will not allow himself to make fallacious inferences from sense of effort and so forth. Does he not tacitly rest the case on the belief that otherwise pleasure and pain, desire and volition, the whole contents of consciousness as such are illusion and inutility? In acknowledging only "apparent design" in nature, and resolving the teleological into the æsthetic judgment, he precludes himself from this escape. The influence of Kant's later critiques is all the more obvious from Dr. Hodgson's antagonism to the earlier.

Out of the moral consciousness arises the religious. And of this Dr. Hodgson is at pains to show the competence and limits.

The fourth book on "The Real Universe" is really a *Religionsphilosophie*. Approached in a characteristically analytical way. Matter or adverse occupancy of space by coherence of parts is composite even in its minima. It must therefore have been produced by non-material real conditions. Either this or the "aseity" not yet proven of matter. It is upon these unseen realities, which through matter their product work in the organism and condition consciousness, that faith fastens. Upon them it projects, in a way satisfying only to the practical reason, those conclusions which religion derives from ethic and completes ethic by. Among other vaticinations in this field consciousness stumbles pathetically upon a theory of an organism formed by the neuro-cerebral system with the growth of character, an organism perchance disengageable at death and capable of a future life with those it has loved and lost—the theory of the authors of "The Unseen Universe." But Dr. Hodgson is severe with himself and will not take any surmise for metaphysical truth.

The strength or the weakness of the system lies in the refusal to attribute agency to consciousness. Where, if it does nothing, and the neurosis all, lies the use of consciousness? and yet if we introduce final causes, what becomes of Dr. Hodgson's system? Or is its sole use the speculatively unjustifiable self-projection into the unseen which characterises the ethico-religious consciousness?

But beyond the significance of any single doctrine of "The Metaphysic of Experience," or even of its central doctrine, is that of its method. Many of its results must hold good, but, were it otherwise, the book would live, because of the unflinching sincerity which is its keynote. H. W. B.

AN INTRODUCTION TO GEOLOGICAL SCIENCE.

Geology for Beginners. By W. W. Watts, M.A., F.G.S. Pp. xvii + 352. (London: Macmillan and Co., Ltd., 1898.)

THE progress of science demands from time to time new text-books by fresh workers, and in the handy little volume before us we have presented to us the leading facts and principles of geology concisely explained and well illustrated by the light of the most recent researches. The author himself, one of the most energetic of observers and teachers, and with a varied experience both in the field and laboratory, has made excellent use of his opportunity, and in this "Geology for Beginners" he has given to the earnest student one of the best introductions to the science ever published. There are other works on elementary geology which will prove more fascinating to general readers, who seek to become acquainted only with the principles of the science; but those who desire to master the subject must enter into details, and they will do well to follow step by step the instructions given by our author.

From the study of a few selected examples of rock at home, he leads us to the study of rocks and rock-structures out-of-doors. We are then taught to observe the wear and tear of rocks by various agencies, and to understand the formation of gravels, sands, and clays, including in course of time the mode of origin of crush-conglomerates. The action of compressed air on sea-coasts, and many other little matters, not usually explained in text-books, are introduced to our notice. In all information relating to mineralogy and petrology, to metamorphism and earth-movements, the author's statements are clear, and as full as need be for an elementary student. Each chapter is divided into paragraphs with bold headings, and at the end there is a recapitulation which is followed by a series of questions. The author has planned his work on the revised syllabus of the Science and Art Department, and the questions which he quotes are those which have been set by that Department and by the Oxford and Cambridge Schools' Examination Board.

Throughout the volume the subjects are illustrated by diagrams, by photographs of hand-specimens and microscopic slides of rocks, and by photographs of natural exposures of rocks. In the chapters relating to the successive geological periods there are numerous figures of fossils. In most cases the names of the genera only are

given, but in some instances the names of the characteristic species are also mentioned. This portion of the work would, we think, bear amplification in a new edition. We note that *Eozoon* is abandoned as a fossil. The Archæan system is regarded as Eozoic, as the bands of limestone and graphite which it contains are probably of organic origin, while among the Longmynd rocks "obscure traces referred to worm-tracks and trilobites have been found."

Concluding chapters deal with the origin of landscape, with escarpments, base-levels, &c., and there is a brief outline of economic geology. Too little attention is perhaps, as a rule, given to this last professional aspect of geology; but in his introduction the author rightly observes:

"Pursuing these studies we are brought into contact with constituents of the earth's crust which are of value in the arts and manufactures, and it is our business to learn about them, where they are found, and how they were formed, and if possible to point out where similar things may be found elsewhere."

Applied geology must of course be based on the firm footing of science—on a foundation the main features of which are so ably delineated in the present little volume.

OUR BOOK SHELF.

Plant Life, considered with special reference to Form and Function. By Charles Reid Barnes, Professor of Plant Physiology in the University of Chicago. Pp. vii + 428. (New York: Henry Holt and Co., 1898.)

IT is rather difficult to speak with justice about Prof. Barnes' little book. The idea, set forth in his preface, of attempting to give a general and somewhat philosophical account of plant life such as shall be useful to young readers, is an ambitious one, and the author has, here and there, almost realised parts of it. But we must confess that, taken as a whole, the book is not satisfactory—it is more provocative of yawning and somnolence than keen interest. At times, too, it is amazingly behind the times. The discredited figures of centrosomes are reproduced with a fidelity worthy of a better cause, and the account given of the ascent of sap is worse than misleading. Some of the figures, too, are very bad, and it is difficult to see the use of a delineation of a *Fucus* egg, such as presented in Fig. 42.

The physiological part is in some respects, perhaps, less open to objection than much of the rest of the volume; but here also there is a deal of useless talking round points, giving wordy definitions instead of definite ideas. What is the good of telling young students that irritability is the power of responding to a stimulus, without giving them some idea of what a stimulus itself consists? Quite enough knowledge of chemistry is presupposed in the earlier chapters to have warranted a more precise explanation of the nature of a stimulus than "the external change which brings about the reaction"; and the metaphor of the trigger and loaded gun ought to be carefully explained, if it is to be put before young readers.

These are a few of the defects which mar the execution of a task perhaps almost impossible of fulfilment within the compass of a small book; but if the author has not, at least in our judgment, succeeded in writing a book pre-eminently useful for students, it may, as a kind of note-book, prove of service to young teachers. The volume ends with tolerably good appendices containing directions for laboratory work and the collecting of suitable material for study.

Stories of Starland. By Mary Proctor. Pp. 186. (New York: Potter and Putnam Co. London: G. W. Bacon and Co., Ltd.)

TO write a book in a conversational style for the instruction of children requires a deal of art and close familiarity with the curious workings of young minds. Books of this kind have usually to be classed as failures, and the present volume only rises in parts above their level. In the first place, few of the illustrations will interest children, and the figures of Mars on p. 69, and of the Orion Nebula on p. 157, are in no way satisfactory. Then the children's questions and answers are too ready and apt for an average child to follow or retain in his mind. Thus, on the four pages 20–23, Master Harry, who plays the part of the inquiring boy, has impressed upon him that it would take a train nearly one hundred and seventy-five years to get to the sun, that at the rate of two cents a mile the fare would be nearly two million dollars, that walking at the rate of four miles an hour for ten hours a day the journey would occupy more than six thousand years, that a cannon ball would take nine years to reach the sun, and the sound of the explosion fourteen years, and that if an imaginary long arm touched the sun, the pain of burning would not be felt for one hundred and fifty years on account of the time taken in the transmission of sensation through nerves.

Now all this may be very well in a popular lecture in a country village, for grown-up people sometimes like to be impressed by statistics of the millions upon millions type, but it has no educational value whatever, and is entirely out of place in a volume intended for the instruction of children. In fact, Miss Proctor makes the common mistake of crowding too many uninteresting details into her book, and of describing too many appearances which her pupils will be unable to see for themselves.

By far the best part of the volume is that in which the chief constellations are described, and the legends connected with the constellation figures are related. These star-stories from the mythology and folk-lore of different peoples are better suited to the mental condition of a child than the descriptions of petty details concerning planetary motions and appearances.

A number of short poems of variable quality are interspersed through the pages, and may help to relieve the narrative when children of poetic temperament are the readers or listeners.

Canalisations électriques. By R. V. Picou. Pp. 172. (Paris: Gauthier Villars. Masson et Cie.)

DETAILS concerning the erection and working of aerial lines for electric currents are given in this volume, which belongs to the well-known Aide-Mémoire series. The first part of the volume includes descriptions of the wires used, the various forms of insulators, and different kinds of posts and supports used to carry the wires; the second part is concerned with the mounting of lines, all the details as to earths, tension, and protection against electrical and other disturbances being dealt with. In the third part of the volume the chief formulæ and tables used by electrical engineers engaged in wiring work are brought together.

Contributions a l'Étude de l'Hérédité et des Principes de la Formation des Races. By J. M. Harraca. Pp. 172. (Paris: Félix Alcan.)

HERE and there in this little volume the reader will find an interesting point referring to facts or views bearing upon heredity, but the search for this material for thought in a waste of words is very wearying. The author writes with apparent conviction that he has new things to say, and he certainly does express some ideas which appear to merit consideration, so that students of heredity may find it worth their while to glance through the volume.

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.*]

Flow of Water.

BEING away from home at this place, I did not see a copy of NATURE of September 15 in time to reply in the next issue to the letter of Prof. Osborne Reynolds. That letter is to a great extent a discussion of a point of considerable interest, viz. the clear border visible in my experiments with air injected into flowing water.

The discussion is, however, preceded by a statement which, whether intentionally or not, seems to imply that not only had Prof. Reynolds previously with similar apparatus made most of the experiments I have published during the last year or two, but had communicated to me his methods and shown me this apparatus. Apparently, therefore, my humble part has been the production of a certain number of photographs of effects slightly modified from those dealt with by him.

Now, though questions of this sort are of little interest, I have no alternative but to reply to all this, because, unfortunately, the real facts of the case as to my indebtedness to Prof. Reynolds have left quite a contrary impression on my mind to that which might otherwise be supposed.

With brevity in view, I will merely refer your readers to an article in NATURE (May 12), which gives a brief outline of my research up to that date. In that article is mentioned and duly acknowledged the only point for which I am indebted to the writings of Prof. Reynolds, viz. the idea of the two manners of motion of water, so ably worked out by him in the *Philosophical Transactions* of the Royal Society.

Beyond this I cannot recall a single idea, communicated verbally or otherwise, which I owe to Prof. Reynolds, and I certainly have never seen or heard of any other appliances which bear the remotest resemblance to those I have designed and used.

If the foregoing simple statement of fact is not sufficient, I am quite prepared to enter into the subject more in detail, although I should regret to have to do so.

My reply to the other portion of the letter will be rendered much more clear by means of diagrams, and I will therefore defer my answer to it until I return to work at Liverpool.

H. S. HELE-SHAW.

South Beach Hotel, Troon, N.B., September 26.

The Movement of Encke's Comet.

IN Prof. Poincaré's paper on the "Stability of the Solar System," the statement is made that "astronomers have only been able to explain the movement of Encke's comet by supposing the existence of a resisting medium."

It may be of interest if I state that in a paper published in the *Astrophysical Journal* for January 1896, I have shown that the movement of Encke's comet may be explained by the application of well-known physical laws, which have been verified experimentally by a number of physicists, and that no suppositious resisting mediums are necessary. It is also of interest to note that the same phenomena which explain this change of rate also explain the other cometary phenomena, such as the formation of cometary tails, the curious bridge in Biela's comet, and enable us to predict that comets are unstable bodies and must all ultimately split up into swarms of meteorites, the fragments continuously separating from each other.

I might also call attention to the fact that since, according to this theory (which has so far accounted for all the facts known without assuming any premises except well-known properties of matter), a comet can be used as a gigantic absolute electrometer (its tail being the index) for measuring the electrostatic potential of the sun and planets, accurate observation of the curvature and spectra of comets' tails are much to be desired throughout their whole period of visibility.

REGINALD A. FESSENDEN.

Western University of Pennsylvania, September 3.

A Request for Zoological Literature.

I WISH to ask my fellow zoologists, especially those on the continents of Europe and America, to be kind enough to send me, for our library here, separate copies of their papers and memoirs on zoological subjects. Here, in New Zealand, a naturalist is not only isolated, but has no efficient supply of current zoological literature; the nearest library containing modern periodicals being Sydney—a week's journey. The museum library in Dunedin, though well equipped in some respects (travels and older books), is extremely poorly provided with periodical literature. We take in the English journals and *Proceedings* of Societies, &c., but we do not purchase a single German periodical (with the exception of the Naples *Mittheilungen* and the *Jahresberichte*), and only one French journal, *Annales des Sciences naturelles*.

Hence, we are fearfully handicapped in our research work, and in our efforts to keep abreast of zoological advances. Out of sight, here, is to be out of mind to a great extent; and I would earnestly ask my colleagues in Europe and America, in their kindness, to help to remedy this disadvantage. Even if we wish to purchase a work in Europe, it takes at the very least three months before we can obtain any reply to our orders, and more usually four or five months intervene.

You dwellers in and near cities and large libraries cannot appreciate this great inconvenience.

W. BLAXLAND BENHAM.

Dunedin, New Zealand, August 14.

Stereochemistry and Vitalism.

WHEN listening to Prof. Japp's stimulating presidential address, I could not but wish that he had pursued his subject further and inquired into the antecedents of the life-made carbon compounds.

These are probably formed in the first place, not as compounds of only C, H, and O, but rather as constituents of a large molecule which has nitrogen as its centre. The growth of the C, H, and O groups depends on the lability of N compounds, *i.e.* their proneness to transfer matter and energy. If, then, the formation of the said carbon compounds is controlled by the nitrogen, whose atoms (with a valency alternating between 3 and 5) are asymmetrical or have a symmetry different from that of the carbon atoms, *does this peculiarity of the nitrogen determine the asymmetry of the resulting carbon compounds?*

F. J. ALLEN.

Mason University College, September 24.

A White, or Milky Sea.

I LEFT Bombay for England in January 1881, on board the P. and O. s.s. *Sumatra* (Captain Briscoe), and on February 1, the vessel being then in N. lat. 14° and E. long. 53° (not far from the position described by your correspondent) had an opportunity of witnessing the phenomenon known as the "Milky Sea," rarely seen except in these waters. The following extract from my book, "An Engineer's Holiday," describing and explaining the appearance, may interest Mr. Barrett:—

"The whole ocean, from the ship to the visible horizon, looked as if it were covered with snow, whose surface evidently shone by the reflected light of the sky, for Venus, being very bright, threw a distinguishable line of radiance across it, while the phosphorescent crests of waves were now and then seen breaking above the layer of shining matter which overlaid the water.

"A current, always encountered north of Socotra, set the ship, on the day in question, fourteen miles to the northward of her course. This stream was crowded with large medusæ, visible not only during the day, but also at night, when, being themselves non-luminous, they appeared as whirling black discs in the general phosphorescence of the ship's wake. The ship's officers fully believed that this current brings with it, besides jelly fish, enormous quantities of decayed and phosphorescent matter, to whose presence they attributed the appearance of the 'Milky Sea.'

"The fact, however, that the seeming snow reflects light, and is broken through by quite small waves, disposes of this explanation, and we soon convinced ourselves that the phenomenon is really due to a thin layer of mist lying on the water, exactly

resembling one of those local fogs which every one has seen, and which may give to a valley or even a slight depression the appearance of being snowed up. It occurs when the sea is colder than the atmosphere, and the latter still and heavily loaded with aqueous vapour. Under these circumstances, a layer of air immediately in contact with the water is chilled below the dew point and becomes misty, while that above remains transparent: the upper surface of such a fog, which is only a few inches thick, being seen by the reflected light of the sky" ("An Engineer's Holiday," vol. ii. p. 314).

The temperature of the sea on the night in question was 70° F., while that of the air was 79°, an unusual amount of difference in the Arabian sea. Water, brought on deck by a bucket, showed no signs of milkiness, though crowded as usual with various phosphorescent organisms. DAN. PIDGEON.

The Long House, Letherhead, September 24.

Luminous Clouds?

I OBSERVED a phenomenon at the Lizard, on the night of September 10, which is new to me, but what I presume is meant by luminous clouds.

At 10.48 p.m. several others and myself saw a large patch of what looked like luminous mist suddenly appear just to the south of the constellation Perseus. It only lasted a very short time, but quickly reappeared accompanied by another which extended from near the extremity of the first to the higher part of Cassiopeia. The longer axes of these patches were in one line nearly east and west, and low down in the west in this line produced, appeared and reappeared a similar patch. Shortly afterwards a similar patch appeared with its longer axis on the same line almost at the zenith. The line of direction of these clouds formed a small angle with the Milky Way. I may state that the sky was quite clear except for a bank low down in the north, and that the light of these clouds was sufficient to attract attention although one was not looking in their direction, and although they were so high in the sky. Several fugitive patches appeared in the west at short intervals, and at 0.10 a.m. (11th) a very bright patch was to be seen in the north-east. Just afterwards the patch in the west reappeared, and with one or two short interruptions and, at first, considerable variation of intensity, remained until close on 1 a.m. The position remained, as far as I could see, constant, and at about 0.30 a.m. I fixed its position by means of a flag-staff and the top of a wall, and on the following day I took the bearings by the theodolite. The lower edge of the cloud was nearly straight and horizontal, and the angles are for the centre of this lower edge. They are as follows: N. 281° 12′ E. (mag.), elevation 7° 18′.

I thought that if any one is collecting information on the subject, a report from the extreme south and west might be useful, especially as I was able to get the bearing pretty accurately.

I may add that the aurora of the evening of the 9th was well observed throughout Cornwall, though I do not know that I can give much information that would be of value with respect to it.

ARTHUR P. JENKIN.

Trewirgie, Redruth, September 13.

"Crannoges" in Estuaries.

I FIND in NATURE of September 15 a notice of certain remains near Dumbarton as the only known specimens of "crannoges" in tidal water.

The farm-house of Cranny, in the townland of the same name, parish of Inver, County Donegal, Ireland, is supposed to stand on an artificial island in a tidal estuary, that of the Eany, or Eidhneach (meaning Ivy) River. The mound is now surrounded by a masonry revetment.

Opposite it, on the right bank of the same estuary, is a low mound which seems artificial, and lower down the old church of St. Natalis stands on another.

I have nothing to propound, but the ground may be worth examining. I have known it for many years, and think all three "crannoges." There is some printed record, not now before me, of the discovery of wooden framework on the right bank of the Eany, in glebe land. W. F. SINCLAIR.

Chelsea, September 16.

Transference of Heat in Cooled Metal.

Lorsque je vous ai écrit le 30 Juin dernier pour vous prier d'appeler, dans votre estimable journal, l'attention sur un phénomène de *conduction de chaleur dans une barre;* je pensais parler d'un phénomène *bien connu ainsi que je le disais dans ma lettre.* Je désirais simplement provoquer de la part de quelques uns de vos lecteurs, soit des recherches, soit des enquêtes analogues à celle que j'avais fait de mon côté auprès des artisans et ouvriers; mais je n'avais nullement la prétention de signaler un phénomène *nouveau.* Le premier physicien qui en ait parlé est à ma connaissance M. Izarn, professeur de physique au lycée de Clermont-Ferrand (France), et qui est connu par bien d'autres travaux. Voyant qu'on a l'air de m'attribuer la découverte de ce phénomène, je vous serais très reconnaissant si vous vouliez bien détromper les lecteurs de votre journal et remettre les choses au point. HENRY BOURGET.

Observatoire de Toulouse, Septembre 13.

Horn-feeding Larvæ.

READING the correspondence in NATURE on larvæ in antelope horns, reminded me of an experience in India. I was on a shooting trip near the Niti Pass in May, and bought a sheep for food from a native. Within five minutes of it being killed its horns were removed from the head, and it was found that they contained each some dozen maggots, white, and about half an inch in length. The horns had not been perceptibly perforated, and seemed quite sound. This fact may be well known, but I give it for what it is worth.

G. G. TRAHERNE.

"Purple Patches."

IN NATURE of November 12, 1896, there appeared a letter asking for some explanation of certain purple patches frequently noticed by the writer (A. Pedder) on roadways and pavements, especially at Bath. There were but three replies, two of which suggested "copying-ink" pencils as responsible.

The following notes, made recently in Derbyshire by myself, seem so nearly to fit the case that I venture to think a cause such as here described, or one closely allied, might explain some at any rate, of the cases mentioned. Here are the verbatim notes:—

"29/8/98.—At Axe Edge last Wednesday I noticed on a coal-pit ventilating shaft (Thatch Marsh Colliery) on the moor certain deepish blue masses on a ledge near the base. Some masses brighter blue, others nearly black. Under a lens appeared to contain horny parts of larvæ and many small seeds. They are probably the droppings of birds. They leave a bluish stain on the stone.

"To-day I noticed the same on some pieces of stone on the road to Goyt's Bridge, a steep, rocky road.

"30/8/98.—Visited Axe Edge shaft again. There were no fresh deposits on it. This may be due to almost continuous rain the last four days; but the stains are still there. Also found deposit on one or two stones round shaft and on a piece of wooden staging. They were very plentiful, especially on the tops of the six posts of this staging, where one would expect birds to settle chiefly. The colour and stains were just the same—some reddish purple and some bluish purple. The colour is thus evidently due only to the excreta (?), and not to the body on which deposited. The seeds appear reddish, and it seems likely that the colour is due to them. (Bilberries are plentiful on the surrounding moor)."

"1/9/98.—The seeds are identical with bilberry, and on extracting the excreta with cold water a claret-red colour is obtained, which leaves a greenish-blue stain on paper."

Dulwich. F. SOUTHERDEN.

Re-Blossoming of Horse-Chestnut.

THERE is at present (September 20) a tree in South-End, Hampstead, showing a bunch of fresh green leaves and a well-formed spike of flowers. Some years back (1893, I think), another tree, in the same plantation, put forth leaves and blossom in September. J. J. W.

INTERNATIONAL CONFERENCES AND THE BRITISH ASSOCIATION.

THE circumstances under which the International Conference on Terrestrial Magnetism and Atmospheric Electricity met at Bristol, and its relations to the British Association, were fully described in the address of the President which we have already published. The success of the Conference leads to the hope that similar arrangements may be made in future with regard to other international reunions which may be held in this country.

The number of such gatherings is increasing, but, useful as they undoubtedly are, they make serious inroads on the summer vacation; they diminish the few short weeks which, when the necessary holiday has been taken, can be devoted either to research or to preparation for the work of the next session; and lastly they necessarily compete with, and injuriously affect, each other.

Thus it is unquestionable that the fact that physiologists foregathered in Cambridge shortly before the meeting of the British Association was one of the causes why at Bristol physiologists were conspicuous by their absence. Last year the number of British geologists who visited Canada was relatively small, as they could not be in the Caucasus and on the shores of the Pacific at the same time.

It may be impossible to prevent such meetings from interfering when they are held in different countries and when two nations are the hosts, but everything that is possible should be done to prevent it when the gatherings take place in the same summer and in the same country. Steps have recently been taken in this direction. Conferences of zoologists and physiologists were held simultaneously in Cambridge, and the Conference on Terrestrial Magnetism was affiliated to the British Association. This latter plan could not be adopted if the number of persons attending an International Conference was so large that, if the Conference were held simultaneously with the meeting of the Association, it would overtax the receptive capacity of a great town. Such cases are comparatively rare, and in others the aid of the Association is so valuable, that it may be hoped that the precedent now set will be followed frequently.

The conditions of a successful International Conference are interesting and important questions to discuss, an adequate attendance of British and foreign scientific men, and well arranged opportunities for social intercourse. Taking the first two for granted, and dealing therefore only with the last, it is well known that an elaborate scheme of entertainments and excursions is most generously and even lavishly provided by the locality in which the British Association meets. These were, and probably always would be, thrown open to members of an International Conference meeting together with and recognised by the Association. If the number of those attending the Conference was sufficiently large to justify the wish to have some special entertainments—it may be a dinner or an excursion—reserved for them alone, this could no doubt be arranged at a cost to the promoters of the Conference much less than that involved in the holding of an independent meeting. The British Association thus possesses ready-made machinery for the reception and entertainment of foreigners, which would have to be created anew for each independent Conference. On the other hand, no small part of the elaborate preparations for the meeting of the Association is now too often devoted to the entertainment of persons whose interest in science is little more than a hardy annual which blossoms in August or September, and requires a stimulating treatment of cheap excursions to bring it to maturity. No harm would be done to the Association, and good would result in many ways if these were in part replaced by distinguished foreign visitors and their English *confrères*. The authorities of the Association have shown a praiseworthy readiness to vary their arrangements so as to grapple with new conditions. Though nominally a department of Section A, and working most harmoniously with the officers of that Section, the International Magnetic Conference was practically at liberty to manage its own affairs, and was in no way hampered by red-tape. The Permanent Committee, appointed not by the Association, but by the International Meteorological Conference at Paris in 1896, was added *en bloc* to the Committee of Section A, and was allowed unfettered control of the Magnetic Department of that Section.

If the authorities of the Association are thus wisely liberal in future, there is no reason why at least the smaller International Conferences which take place in this country should not meet in alliance with the British Association.

If a Section can for one year coexist with an almost independent department, there is no reason why similar temporary arrangements should not be adopted on a more extensive scale, should occasion so require. The promoters of the Conference would be saved a great deal of trouble and even of expense. The cost to the Association and to the locality would be no greater than it is now. The persons entertained would be genuine scientific workers. The meetings of the Association would gain in interest and prestige, while at most of the places where the Association meets there would be no difficulty in providing space for several additional Sections if such subdivision were necessary.

The experiment which has been tried this year on a small scale was a complete success, and it is desirable that those who may have the management of International Congresses in future should be fully aware of the readiness which the Council of the British Association has displayed to make the great organisation which it controls as useful as possible. They have much to give, and on this occasion they gave it freely; while, on the other hand, the Association gained both in the interest of its proceedings, and in the usefulness to science which is the object of its existence.

NOTES.

THE seventeenth Congress of the Sanitary Institute was opened at Birmingham on Tuesday, and will continue in session during the remainder of this week. On Tuesday afternoon Sir Joseph Fayrer, Bart., the President of the Congress, delivered an address, in which he surveyed the progress of preventive medicine during recent times; and in the evening the Lord Mayor opened a great exhibition of appliances, machinery, food products, and the like, which is the usual feature of the Congress, and lasts a month. On Wednesday municipal representatives, medical officers of health, sanitary engineers, sanitary inspectors, and ladies held conferences and discussed papers. Thursday and Friday are to be devoted to sectional work, and there are two important lectures, one to the Congress, and one to the general public. Among the topics to be discussed are the relations of medical officers to vaccinal legislation, the milk supply, water analysis, bacteria and infectious disease, hygiene in dress, and the decrease in the birth-rate.

THE death is announced at Paris of M. Gabriel de Mortillet, the eminent anthropologist.

THE annual exhibition of the Royal Photographic Society was inaugurated by a soirée held on Saturday last, September 24.

AT the meeting of the Entomological Society of London, on October 5, a paper by Mr. F. Merrifield, "On colouring of pupæ of *P. machaon* and *P. napi* caused by exposing the pupating

larvæ to coloured surroundings," will be read; and also one by Mr. G. H. Verrall, "On Syrphidæ collected near Aden by Colonel J. W. Yerbury."

RECENT researches by Surgeon-Major Ronald Ross have shown that the mosquito may be the host of parasites of the type of that which causes human malaria. Ross has distinctly proved that malaria can be acquired by the bite of a mosquito, and the results of his observations have a direct bearing on the propagation of the disease in man. Dr. P. Manson describes the investigations in a paper in the *British Medical Journal*, and sums them up as follows:—The observations tend to the conclusion that the malaria parasite is for the most part a parasite of insects; that it is only an accidental and occasional visitor to man; that not all mosquitos are capable of subserving it; that particular species of malaria parasites demand particular species of mosquitos; that in this circumstance we have at least a partial explanation of the apparent vagaries of the distribution of the varieties of malaria. When the whole story has been completed, as it surely will be at no distant date, in virtue of the new knowledge thus acquired, we shall be able to indicate a prophylaxis for malaria of a practical character, and one which may enable the European to live in climates now rendered deadly by this pest.

A VALUABLE report upon the various attempts which have been made to bring China grass (obtained from *Boehmeria nivea*) and Ramie or Rhea (obtained from *B. tenacissima*) into use for manufacturing purposes is contained in the *Kew Bulletin* for September. The report describes machines which have been devised to deal with the grass, and indicates the merits and defects of the most important of them. It will be seen from the following summary of the Kew report that the problem has not yet been satisfactorily solved:—"Notwithstanding all the expenditure of mechanical skill and inventive ability, the conclusion cannot be evaded that we are still as far off as ever from being able to place upon the market a finished product which will effectually compete with silk, flax, and the better qualities of cotton. The plants can be grown with the greatest ease. But when the problem of treatment is solved, the supply of the raw material will be limited to warm countries. The cultivation of China grass in temperate regions will never be able to compete successfully with that of Ramie (or perhaps of China grass) in the tropics. It is known that when ribbons can be produced sufficiently cheaply, these can be degummed and turned into filasse at a small cost. The whole question then still turns, as in 1888, on the production of ribbons. We are still waiting for a decorticator which will not merely turn out ribbons fit for further manufacturing processes—that has been accomplished—but will turn out, say, half a ton a day at a small cost. Till this has been found, the planter cannot profitably deal with his crop, and the degumming processes now almost entirely dependent on hand-cleaned fibre from China are paralysed for want of a supply which will allow the finished product to compete with other fibres."

NEWS has been received by the *Times* that the *Antarctic*, with the Swedish Arctic Expedition under Dr. A. G. Nathorst, has returned to Tromsö, after a successful cruise to the seas and islands around Spitsbergen; and the following notes on the results of the expedition are published:—The *Antarctic* left Tromsö on June 8, and proceeded to Bear Island, which was reached on the 11th; a week was spent there. The whole island was surveyed, and a map on the scale of 1 : 50,000 was drawn by Lieut. Kjellstrov and Dr. Hamberg. After surveying and mapping Bell Sound, on the west of Spitsbergen, and visiting some points of interest in Ice Sound, the expedition proceeded westwards, and did some hydrographical work as far as the margin of the Greenland ice-pack (78° 1′ N. lat., 4° 9′ W. long.). The ship was then turned to the south and east of Spitsbergen, and reached King Charles Land, which was completely mapped on the scale of 1 : 100,000 and surveyed. From there the *Antarctic* proceeded to White Island, which was circumnavigated; the expedition landed at the only two places where landing is possible, and the geology of the island was ascertained. This island is completely covered by an ice-cap, which is broken off at the sea shore, ending in a perpendicular ice-wall, just as is found on the Antarctic Continent, though in miniature. Great table-formed icebergs are given off from this ice-sheet. From White Island, which is larger than indicated on the maps, the *Antarctic* made its way through alternating heavy ice and open water to Charles XII. Island, whence the expedition proceeded northwards and reached 81° 14′ N. lat. The expedition then passed north of the Seven Islands and proceeded to Treuenberg Bay, Grey Hook, and Danes Island, from which they steered southwards along the western coast of Spitsbergen. When the *Antarctic* reached the south end of Prince Charles Foreland the circumnavigation of the whole of Spitsbergen, with the surrounding islands, was completed. The scientific work of the expedition has been most successful; they have brought back large geological, botanical, and zoological collections. The geology, botany, and zoology of King Charles Land are now completely known, and there are evident important connections between the geology of Spitsbergen and that of Franz Josef Land.

THERE are a great number of curious superstitions as to the time of day when a dying person is most likely to draw his last breath, and the tide, the moon, and the wind have all been supposed to have some share in the matter. According to the *British Medical Journal*, Raseri, who has analysed 25,474 cases of death, and 36,515 of birth, where the exact time of day was noted, finds that the maximum number of deaths occur in the early afternoon (2–7 p.m.), and the minimum in the last hours before midnight, while the maximum number of births occur in the early hours of the morning, and the minimum in the early hours of the afternoon. As regards the cause of this, he points out that the hours of the maximum number of deaths are precisely those when the pulse rate and temperature are at their highest in health, and when there is a febrile exacerbation in illness.

THE Report of the Chief of the United States Weather Bureau upon meteorological observations made during the year 1896-97 has just been received. It consists of a volume containing more than four hundred pages, with nearly one hundred large charts and plates. The very valuable work carried on by the Weather Bureau is too well known to meteorologists to need commendation here. The vote for the service during the fiscal year 1896-97 was 883,772 dollars; but, remembering how very considerably the work has extended during the past few years, we are surprised to learn that this grant is 109,748 dollars less than that made in 1883. In the past fifteen years the number of voluntary observers has increased from 300 to about 3000, and the number of stations on the sea-coasts and the Great Lakes, where storm warnings are displayed for the benefit of mariners, has increased from 41 to 253. These storm warnings have proved of very great service. At each of the 253 stations where the signals are displayed, telegraphic messages, giving the situation, intensity and probable movement of the storm are distributed to the masters of vessels within an hour after the information has been dictated by the forecast official at headquarters. It is estimated by shipowners that one hurricane sweeping the Atlantic seaboard would cause damage to floating craft of more than 600,000*l*. During the past three years ten or more of these destructive storms have visited the coast-line of the United States, but in every case the danger warnings were displayed long in advance of the storm, and no marine disasters

of importance occurred. These facts alone justify the appeal of the Chief of the Weather Bureau for an increased grant. His estimate of the money needed to meet the legitimate requests of the agricultural, marine, commercial, and manufacturing interests of the States is 1,044,050 dollars, being an increase of 160,348 dollars. The present report furnishes abundant evidence that whatever money is voted will be used in making the Bureau of service to the people of the States, and of assistance to the progress of meteorological science. In addition to the usual report upon the administrative work, the volume contains an account of the climatology of the year, and papers upon the rainfall of the United States and the floods of the Mississippi Valley, both of which have already been noticed in NATURE.

THE September number of *Annalen der Hydrographie und maritimen Meteorologie* contains two papers of more than usual interest: (1) Yearly isotherms and isabnormals of sea-surface temperature, by Dr. W. Köppen. The author has calculated the yearly isotherms from the best available sources, including those of the Deutsche Seewarte and the Meteorological Office, and in addition to the usual methods of showing simply the warm and cold currents, he has indicated the districts where the surface water is more than 2° C. above or below the temperature due to geographical position. (2) Contribution to the knowledge of wind conditions on the sailing routes between the equator and Cape Horn, by Dr. H. König. The data used are principally those collected for the sailing directions issued by the Seewarte. In addition to various tables showing the distribution of wind directions for months and seasons, and referring to different districts, the author has shown graphically for each month and each 5°-square the percentages of the three most prevalent wind directions, with numbers showing their mean force, the calms, and the total number of observations from which the results are deduced. Both the above discussions are accompanied by interesting explanatory remarks.

TELEPHONIC communication has been established between a number of farms in Australia by means of wire fences. The *Australian Agriculturist* publishes a note from a correspondent writing from a station near Cobar, stating that it was easy to converse with friends at a station eight miles distant with instruments connected on the wire fences, and the same kind of communication was established over a distance of thirteen miles. A large number of stations are connected in this way, and the system if widely adopted will do much to relieve the monotony of back country life.

PROF. ZICKLER, of Brünn, has (says the *Electrical Review*) conducted an elaborate series of experiments, which show that a telegraphic instrument can be actuated at considerable distances by a beam of ultra-violet light. He employs a powerful arc lamp as his transmitter, using a screen of glass to produce intermittent flashes of the ultra-violet beam, which embody themselves as dot and dash signals on his receiver. The receiver is an air-gap in a circuit containing an induction coil regulated to an electromotive force just below the sparking point at the air-gap. As Hertz long ago has shown, a beam f ultra-violet light falling on the kathode of a strained air-gap, near its breaking-down point, will immediately provoke a discharge. Zickler started by producing this effect over a distance of 2 m. Then, by improving the shape and material of his electrodes and enclosing them in a chamber of compressed air, he was able to increase this distance to 200 m. This is a remarkable result, and it is extremely interesting to physicists to learn that the short and easily absorbed ultra-violet light can influence a spark discharge at so great a distance.

THE attention of several physicists has been of late turned to determinations of the thermal conductivity of rocks. A large number of experimental results, chiefly statistical, and obtained by using the "Wall method," are detailed by Messrs. B. O. Pierce and R. W. Willson in the *Proceedings* of the American Academy of Arts and Sciences; while Dr. Francesco Morano has been engaged in determining the internal and external conductivity of the rocks of the Roman Campagna and the corresponding fluctuations of temperature of the soil (*Atti dei Lincei*, vii.). While these experiments lead to purely numerical results, Dr. Lees, of Manchester, in a paper read before the British Association, has succeeded in establishing the fact that pressure produces a marked increase of conductivity in the less closely-grained rocks, especially sandstone.

THE disposal of the town refuse of Naples has led to a lengthy discussion at the meetings of the Reale Istituto d'Incoraggiamento di Napoli, and the publication of a number of papers in their large annual volume of *Atti*. The subject is introduced by Prof. Paolo Boubée, who seems to rather favour treatment by the Arnold-Le Blanc system, or the use of destructors; though it would appear that the refuse of the Neapolitan streets is too wet, and also too poor in carbon, to burn without the additional consumption of coal. At present the street sweepings are taken and deposited some distance outside the city, and the accumulations ultimately used as manure; but the effluvia arising from so large a mass of putrefying matter have become prejudicial to health. It is suggested that the problem might be best solved by a series of experiments on the different alternative methods of disposal; and even the clumsy and wasteful plan of dumping the refuse at sea seems considered deserving of a trial.

AN "Improved form of Hydrometer" by means of which the effect of capillarity is eliminated, is proposed by the Rev. H. O'Toole of Blackrock College, writing in the *Scientific Proceedings* of the Royal Dublin Society. It is similar in principle to Nicholson's hydrometer, but, instead of one bulb, it has two connected by a narrow stem of the same material and sectional area as that which supports the weight. It is first loaded till the lower bulb is immersed, and then loaded till both bulbs are immersed. The additional weights put in at the second observation represent exactly the weight of a quantity of liquid equal in volume to the upper bulb between the two points of immersion.

"A CONTRIBUTION to the Study of Individual Variation in the Wings of Lepidoptera" is given by Mr. William L. W. Field in the *Proceedings* of the American Academy of Arts and Sciences, xxxiii. 21. The paper gives the results of an attempt to find in a particular species answers to the following questions: (1) Is a part developed in any given species in an extraordinary manner as compared with the development of the corresponding part in other allied species, more variable than parts which exhibit less specific peculiarity? (2) Which sex is the more variable? The species chosen is the moth *Thereus abbotii*, in which the outer margins of the primaries are excessively irregular and extraordinarily long as compared with the other dimensions of the wings. Measurements were made, for a large number of specimens, of the length of the sinuous margin, the length and breadth of the wing, and the chord of the margin; and from these the author concludes that, in the moth in question, the most aberrant dimension of the fore wing is likewise the most variable, in accordance with Darwin's law. The females show, in general, a greater degree of variability than the males; but in the one markedly aberrant feature under discussion, their variability is less than that of the males. With reference to the first conclusion, the propriety may be questioned of instituting comparisons between the lengths of the jagged contour of the outer margin and the straight lines which determine the actual dimensions of the wings. Mr. Field might with advantage make observations on some other insect in which the length or breadth of the wing was the aberrant feature.

IN a long article (to be continued) contributed to the *Zoologist*, Mr. W. L. Distant reviews the facts and theories as to assimilative coloration, and propounds some new views. He remarks in the course of his paper: "It seems possible that assimilative coloration may have been a first and very general consequent in animal development; that such a view is suggested by many facts; and that the subsequent protective resemblance acquired by numerous living creatures through the process of natural selection, when life had advanced to the competitive stage, is far too frequently used as an explanation for whole series of uniform phenomena in coloration, which have probably survived unaltered from remote antiquity, and which by their very essence were outside the law of natural selection, or unaltered survived as the 'fittest.'"

THE *Biologisches Centralblatt* (No. 17) contains a paper by Hartvig Huitfeldt-Kaas on the Plankton of the fresh-water lakes of Norway. The author follows the methods of Apstein, and finds that in general the Plankton is richer in shallow waters than in deep, except in regions where the rainfall is excessive, *i.e.* where the lake is subject to sudden large additions to the volume of water. The seasonal variations in the quantity of Plankton in a number of lakes are exhibited graphically.

THE *National Geographic Magazine* for August contains a paper by Mr. W. J. McGee on Papagueria, the land of the Papago or Papaf Indians, an arid region lying beyond the Sierra Madre, partly in Mexico and partly in Arizona; and covering an area of about 50,000 square miles. The study of the natives presents some remarkable features; their whole existence may be said to be occupied with the search for water, and the tribe is distinguished by exceptional force and stability of character. More than three centuries of contact with white races has produced little or no effect upon them.

THE issue of the Belgian *Moniteur International* of August 7 last is largely devoted to the new *Société Anonyme d'Études et d'Éditions Géographiques Élisée Reclus*. The laws and constitution of the Society are printed in full, and there are special articles by M. Reclus and others. The new Society has for its object the furthering of geographical study and exploration in all directions, by means of co-operation with existing foreign institutions and with foreign branches of the Society itself; and special attention is to be given to the working-up and publishing of geographical information relating to particular regions, in a form adapted for economic and commercial purposes.

THE number of the *Naturwissenschaftliche Wochenschrift* for September 11 contains an excellent popular account of the Adschidarja, the gulf connected with the Caspian Sea by the narrow strait of Karabugas, and often known by the latter name. A current flows from the Caspian to the Adschidarja, varying in speed at different seasons, but never changing its direction, and the waters of the gulf are intensely salt—28 per cent.—compared with about 1·4 per cent. in the Caspian. Actual measurements made at different dates since its discovery in 1836 show that the Adschidarja and the Karabugas are being rapidly filled up, and the fossil remains show that for a long period the waters of the former have been growing steadily salter. The description of the chemical deposits, both organic and inorganic, is of extreme interest, the latter specially so in relation to the formation of oil-bearing strata.

DR. H. CARRINGTON BOLTON has discovered in a cavern at Lake Minnewaska, New York, a grotto in which are reproduced on a small scale many of the beautiful phenomena seen at the celebrated Blue Grotto of the island of Capri. The lake is situated on the Shawangunk range of mountains at an elevation of about 1700 feet; it lies in a basin, excavated in glacial times, about half a mile long and less than a quarter in width, and of a depth reaching seventy feet. The rock on all sides is a white quartzite, which rests upon shale, but no outcrop of the latter is visible at the lake. The water varies in colour from Nile green through turquoise blue and sky blue to deep indigo blue, and in all these shades exhibits the silvery appearance, when agitated, characteristic of the grotto at Capri. A body immersed in the water has a beautiful silvery sheen, similar to the reflection of moonlight. The water has these colours at all hours, but they are strongest when the sun is in the zenith; late in the afternoon the slanting rays of the sun enter the opening and light up the cavern, greatly diminishing the optical effects.

THE last two issues (vol. i. Nos. 9 and 10) of the Records of the Botanical Survey of India comprise a contribution to the Botany of the Chitral Relief Expedition, 1895, by Mr. J. F. Duthie; and a Botanical Tour in Chamba and Kangra, by Mr. G. A. Gammie.

A VALUABLE list of the Freshwater Algæ of Queensland is issued by the Department of Agriculture, Brisbane (*Botany Bulletin*, No. 15). The compiler, Mr. F. M. Bailey, has incorporated with his own observations those of the European algologists, Askenasy, Moebius, Nordstedt, Schmidle, and Borge, who have worked at the algology of Australia.

THE Geological Survey of Queensland (Department of Mines) has issued a list of Additions to the Fossil Flora of Queensland, compiled by Mr. John Shirley. The species described are mainly from the Ipswich formation, Trias-Jura system, and are mostly Gymnosperms and Pteridophyta, with a few Dicotyledones. The list is accompanied by twenty-five plates.

IT is recorded in the *Kew Bulletin of Miscellaneous Information* (No. 140) that the Queen's Cottage Grounds (between 37 and 38 acres) have now been formally added to the precincts of the Royal Gardens; but that public access to them cannot be given until provision for their maintenance and supervision has been made in the estimates for the next financial year. It is intended to preserve the grounds as far as possible in their present condition.

THE numbers of the *Journal of Applied Microscopy* for June and July, published by the optical firm of Bausch and Lomb, Rochester, New York, contain a number of very useful articles on microscopical technique, and on the structure of the microscope, as well as some which are more purely biological. The *Journal* should be in the hands of all microscopists.

THE *Biologisches Centralblatt* continues to publish useful epitomes of recent research in various branches of biological science. In the number for August 15 we find a paper, by Bernhard Jacobi, on the results of the newest researches on the locality and conditions of the formation of proteids in green plants, with a bibliography appended. The same number contains an article, by J. E. W. Ihle, on the phylogeny and systematic position of the Pentopodæ.

THE illustration of lectures and lessons by lantern slides is now so widely used, that attention may profitably be called to the supplementary list of slides just published by Messrs. Newton and Co. Among the lantern slides of interest to teachers of science, we notice in this list a set of 111 bacteriological slides, reproduced from original negatives by Dr. Spitta; numerous recent astronomical photographs, including pictures of the Indian eclipse; views taken by Prof. Crookshank during the meeting of the British Association in Toronto last year; geological formations in the neighbourhood of Barmouth; and fifty-five pictures of English birds, photographed from the well-mounted specimens in the Natural History Museum. In addition to the titles of slides, the list contains descriptions of new lanterns and lantern accessories of service in science demonstrations.

THE additions to the Zoological Society's Gardens during the past week include a Chimpanzee (*Anthropopithecus troglodytes*, ♂) from West Africa, presented by Mr. Claude E. Bird; a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mr. C. Ganz: a Brown Capuchin (*Cebus fatuellus*) from Guiana, presented by Miss May Hill; two White-throated Capuchins (*Cebus hypoleucus*) from South America, presented by Mrs. C. E. Cregan; three Black-eared Marmosets (*Hapale penicillata*) from South-east Brazil, presented by Mrs. Dal Young; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. W. E. Raynes-Cole; a Red-vented Bulbul (*Pycnonotus hæmorrhous*) from India, deposited.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN OCTOBER:—

October 2. 10h. 27m. to 11h. 35m. Occultation of 47 Arietis (mag. 5·9) by the moon.
4. Tempel's comet (1867 II.) due at perihelion.
5. 9h. 46m. Minimum of Algol (β Persei).
5. 16h. 6m. to 17h. 27m. Occultation of 132 Tauri (mag. 5·1) by the moon.
7. Saturn. Outer minor axis of the outer ring = 16″·09.
7. 17h. 0m. Mars in conjunction with the moon (δ 1° 25′ N.).
8. 6h. 35m. Minimum of Algol (β Persei).
13. 11h. 0m. Jupiter in conjunction with the sun.
15. Venus. Portion of illuminated disc = 0·521. Diameter 34″·0.
15. Mars. Portion of illuminated disc = 0·880. Diameter 8″·0.
16. 4h. 0m. Mercury 2′ S. of Jupiter.
18–20. Meteoric shower from Orion (radiant 91° + 15°).
20. Perrine-Chofardet's new comet due at perihelion.
22. 3h. 44m. to 4h. 57m. Occultation of π Capricorni (mag. 5·2) by the moon.
22. 5h. 5m. to 5h. 51m. Occultation of ρ Capricorni (mag. 5·0) by the moon.
23. 5h. 13m. to 6h. 13m. Occultation of 18 Aquarii (mag. 5·4) by the moon.
24. Uranus 54′ S. of β Scorpii.
27. 5h. 0m. Venus at greatest brilliancy.
29. 13h. 21m. to 14h. 10m. Occultation of μ Arietis (mag. 5·8) by the moon.

THE PLANET BETWEEN THE EARTH AND MARS.—Herr G. Witt, of the Urania Observatory, Berlin, is to be congratulated on the fortunate discovery he has made while searching photographically for minor planets. On August 14 last he found on the plate he had exposed, in addition to the trail of the minor planet he was hoping to catch, a second trail which indicated the presence of another of these small bodies moving round the sun with a more than usual velocity. Herr Witt was not content, however, to let the matter rest thus, so he undertook a series of eye observations and measurements which are necessary for the determination of the elements of the body in question. Herr Berberich undertook the task of investigating its motion from these observations, and the result, as far as is known, is surprisingly interesting. Instead of the object being a new or a previously observed member of that system of bodies which travels round the sun between Mars and Jupiter, it proves to be quite an exception, its orbit lying *within* that of Mars; in other words, it travels in a path which is nearer to the earth than that of Mars. It completes its revolution in a period of about 600 days; that is, roughly, 80 days less than Mars takes: both the eccentricity and inclination of the orbit are considerable. This small body thus becomes our nearest neighbour after the moon, and, although small, will shine when closest to us as a star of the sixth magnitude. No doubt the discovery of this new planet will incite afresh observers of these small bodies; and who will say that this new object is the only member of its kind that performs its revolution round the sun in an orbit between the earth and Mars?

PHOTOGRAPH OF THE CHROMOSPHERE.—In the *Astrophysical Journal* for August there is reproduced one of the photographs taken by Prof. Naegamvala during the recent eclipse of the sun in January last. Prof. Naegamvala, it will be remembered, was stationed at Jeur, and although his chief instrument (a six-inch Taylor Cooke triplet and two objective prisms of 45°) arrived from the makers as late as January 11, he was very fortunate in being able to adjust it as well as he did in the small amount of time he had at his disposal. The advantage of the prismatic camera over an ordinary slit spectroscope has during the late eclipse been abundantly proved, for one is easily able to differentiate at a glance between the spectra of the corona, the chromosphere and the prominences. There are, however, several points in photographs taken during an eclipse with such instruments which must be carefully considered, and which, when overlooked, are liable to lead to errors. An oversight of this kind occurs in the text describing the photograph referred to above. The writer states: "Perhaps the most interesting feature of the photograph is the prominence shown in two lines between H and Hδ, but invisible in H and K and the hydrogen lines."

A glance at the photograph tells us that the prominence is recorded in both the H and K light, but the peculiar position of the prominence in the spectrum is due to the fact that the two "lines" are the images of the upper portion of a prominence on the chromosphere obscured by the dark moon on the side opposite to that represented by the arcs. This same prominence is depicted on most of the negatives that were secured at Viziadrug, and is recorded not only in the H and K lines, but in the hydrogen and other lines.

OBSERVATIONS OF JUPITER DURING THE OPPOSITION 1898.—Sig. J. Comas Solá, observing at the Observatory of Català with an equatorial of 22 cm. aperture, made some very interesting observations of the surface markings on Jupiter during the period extending from January 18 to June 12 during the present year (*Astr. Nachr.*, 3519). The general aspect of the surface did not offer evidence of very great change, but rather indicated that the planet was in a state of relative calm. More especially was this the case with the northern equatorial belt, which last year was very large, double and perhaps triple, but recently has been observed to be very simple, showing a uniform structure of a deep ruddy colour. The equatorial zone was found to be of an intense reddish yellow or yellowish orange colour, and was especially rich in details. In addition to the oblique grey markings usually seen, the whole zone appeared flaky, and when the definition was good this was found to be made up of large and small dark round spots. The south equatorial belt did not offer any new markings, but appeared in its normal condition. The red spot, according to Sig. Solá, was always very pale and grey, but in spite of its feebleness he could see the whole of its elliptic contour. The eastern portion always appeared darker than the rest, and sometimes a small dark spot could be seen in this position. From three transits of the eastern portion of this spot in April, May and June, the mean Jovian longitude was found to be 36°·6 for May 23. In the map showing the planisphere of this planet, which accompanies the article, the reader will gather a good general idea of the positions and shape of the markings which were seen by this observer.

PERIODIC COMETS.—In the *Bulletin Astronomique* for September there is a most interesting article, by M. Schulhof, concerning periodic comets and the present state of theories connected with them. The article covers no less than forty-one pages of the *Bulletin*, so we cannot do more than give a very brief outline of its contents. M. Schulhof restricts his remarks simply to the movements of the comets and their accompanying perturbations, but does not touch on their chemical or physical characteristics. After a brief summary of the general ideas concerning the motions of each of these comets, and the part taken by the several investigators who have worked out the orbits, he draws attention to the great similarity between groups of comets, caused, as he mentions, by the presence of our planets exerting their influence as these bodies approach our system. The origin of comets and their relation to meteor swarms are further discussed, also the views of Schiaparelli, Faye, and Tisserand. In concluding, M. Schulhof makes mention of the difficulty connected with a complete reduction of the observations of a comet of short period, with which all computers are familiar, pointing out that the perturbatory actions of all the planets except Neptune have to be taken into account.

THE BRITISH ASSOCIATION.

SECTION H.

ANTHROPOLOGY.

OPENING ADDRESS BY E. W. BRABROOK, C.B., F.S.A., PRESIDENT OF THE SECTION.

I AM very sensible of the honour of presiding over this Section at a Bristol meeting. Bristol, from its association with the memory of J. C. Prichard, may be regarded as the very birthplace of British anthropology.

In submitting to this Section some observations on the past progress and the present position of the Anthropological Sciences, I use the plural term, which is generally adopted by our French colleagues, in order to remind you that Anthropology is in fact a group of sciences. There is what in France is called pure anthropology or anthropology proper, but which we prefer to call physical anthropology—the science of the physical characters of man, including anthropometry and craniology, and mainly based upon anatomy and physiology. There is comparative anthropology, which deals with the zoological position of mankind. There is prehistoric archæology, which covers a wide range of inquiry into man's early works, and has to seek the aid of the geologist and the metallurgist. There is psychology, which comprehends the whole operations of his mental faculties. There is linguistics, which traces the history of human language. There is folk-lore, which investigates man's traditions, customs, and beliefs. There are ethnography, which describes the races of mankind, and ethnology, which differentiates between them, both closely connected with geographical science. There is sociology, which applies the learning accumulated in all the other branches of anthropology to man's relation to his fellows, and requires the co-operation of the statistician and the economist. How can any single person master in its entirety a group of sciences which covers so wide a field, and requires in its students such various faculties and qualifications? Here, if anywhere, we must be content to divide our labours. The grandeur and comprehensiveness of the subject are among its attractions. The old saying, "I am a man, and therefore I think nothing human to be foreign to me," expresses the ground upon which the anthropological sciences claim from us a special attention.

I may illustrate what I have said as to the varied endowments of anthropologists by a reference to the names of four distinguished men who have occupied in previous years the place which it falls to my lot to fill to-day—most unworthily, as I cannot but acknowledge, when I think of their pre-eminent qualifications. When the Association last met at Bristol, in 1875, Anthropology was not a Section, but only a Department, and it was presided over by Rolleston. There may be some here who recollect the address he then delivered, informed from beginning to end with that happy and playful wit which was characteristic of him; but all will know how great he was in anatomy, what a wide range of classical and other learning he possessed, and how he delighted to bring it to bear on every anthropological subject that was presented to his notice. In 1878 Huxley was the Chairman of this Department. It is only necessary to mention the name of that illustrious biologist to recall to your memory how much anthropology owes to him. Eight years before, he had been President of the Association itself, and seven years before that had published his "Evidence as to Man's Place in Nature." Brilliant as his successes were in other branches of scientific investigation, I cannot but think that anthropology was with him a favourite pursuit. His writings upon that subject possess a wonderful charm of style. In 1883 the Chairman was Pengelly, who for many years rendered service to anthropology by his exploration of Kent's Cavern and other caves, and who happily illustrated the close relation that exists between geology and anthropology. His biography, recently published, must have reminded many of us of the amiable qualities which adorned his character. Finally, in 1886, two years after anthropology had become a Section, its President was Sir George Campbell, a practical ethnologist, a traveller, an administrator, a legislator, a geographer, who passed through a long career of public life with honour and distinction. All my other predecessors are, I am glad to say, still living, and I make no mention of them. The few names I have cited—selected by the accidental circumstance that they are no longer with us—are sufficient to show what varied gifts and pursuits are combined in the study of anthropology.

There is another side to the question. Great as is the diversity of the anthropological sciences, their unity is still more remarkable. The student of man must study the whole man. No true knowledge of any human group, any more than of a human individual, is obtained by observation of physical characters alone. Modes of thought, language, arts and history must also be investigated. This simultaneous investigation involves in each case the same logical methods and processes. It will in general be attended with the same results. If it be true that the order of the Universe is expressed in continuity and not in cataclysm, we shall find the same slow but sure progress evident in each branch of the inquiry. We shall find that nothing is lost, that no race is absolutely destroyed, that everything that has been still exists in a modified form, and contributes some of its elements to that which is. We shall find that this, which no one doubts in regard to physical matters, is equally true of modes of thought. We may trace these to their germs in the small brain of the palæolithic flint-worker; or, if we care to do so, still farther back. This principle has, as I understand, been fully accepted in geology and biology, and throughout the domain of physical science—what should hinder its application to anthropology? It supplies a formula of universal validity, and cannot but add force and sublimity to our imagination of the wisdom of the Creator. It is little more than has been expressed in the familiar words of Tennyson:—

> "Yet I doubt not thro' the ages one increasing purpose runs,
> And the thoughts of men are widen'd with the process of the suns;"

and supports his claim to be "the heir of all the ages, in the foremost files of time."

I propose, in briefly drawing your attention to some recent contributions to our knowledge, to use this as a convenient theory and as pointing out the directions in which further investigation may be rewarded by even fuller light.

Applying it, first of all, to the department of physical anthropology, we are called upon to consider the discovery by Dr. Dubois at Trinil in Java of the remains of an animal called by him *Pithecanthropus erectus*, and considered by some authorities to be one of the missing links in the chain of animal existence which terminates in man. In his presidential address to this Association last year, Sir John Evans said, "Even the *Pithecanthropus erectus* of Dr. Eugène Dubois from Java meets with some incredulous objectors from both the physiological and the geological sides. From the point of view of the latter the difficulty lies in determining the exact age of what are apparently alluvial beds in the bottom of a river valley." In regard to these objections, it should be remembered that though the skull and femur in question are the only remains resembling humanity discovered in the site, it yielded a vast number of fossil bones of other animals, and that any difficulty in settling the geological age must apply to the whole results of the exploration. The physiological difficulties arise in two points—do the skull and femur belong to the same individual? are they or either of them human, or simian, or intermediate? As to the first, it is true that the two bones were separated by a distance of about fifty feet, but as they were found precisely on the same level, accompanied by no other bones resembling human bones, but by a great number of animal remains, apparently deposited at the same moment, the theory that they belonged to different individuals would only add to the difficulty of the problem. With regard to the skull, a projection of its outline on a diagram comparing it with others of low type belonging to the stone age shows it to be essentially inferior to any of them. With regard to the thigh, you will recollect that at the Liverpool meeting of this Section, Dr. Hepburn displayed a remarkable collection of femora from the anatomical museum of Edinburgh University, exhibiting pathological and other conditions similar to those in the femur of Trinil. Though this evidence tends to show that the bone is human, it is not inconsistent with, but on the contrary goes to support, the conclusion that it belongs to an exceedingly low and ancient type of humanity. Whether, therefore, we call the remains *Pithecanthropus erectus* with their discoverer, or *Homo pithecanthropus* with Dr. Manouvrier, or *Homo Javanensis primigenius* with Dr. Houzé, we are in presence of a valuable document in the early evolution of mankind.

One element of special interest in this discovery is that it brings us nearer than we have ever been brought before to the time when man or his predecessor acquired the erect position. I believe that it is acknowledged by all that the femur belonged

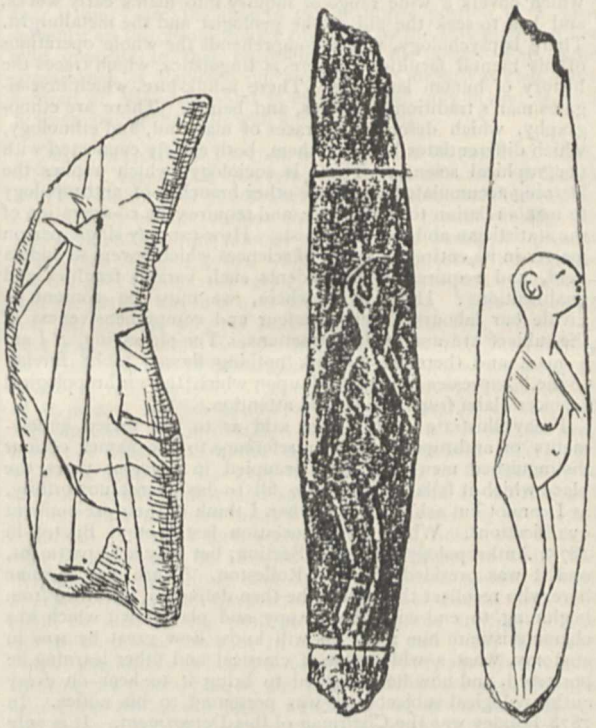
to an individual who stood upright, and I presume that the capacity of the skull being greater than that of any known anthropoid is consistent with the same inference. The significance of that has been most clearly set forth by my predecessor, Dr. Munro, in his address to this Section at Nottingham in 1893. He showed that a direct consequence of the upright position was a complete division of labour as regards the functions of the limbs—the hands being reserved for manipulation and the feet for locomotion ; that this necessitated great changes in the general structure of the body, including the pelvis and the spinal column ; that the hand became the most complete and effective mechanical organ nature has produced ; and that this perfect piece of mechanism, at the extremity of a freely moving arm, gives man a superiority in attack and defence over other animals. Further, he showed that, from the first moment that man recognised the advantage of using a club or a stone in attack or defence, the direct incentive to a higher brain development came into existence. The man who first used a spear tipped with a sharp flint became possessed of an irresistible power. In his expeditions for hunting, fishing, gathering fruit, &c., primitive man's acquaintance with the mechanical powers of nature would be gradually extended ; and thus from this vantage point of the possession of a hand, language, thought, reasoning, abstract ideas would gradually be acquired, and the functions of the hand and the brain be developed in a corresponding manner. I do injustice to Dr. Munro's masterly argument by stating it thus crudely and briefly. It amounts to this—once the erect position is obtained, the actions of man being controlled by a progressive brain, everything follows in due course.

The next stage which we are yet able to mark with certainty is the palæolithic, but there must have been a great many intermediate stages. Before man began to make any implements at all, there must have been a stage of more or less length, during which he used any stick or stone that came to his hands without attempting to fashion the one or the other. Before he acquired the art of fashioning so elaborate an implement as the ordinary palæolithic axe or hammer, there must have been other stages in which he would have been content with such an improvement on the natural block of flint as a single fracture would produce, and would proceed to two or three, or more fractures by degrees. It must have been long before he could have acquired the eye for symmetry and the sense of design, of adaptation of means to ends, which are expressed in the fashioning of a complete palæolithic implement. It is probable that such rude implements as he would construct in this interval would be in general hardly distinguishable from flints naturally fractured. Hence the uncertainty that attaches to such discoveries of the kind as have hitherto been made public. Prof. McKenny Hughes, who speaks with very high authority, concludes a masterly paper in the *Archæological Journal* with the statement that he has "never yet seen any evidence which would justify the inference that any implements older than palæolithic have yet been found." The name "palæotalith" which had been suggested for pre-palæolithic implements seems to him unnecessary at present, as there is nothing to which it can be applied ; and as it will be long before it can be asserted that we have discovered the very earliest traces of man, he thinks it will probably be long before the word is wanted. An elaborate work on the ruder forms of implement, just published by M. A. Thieullen, of Paris, who has for many years been engaged in collecting these objects, adds materially to our knowledge of the subject.

Another line of argument bearing strongly in the same direction is afforded by the discovery in various places of works of art fabricated by early man. The statuettes from Brassempouy, the sculptures representing animals from the Bruniquel, the well-known figure of the mammoth engraved on a piece of ivory from Périgord, and many other specimens of early art attest a facility that it is not possible to associate with the dawn of human intelligence. M. Salomon Reinach tells an amusing story. A statuette in steatite of a woman, resembling in some respects those of Brassempouy, was discovered in one of the caverns of Mentone, as far back as 1884, but when the discoverer showed it to a personage in the locality, that authority advised him not to let it be seen, lest it should take away from the belief in the antiquity of the caves, it being then thought too artistic to be consistent with early man. The finder acted on this advice, in ignorance of the real interest of the statuette, until April 1896, when he showed it to M. Reinach and M. Villenoisy, who promptly interviewed the sage adviser in question, and obtained a confirmation of the statement. Some interesting additions to our gallery of prehistoric art have been recently made by M. Emile Rivière and M. Berthoumeyrou, at Cro-Magnon in the Dordogne. These are a drawing of a bison and another of a human female in profile, which M. Rivière has kindly allowed me to reproduce. Among the other objects found in the same place were some flint implements brought to a fine point, suitable for engraving on bone or horn.

The idea of making in any form a graphic representation of anything seen has never, so far as I know, occurred to any lower animal ; and it could hardly have been among the first ideas formed in the gradually developing human brain. When that idea is found carried out with remarkable artistic skill, by means of implements well adapted for the purpose, we may surely assume that the result was not obtained till after a long interval of time, and was approached by gradual steps marked by progress in other faculties, as well as in the artistic faculty. It may be that some day all uncertainty on this head will be removed by decisive discoveries.

The interval between the Palæolithic and Neolithic periods rests in the like condition of incertitude. That by some means,



and somewhere on the face of the globe, the one period gradually passed into the other we cannot but believe. That the transition between them may have involved innumerable degrees is also highly probable. Where and when, and how each step was taken we do not know at present, and possibly never shall know. The problem is not satisfactorily solved by the production of palæolithic implements resembling neolithic forms, or neolithic implements resembling palæolithic forms ; inasmuch as between the one period and the other an interval of time involving geological and other changes has to be accounted for.

In this respect, also, our best authorities are the most cautious and conservative. In the excellent address which Prof. Boyd Dawkins delivered to the Royal Archæological Institute at the Dorchester meeting last year, on the present phase of prehistoric archæology, he contrasted the few primitive arts, such as sewing, and the manufacture of personal ornaments and rude implements of the chase, possessed by the palæolithic hunters—apart from their great proficiency in the delineation of animals—with the variety of arts, such as husbandry, gardening, spinning, weaving, carpentry, boat-building, mining, and pottery-making, possessed by the neolithic herdsmen, and held that between the

two there is a great gulf fixed. Somewhere that gulf must be bridged over. Prof. Boyd Dawkins says that the bridge is not to be found in the caverns of the South of France. It is difficult to meet his argument that the presence of grains of barley and stones of the cultivated plum at Mas d'Azil are evidences of neolithic civilisation. His objections to other discoveries are not so strong as this, but are strong enough to make us pause. The tall, long-headed, people whose remains were found at Cro-Magnon, he holds to be early neolithic and not palæolithic, to stand on the near side and not on the far side of the great gulf.

These considerations lend importance to the discoveries which have been laid before this Association at previous meetings by Mr. Seton-Kerr, and which have also been commented upon by Prof. Flinders Petrie and Sir John Evans. If we are compelled to admit a breach of continuity in Europe, is it in Africa that we shall find the missing links? That is another of the great problems yet unsolved. The evidence we want relates to events which took place at so great a distance of time that we may well wait patiently for it, assured that somewhere or other these missing links in the chain of continuity must have existed and probably are still to be found.

The next stage, which comprises the interval between the neolithic and the historic periods, was so ably dealt with by Mr. Arthur J. Evans in his address to this Section at the Liverpool meeting, that it does not call for any observations from me. Two Committees appointed by the Association in connection with this Section touch upon this interval—the Committee for investigating the lake dwellings at Glastonbury, and the Committee for co-operating with the explorers of Silchester in their well-conducted and fruitful investigation of the influence of Roman civilisation on a poor provincial population. I pass on to consider the very great progress that has been made of late years in some of the branches of anthropology other than physical and prehistoric, and especially in that of folk-lore. I do this the more readily because I do not recollect that folk-lore has ever before been prominently referred to in an address to this Section. It is beginning to assert itself here, and will in time acquire the conspicuous position to which it is becoming entitled, for the British Association is sensitive to every scientific movement, and responds readily to the demands of a novel investigation. Already, for three or four years, a day has been given at our meetings to folk-lore papers; and at the Liverpool meeting an exceeding philosophic, and at the same time practical, paper was read by Mr. Gomme, and is printed *in extenso* in the *Proceedings* as an Appendix to the Report of the Ethnographic Survey Committee. The term "folk-lore" itself is not without a certain charm. It is refreshing to find a science described by two English syllables instead of by some compound Greek word. The late Mr. W. J. Thoms had a happy inspiration when he invented the name. It is just twenty years since the Folk-lore Society was established under his direction. It has accumulated a vast amount of material, and published a considerable literature; it is now rightly passing from the stage of collection to that of systematisation, and the works of Mr. J. G. Frazer, Mr. E. Sidney Hartland, and others, are pointing the way towards researches of the most absorbing interest and the greatest practical importance.

A generalisation for which we are fast accumulating material in folk-lore is that of the tendency of mankind to develop the like fancies and ideas at the like stage of intellectual infancy. This is akin to the generalisation that the stages of the life of an individual man present a marked analogy to the corresponding stages in the history of mankind at large; and to the generalisation that existing savage races present in their intellectual development a marked analogy to the condition of the earlier races of mankind. The fancies and ideas of the child resemble closely the fancies and ideas of the savage, and the fancies and ideas of primitive man.

An extensive study of children's games, which had been entered into and pursued by Mrs. Gomme, has been rewarded by the discovery of many facts bearing upon these views. A great number of these games consist of dramatic representations of marriage by capture and marriage by purchase—the idea of exogamy is distinctly embodied in them. You will see a body of children separate themselves into two hostile tribes, establish a boundary line between them, demand the one from the other a selected maiden, and then engage in conflict to determine whether the aggressors can carry her across the boundary or the defenders retain her within it.

There can be little doubt that these games go back to a high antiquity, and there is much probability that they are founded upon customs actually existing, or just passing away at the time they were first played. Games of this kind pass down with little change from age to age. Each successive generation of childhood is short: the child who this year is a novice in a game becomes next year a proficient, and the year after an expert, capable of teaching others, and proud of the ability to do so. Even the adult recollects the games of childhood and watches over the purity of the tradition. The child is ever a strong conservative.

Upon the same principle, next to children's games, children's stories claim our attention. Miss Roalfe Cox has collected, abstracted, and tabulated not fewer than 345 variants of Cinderella, Catskin, and Cap o' Rushes. These come from all four quarters of the globe, and some of them are recorded as early as the middle of the sixteenth century. These elaborate stories are still being handed down from generation to generation of children, as they have been for countless generations in the past. Full of detail as they are, they may be reduced to a few primitive ideas. If we view them in their wealth of detail, we shall deem it impossible that they could have been disseminated over the world as they are otherwise than by actual contact of the several peoples with each other. If we view them in their simplicity of idea, we shall be more disposed to think that the mind of man naturally produces the same result in the like circumstances, and that it is not necessary to postulate any communication between the peoples to account for the identity. It does not surprise us that the same complicated physical operations should be performed by far distant peoples without any communication with each other: why should it be more surprising that mental operations, not nearly so complex, should be produced in the same order by different peoples without any such communication? Where communication is proved or probable, it may be accepted as a sufficient explanation; where it is not provable, there is no need that we should assume its existence.

The simple ideas which are traceable in so many places and so far back are largely in relation with that branch of mythology which personifies the operations of nature. Far be it from me to attempt to define the particular phase of it which is embodied in the figure of Cinderella as she sits among the ashes by the hearth, or to join in the chase after the solar myth in popular tradition. The form of legend which represents some of the forces of nature under the image of a real or fictitious hero capable of working wonders appears to be widely distributed. Of such, I take it, are the traditions relating to Glooscap, which the late Dr. S. T. Rand collected in the course of his forty years' labours as a missionary among the Micmac Indians of Nova Scotia, where, Mr. Webster says, Glooscap formerly resided. The Indians suppose that he is still in existence, although they do not know exactly where. He looked and lived like other men; ate, drank, smoked, slept and danced along with them; but never died, never was sick, never grew old. Cape Blomidon was his home, the Basin of Minas his beaver-pond. He had everything on a large scale. At Cape Split he cut open the beaver dam, as the Indian name of the cape implies, and to this we owe it that ships can pass there. Spencer's Island was his kettle. His dogs, when he went away, were transformed into two rocks close by. When he returns he will restore them to life. He could do anything and everything. The elements were entirely under his control. You do not often meet with a mischievous exercise of his power. It is a curious part of the tradition, possibly a late addition to it, that it was the encroachments and treachery of the whites which drove him away.

The early inhabitants of the island of Tahiti appear to have had a whole pantheon of gods and heroes representing the various operations of nature. Even the Papuans have a legend in which the morning star is personified acting as a thief. But it is needless to multiply instances. Lord Bacon—who says "The earliest antiquity lies buried in silence and oblivion. . . . This silence was succeeded by poetical fables, and these at length by the writings we now enjoy; so that the concealed and secret learning of the ancients seems separated from the history and knowledge of the following ages by a veil or partition wall of fables interposing between the things that are lost and those that remain"—has shown in his "Wisdom of the Ancients" that classical mythology was in truth a vast system of nature-worship, and in so doing has done more than even he knew,

for he has affiliated it to those ideas which have been so commonly formed among rude and primitive peoples. It is true, he says, fables in general are composed of ductile matter, that may be drawn into great variety by a witty talent or an inventive genius, and be delivered of plausible meanings which they never contained. But the argument of most weight with him, he continues, "is that many of these fables by no means appear to have been invented by the persons who relate and divulge them, whether Homer, Hesiod, or others; but whoever attentively considers the thing will find that these fables are delivered down and related by those writers, not as matters then first invented and proposed, but as things received and embraced in earlier ages. The relators drew from the common stock of ancient tradition, and varied but in point of embellishment, which is their own. This principally raises my esteem of these fables, which I receive, not as the product of the age, or invention of the poets, but as sacred relics, gentle whispers, and the breath of better times, that from the traditions of more ancient nations came, at length, into the flutes and trumpets of the Greeks."

Except that he supposes them to be a relic of better times, the poet's dream of a golden age no doubt still ringing in his ears, Bacon had, in this as in many other matters, a clear insight into the meaning of things.

Another idea that appears among very early and primitive peoples, and has had in all time a powerful influence on mankind, is that of a separable spirit. The aborigines of North-west Central Queensland, who have lately been studied to such excellent purpose by Dr. Walter Roth, the brother of a much-esteemed past officer of this Section, are in many respects low in the scale of humanity; yet they possess this idea. They believe that the ghost, or shade, or spirit of some one departed can so initiate an individual into the mysteries of the craft of doctor or medicine-man as to enable him, by the use of a death-bone apparatus, to produce sickness and death in another. This apparatus is supposed to extract blood from the victim against whom it is pointed without actual contact, and to insert in him some foreign substance. They will not go alone to the grave of a relative for fear of seeing his ghost. It appears that they have the fancy that Europeans are ghosts. The Tasmanians also, as Mr. Ling Roth himself tells us, had the same fancy as to the Europeans, and believed that the dead could act upon the living. The Pawnee Indians, we are assured by Mr. Grinnell, believe that the spirits of the dead live after their bodies are dust. They imagine that the little whirlwinds often seen in summer are ghosts. The Blackfeet think the shadow of a person is his soul, and that while the souls of the good are allowed to go to the sand-hills, those of the bad remain as ghosts near the place where they died. The Shillooks of Central Africa are said to believe that the ghostly spectres of the dead are always invisibly present with the living, and accompany them wherever they go. The aborigines of Samoa believed in a land of ghosts, to which the spirits of the deceased were carried immediately after death. The religious system of the Amazulu, as described by Bishop Callaway, rests largely on the foundation of belief in the continued activity of the disembodied spirits of deceased ancestors.

Mr. Bryce, in his "Impressions of South Africa," says that at Lezapi, in Mashonaland, are three huts, one of which is roofed, and is the grave of a famous chief, whose official name was Makoni. "On the grave there stands a large earthenware pot, which used to be regularly filled with native beer when, once a year, about the anniversary of his death, his sons and other descendants came to venerate and propitiate his ghost. Five years ago, when the white men came into the country, the ceremony was disused, and the poor ghost is now left without honour and nutriment. The pot is broken, and another pot, which stood in an adjoining hut, and was used by the worshippers, has disappeared. The place, however, retains its awesome character, and a native boy who was with us would not enter it. The sight brought vividly to mind the similar spirit worship which went on among the Romans, and which goes on to-day in China; but I could not ascertain for how many generations back an ancestral ghost receives these attentions—a point which has remained obscure in the case of Roman ghosts also."

The aborigines of New Britain are said to believe that the ghosts of their deceased ancestors exercise a paramount influence on human affairs, for good or for evil. They have the poetical idea that the stars are lamps held out by the ghosts to light the path of those who are to follow in their footsteps. On the other hand, they think these ancestral ghosts are most malicious during full moon. Not to multiply instances, we may say with Mr. Staniland Wake, it is much to be doubted whether there is any race of uncivilised men who are not firm believers in the existence of spirits or ghosts. If this is so, and the idea of a separable spirit, capable of feeling and of action apart from the body, is found to be practically universal among mankind, and to have been excogitated by some of the least advanced among peoples; and if we observe how large a share that idea has in forming the dogmas of the more specialised religions of the present day, we shall not see anything inherently unreasonable in the generalisation that the group of theories and practices which constitute the great province of man's emotions and mental operations expressed in the term "religion" has passed through the same stages and produced itself in the same way from these early rude beginnings of the religious sentiment as every other mental exertion. We shall see in religion as real a part of man's organisation as any physical member or mental faculty. We shall have no reason to think that it is an exception to any general law of progress and of continuity which is found to prevail in any other part of man's nature.

The same inference may be drawn from many other considerations. Take, for instance, the belief in witchcraft, which is so characteristic of uncivilised man that it is hardly necessary to cite examples of it. The Rev. Mr. Coillard, a distinguished missionary of the Evangelical Society of Paris, in a delightful record, which has just been published, of his twenty years' labours as a missionary pioneer among the Banyai and Barotzi of the Upper Zambesi, "on the threshold of Central Africa," says: "In the prison of the Barotzi, toiling at earthworks, is a woman—young, bright, and intelligent. She told me her story. A man of remarkably gentle character had married her. The king's sister, Katoka, having got rid of one of her husbands, cast her eyes on this man and took him. He had to forsake his young wife—quite an easy matter. Unfortunately, a little later on, a dead mouse was found in the princess's house. There was a great commotion, and the cry of witchcraft was raised. The bones did not fail to designate the young woman, and she was made a convict. A few years ago she would have been burnt alive. Ah, my friends, paganism is an odious and a cruel thing!" Ah, Mr. Coillard, is it many years ago that she would have been burnt alive or drowned in Christian England or Christian America? Surely the odiousness and the cruelty are not special to paganism any more than to Christianity. The one and the other are due to ignorance and superstition, and these are more hateful in a Matthew Hale or a Patrick Henry than in a Barotzi princess in the proportion that they ought to have been more enlightened and intelligent than she. It is only 122 years since John Wesley wrote: "I cannot give up to all the Deists in Great Britain the existence of witchcraft"; and I believe that to this day the Order of Exorcists is a recognised order in the Catholic Church.

The same line of argument—which, of course, I am only indicating here—might be pursued, I am persuaded, in numberless other directions. Mr. Frazer, in his work on the Golden Bough, has most learnedly applied it to a remarkable group of beliefs and observances. Mr. Hartland has followed up that research with a singularly luminous study of several other groups of ideas in the three volumes of his "Legend of Perseus." More recently, Mr. Andrew Lang has sought to show that the idea of a Supreme Being occurs at an earlier stage in the development of savage thought than we had hitherto supposed. Striking as these various collocations of facts and the conclusions drawn from them may appear, I am convinced there is much more for the folk-lorist to do in the same directions.

The principle that underlies it all seems to be this: man can destroy nothing, man can create nothing, man cannot of his own mere volition even permanently modify anything. A higher power restrains his operations, and often reverses his work. You think you have exterminated a race: you have put to the sword every male you can find, and you have starved and poisoned all the survivors of the community. In the meanwhile, their blood has been mingled with yours, and for generations to come your bones and those of your descendants will preserve a record of that lost race. You think you have exterminated a religion; you have burned to death all of its teachers you can find, and converted forcibly or by persuasion the rest of the community. But you cannot control men's thoughts, and the old beliefs and

habits will spring up again and again, and insensibly modify your own religion, pure as you may suppose it to be.

Huxley, in his address to the department of Anthropology twenty years ago, said, with the force and candour that were characteristic of him: "Anthropology has nothing to do with the truth or falsehood of religion—it holds itself absolutely and entirely aloof from such questions—but the natural history of religion, and the origin and the growth of the religions entertained by the different kinds of the human race, are within its proper and legitimate province." I do not presume to question that as an absolutely accurate definition of the position—it could not be otherwise; but if there be any here to whom what I have been suggesting is in any sense novel or startling, I should be glad to be allowed to say one word of reassurance to them. When my friend Mr. Clodd shocked some of the members of the Folk-lore Society by his frank statement of conclusions at which he had arrived, following the paths I have indicated, it was said we must fall back on the evidences of Christianity. What more cogent evidence of Christianity can you have than its existence? It stands to-day as the religion which, in most civilised countries, represents that which has been found by the operation of natural laws to be best suited for the present circumstances of mankind. You are a Christian because you cannot help it. Turn Mahometan to-morrow—will you stop the spread of Christianity? Your individual renunciation of Christianity will be but a ripple on a wave. Civilised mankind holds to Christianity, and cannot but do so till it can find something better. This, it seems to me, is a stronger evidence of Christianity than any of the loose-jointed arguments I find in evidential literature.

Upon this thorny subject I will say no more. I would not have said so much, but that I wish to show that these considerations are not inconsistent with the respect I entertain, and desire now as always to express, for those feelings and sentiments which are esteemed to be precious by the great majority of mankind, which solace them under the adversities of life and nerve them for the approach of death, and which stimulate them to works of self-sacrifice and of charity that have conferred untold blessings on humanity. I reverence the divine Founder of Christianity all the more when I think of him as one who so well "knew what was in man" as to build upon ideas and yearnings that had grown in man's mind from the earliest infancy of the race.

To return. If continuity be the key that unlocks the receptacle where lie the secrets of man's history—physical, industrial, mental, and moral; if in each of these respects the like processes are going on—it follows, as I have already said, that the only satisfactory study of man is a study of the whole man. It is for this reason that I ask you to take especial interest in the proceedings of one of the Committees of this Section, which has adopted such a comprehensive study as the guiding principle of its work—I mean the Ethnographical Survey Committee. I have so often addressed this Section and the Conference of Corresponding Societies on the matter, since the Committee was first appointed at the Edinburgh meeting, on the suggestion of my friend Prof. Haddon, that I can hardly now refer to it without repeating what has been already said or forestalling what will be said when its report is presented to you, but its programme so fully realises that which has been in my mind in all that I have endeavoured to say that I must make one more effort to enlist your active interest in its work.

The scheme of the Committee includes the simultaneous recording in various districts of the physical characters, by measurement and by photography, the current traditions and beliefs, the peculiarities of dialect, the monuments and other remains of ancient culture, and the external history of the people. The places in the United Kingdom where this can be done with advantage are such only as have remained unaffected by the great movements of population that have occurred, especially of late years. It might have been thought that such places would be very few; but the preliminary inquiries of the Committee resulted in the formation of a list of between 300 and 400. So far, therefore, as the testimony of the very competent persons whose advice was sought by them is to be relied on, it is evident that there is ample scope for their work. At the same time, the process of migration from country to town is going on so rapidly, that every year diminishes the number of such places. One thinks with regret how much easier the work would have been one or two or three generations ago; but that consideration should only induce us to put it off no longer. The work done by the lamented Dr. Walter Gregor for this Committee in Dumfriesshire and other parts of Scotland is an excellent type of the way in which such work should be done. His collections of physical measurements and of folk-lore have been published in the fourth and fifth reports of the Committee. There can be no doubt that few men possess the faculty he had of drawing forth the confidence of the villagers and getting them to tell him their superstitions and their old customs. He succeeded in recording from their lips not fewer than 733 items of folk-lore. They not merely form exceedingly pleasant reading, such as is perhaps not often met with in a British Association report, but they also will be found to throw considerable light on the views which I have ventured to lay before you. It is much to be wished that others who have the like faculty, if even in a lesser degree, could be induced to take up similar work in other districts, now that Dr. Gregor has so well shown the way in which it ought to be done.

The work done by the Committee for the Ethnographical Survey of Canada; the completion of the Ethnographical Survey of the North-western tribes which has been ably conducted for many years; and the progress made in the Ethnographical Survey of India will also be brought under your notice, the latter in a paper by Mr. Crooke, who has worked with Mr. Risley upon it.

Another movement, which was originated by this Section at the Liverpool meeting, and was referred to in the report of the Council of the Association last year, has made some progress since that report was presented. Upon the recommendation of this Section, the General Committee passed the following resolution and referred it to the Council for consideration and action:—

"That it is of urgent importance to press upon the Government the necessity of establishing a Bureau of Ethnology for Greater Britain, which, by collecting information with regard to the native races within and on the borders of the Empire, will prove of immense value to science and to the Government itself."

The Council appointed a Committee, consisting of the President and General Officers, with Sir John Evans, Sir John Lubbock, Prof. Tylor, and your esteemed Vice-President, Mr. Read, the mover of the resolution. Their report is printed at length in last year's Report of Council, and shows clearly how useful and how easily practicable the establishment of such a Bureau would be. The Council resolved that the Trustees of the British Museum be requested to consider whether they could allow the proposed Bureau to be established in connection with the Museum. I understand that those Trustees have returned a favourable answer; and I cannot doubt that the joint representations which they and this Association will make to Her Majesty's Government will result in the adoption of a scheme calculated to realise all the advantages which we in this Section have so long looked for from it. In the Secretary of State for the Colonies and the Chancellor of the Exchequer we have statesmen who cannot fail to appreciate the benefits the community must derive from acquiring accurate and scientific knowledge of the multifarious races which compose the Empire.

Those of us who visited the United States last year had the opportunity of observing the excellent work which is done by the Bureau of Ethnology at Washington, and those who stayed at home are probably familiar with the valuable publications of that department. An Act of Congress twenty years ago appropriated 4000*l.* a year to the Smithsonian Institution for the continuance of researches in North American anthropology. The control of the Bureau was entrusted to the able hands of Major Powell, who gathered round him a band of skilled workers, many of whom had been previously engaged on ethnographic research under the direction of the Geographical and Geological Survey of the Rocky Mountain region. In field work and in office work, to use Major Powell's convenient distinction, ample return has ever since been rendered to the United States Government for the money thus appropriated, which has since been increased to 8000*l.* a year. Our own Bureau of Ethnology would have a wider sphere of operations, and be concerned with a greater number of races. It would tend to remove from us the reproach that has in too many cases not been without foundation—that we have been content to govern races by the strong hand without caring to understand them, and have thus been the cause of injustice and oppression from ignorance rather than from malevolence. If that were only a record of the past, we might be content with mere unavailing regret; but the colonial

empire is still expanding, and we and our competitors in that field are still absorbing new districts—a practice which will probably continue as long as any spot of ground remains on the face of the globe occupied by an uncivilised race.

Would it not be worth while at this juncture to extend to the peoples of Africa, for instance, the principles and methods of the Ethnographic Survey—to study thoroughly all their physical characters, and at the same time to get an insight into the working of their minds, the sentiments and ideas that affect them most closely, their convictions of right and wrong, their systems of law, the traditions of the past that they cherish, and the rude accomplishments they possess? If for such a service investigators like Dr. Roth, who began his researches in Queensland by so close a study of the languages and dialects of the people that he thoroughly won their confidence, could be found, the public would soon learn the practical value of anthropological research. If the considerations which I have endeavoured to urge upon you should lead not only the scientific student but the community at large to look upon that which is strange in the habits and ways of thinking of uncivilised peoples as representing with more or less accuracy a stage in that long continuity of mental progress without which civilised peoples would not be what and where they are, it could not but favourably affect the principles and practice of colonisation. *Tout comprendre c'est tout pardonner.* The more intimate our acquaintance with the races we have to deal with and to subjugate, the more we shall find what it means to stand with them on the same platform of common humanity. If the object of government be, as it ought to be, the good of the governed, it is for the governing race to fit itself for the task by laying to heart the lessons and adopting the processes of practical Anthropology.

PHYSICS AT THE BRITISH ASSOCIATION.

THE reputation for industry which Section A has acquired in past years will not suffer in any way by the proceedings of the recent meeting in Bristol. In addition to the ordinary meetings of the Section, the International Magnetic Conference met on four days; and as all communications to the Section relating to terrestrial magnetism and atmospheric electricity were referred to the Conference, it may be said that the Section sat in duplicate on five out of its six days of meeting. On Saturday, when the Magnetic Conference did not meet, the two departments were devoted to mathematics and meteorology respectively, and on Wednesday the Section was not divided. On two occasions the Section was associated with others in joint discussions, namely with Section B, on the results of the recent solar eclipse expeditions, and with Section G, on the magnetic and electrolytic effects of electric railways. The members of the International Magnetic Conference also took part in the latter discussion. The papers read before the Section were representative of almost every branch of physics. In the following account they are grouped according to subject, and are not arranged in the order in which they were read.

Before the commencement of his address the President, Prof. Ayrton, referred to the loss to science occasioned by the death of Dr. John Hopkinson. The address, which was published in NATURE of September 8, suggests a new field for physical and chemical research, namely the investigation of the phenomena of smell. For the physicist the most striking experiments described are those which show the slowness of diffusion of odorous particles in still air, and the absorption of scents by glass, while the physiologist cannot fail to be interested in the superior sense of smell possessed by the female sex. In moving a vote of thanks to the President, Lord Kelvin referred to the identity of the senses of taste and smell, including both as the chemical sense, and hoped Prof. Ayrton's address would lead to another bond of union between the chemist and the physicist. Prof. Mascart seconded the vote, specially thanking the President for his welcome to the members of the International Magnetic Conference.

In the subject of heat Prof. Rosa described the continuation of important work by himself and Prof. Atwater, the object being to determine whether the law of conservation of energy holds good for the vital processes going on in the human body. For this purpose a space large enough for a man to live in was enclosed as a calorimeter, and surrounded by alternate jackets of flowing water and air, in such a manner that the heat evolved from the "calorimeter" could be accurately measured. The details of construction of the apparatus were described at the Toronto meeting last year. During the past twelve months the authors have made experiments on men living in the calorimeter for periods varying from four to eight days, and doing different kinds of work. The heat-value of the food supplied and of the excreta were obtained by combustion, and the amount and composition of the gases entering and leaving the calorimeter were also determined. A full description of the work is to be published by the United States Government, under whose auspices the experiments have been carried out; it may, however, be stated that the law of conservation of energy is found to be true within the limits of experimental error. The ratio of the mechanical work done by a man to the total energy supplied to him, that is to say his efficiency as an engine, is usually about 7 per cent., and may be as high as 10 per cent. These figures are higher than the efficiency of a perfect heat-engine working between the same limits of temperature, and lead us to the conclusion that the energy transformation in the human body is not effected solely by heat, but is most probably analogous to that in a circuit containing a battery and electromotor.

Another series of experiments to decide a question of theoretical interest was described in a paper by Dr. A. Galt, on the heat of combination of metals in the formation of alloys. Lord Kelvin has shown how a lower limit to the size of atoms may be found by comparing the work done by the approach of the electrical charges on a thin film of zinc and a thin film of copper, their difference of potential being that due to contact, with the heat of combination of the films to form brass. On the other hand Prof. Oliver Lodge has pointed out[1] that on the chemical theory of electromotive force of contact the heat of formation of an alloy should be much smaller than Lord Kelvin assumes it to be, and an exact determination of its value would form a crucial test between the rival contact and chemical theories. In Dr. Galt's experiments a thin glass bulb with holes in its sides contains the alloy or the mixed metals, and is lowered into a calorimeter of glass containing nitric acid; as the acid passes through the holes the metal is dissolved, and the evolved gases do not escape. The rise of temperature of the acid is noted, and the heat of combination calculated. The results are so far preliminary, and the Association has made a grant for their continuation. Mr. W. N. Shaw read a paper on Dalton's law, in which he called attention to Regnault's experiments on the pressure of mixtures of air and saturated ether vapour; these experiments show a discrepancy between the saturation pressure of ether in air and in a vacuum. The explanation afforded by Regnault is that errors are introduced owing to the condensation of vapour on the vertical walls of the barometer tube; but from experiments on mixtures of air and water-vapour, Mr. Shaw considers that a real departure from the law of Dalton is indicated. The subject is to be investigated in the Cavendish Laboratory. Dr. C. H. Lees described experiments on the thermal conductivity of rocks at different pressures, according to which the conductivities of slate, granite and marble are very slightly increased by increased pressure, while in the case of a rather soft sandstone the increase amounted to 3 per cent. under a pressure of about sixty atmospheres. Mr. S. R. Milner and Prof. Chattock read a paper on the thermal conductivity of water, which they find to be 0·00143 C.G.S. units at 20° C.

Among papers relating to light Mr. J. W. Gifford read a communication on lenses, not of glass, in which he compared the transparency of calcite, quartz and fluor-spar for extreme ultra-violet rays, the last-named being the most transparent. Lord Kelvin discussed the various theories of refraction and anomalous dispersion, and stated that none of the dynamical theories hitherto proposed is satisfactory or free from difficulties. Prof. T. Preston described his experiments on radiation in a magnetic field. Zeeman found that when the spectrum of the sodium light emitted from a source in a magnetic field is viewed at right angles to the lines of force, the bright lines are tripled and the polarisation of the side lines is in a plane perpendicular to that of the central line. By using a very large grating and photographing the lines, Prof. Preston finds that all bright lines in a spectrum are not treated alike; some are unchanged, some become doublets, triplets, quartets, or even sextets. He explained how absorption of the original radiation by vapour surrounding the source might account for the multiplication of lines, but he considers from the sharpness of definition of the lines that the effect is not due to absorption. Prof. S. P.

[1] *Philosophical Magazine*, vol. xix., 1885.

Thompson described and exhibited an experiment by Righi on the production of the Zeeman phenomenon by absorption. A beam of plane polarised white light is passed along the lines of force of a magnetic field, and received in an analyser adjusted to extinction with zero field; in the magnetic field is a sodium flame or a tube filled with nitric oxide. On setting up the field a brilliant yellow light is seen, which cannot be extinguished by rotating the analyser; spectroscopic examination shows it to consist of doubled sodium lines, the constituents of each doublet being slightly more and slightly less refrangible respectively than the original lines. In the case of nitric oxide the light seen is bluish-green, being complementary to the colour of nitric oxide by transmission, and the spectrum consists of doublets. Profs. Lodge and Glazebrook thought that the phenomenon might be fully explained by supposing the magnetic field to alter the period of vibration of the ions so that they respond to waves of slightly higher or lower frequency than their natural one. Dr. C. E. Curry read a paper on the electromagnetic theory of reflexion on the surface of crystals.

A communication from Mr. J. Burke referred to the luminosity produced by striking sugar. The rim of a rapidly revolving disc of sugar is struck automatically by a hammer at the rate of about two blows per second; this causes an almost continuous luminosity extending from the hammer inwards and downwards. The spectrum of the light is confined to the more refrangible side of the F line, and the nature and appearance of the luminosity are unchanged by altering the medium surrounding the sugar. No satisfactory explanation of the phenomenon has yet been found.

The report of the Electrical Standards Committee is a record of progress made in the determination of the standard ampere. Profs. Ayrton and J. V. Jones have designed an ampere balance, for the construction of which a grant has been made by the Association. The details of the instrument were described to the Section. An appendix to the report contains an account of the determination of the temperature-coefficients of two coils used in the determination of the ohm by Profs. Ayrton and Jones, the measurements having been made by Mr. M. Solomon. The coils do not appear to have changed since 1896, but their resistances as measured in 1894 were slightly lower (0·006 to 0·007 per cent.) than the present values. The Electrolysis Committee has investigated the electrical conductivity and the freezing point of several dilute solutions of salts, which furnish some unexpected and, therefore, interesting results. The data are, however, not yet complete. The report was accompanied by a paper from Mr. Whetham on the measurement of the electric conductivity, and one from Mr. E. H. Griffiths on the freezing point determinations. Mr. S. Skinner has investigated the carbon-consuming cell of Jacques, consisting of an iron crucible into which is put fused caustic soda with a carbon rod as electrode, the crucible forming the other electrode. In order to maintain the electromotive force of the cell, air is blown into the caustic soda. Mr. Skinner found that the air acts by cleaning the surface of the iron crucible, and can be usefully replaced by adding sodium peroxide to the caustic soda. By measuring the current furnished by the cell, and the loss of weight of the carbon electrode per second, the author hopes to determine the electro-chemical equivalent of carbon. Messrs. Cahen and Donaldson communicated the results of some comparisons of the output and efficiency of a secondary cell (Tudor type) when charged at constant current and constant electromotive force respectively. By charging at constant potential the time of charging is reduced to less than half that required at constant current, the capacity is thirty per cent. greater, but the energy efficiency is ten per cent. less. Neither method of charging appears to damage the cell. Mrs. Ayrton read a paper on the drop of potential at the terminals of the electric arc, in which she described the exploration of potential distribution in the arc by means of a third electrode of carbon inserted laterally. If the arc be maintained at constant length the power expended at each carbon is a linear function of the current, and if the current be maintained constant the power expended at each carbon is a linear function of the arc-length. The experiments are subject to errors pointed out by Mrs. Ayrton in her paper: (1) the third carbon may not take up the potential of the point of the arc in which it is placed; (2) it alters the potential-distribution and the length of the arc. The author proposes to repeat her experiments, using an insulating third carbon. Prof. Chattock described experiments to determine the velocity of electricity in the electric wind. He finds that the electricity in the electric wind travels much more rapidly than the gaseous particles themselves, reaching in hydrogen a velocity of 900 cm. per second. Profs. Rosa and A. W. Smith have investigated the heating effect of alternating currents upon the dielectric of a condenser, measuring the net watts supplied to the condenser and the heat developed per second in the dielectric. Their results were communicated to the Section by Prof. Rosa. Mr. F. B. Fawcett described standard high resistances constructed by depositing kathode films on glass and heating them for a long time in a partial vacuum; this process renders them constant. Prof. Callendar exhibited a platinum voltmeter, in which the change of temperature of a platinum wire on passing a current through it is utilised to measure the current, and hence electromotive force; the instrument is made self-recording. Mr. E. H. Griffiths exhibited an apparatus for the measurement of resistance, by which the resistance of a coil can be measured to within one part in three millions. Prof. Lodge described a new magnifying telephone, for calling up the operator at the receiving end in systems of wireless telegraphy. The minute current set up in the receiving circuit passes through a small, light coil suspended in a strong magnetic field and rigidly attached to the disc of a microphone transmitter; the coil moves, and so sets the microphone disc in motion. A relay current in the microphone circuit is thus interrupted, and can be sent through the coil of a second similar apparatus. By using three or four magnifications a slight sound can be made to approximate in intensity to the human voice. Prof. Barrett, Messrs. W. Brown and R. A. Hadfield communicated the results of some determinations of the electrical conductivity and magnetic permeability of various nickel-steels. Prof. S. Lemström and Dr. E. H. Cook read papers on the action of electricity on plants. Both agree that the growth of plants is accelerated by electrical discharges or currents; Dr. Cook, however, considers that the increased growth takes place only during germination of the seed and its growth underground, the mature plant being unaffected by electrical actions. In another paper Dr. Cook described experiments on the reflexion of the brush discharge.

The discussion on the magnetic and electrolytic actions of electric railways was opened by Dr. Schott, who described the total destruction of two American magnetic observatories by the approach of electric street-railways. Prof. Rücker indicated disturbances of a magnetometer needle due to the South London Electric Railway felt as far away as 3½ miles, and referred to the complete destruction of the Greenwich vertical force and earth-current records. He pointed out that the trouble could be remedied if electrical engineers would meet physicists in a friendly way, as they had done hitherto in this country. The principal disturbances arise from want of insulation of the return circuits of railway systems and the excessive distance between the outward and return circuits; the former gives rise to earth currents, and the latter to magnetic induction. Dr. Eschenhagen stated that in conjunction with Prof. von Bezold he had found a disturbance of magnetic instruments at a distance of 15 kilometres from electrical railways near Potsdam. Mr. W. H. Preece claimed protection for telegraphs and telephones as well as for magnetic observatories; the telephone, however, when provided with a complete twisted metallic circuit, is not capable of being disturbed, but earth-currents due to leakage seriously interfere with telegraphic work. Signor Palazzo described a method of damping the swings of a magnetometer needle so as to make it unsensitive to small-period oscillations. Prof. Fleming gave many instances of corrosion of gas and water pipes by electrolytic action, the pipes forming part of the earth-return of a leaky circuit. Prof. S. P. Thompson suggested the use of alternating currents and no earth-return, or of continuous currents with well-insulated circuits and the return wire very close to the outward circuit. Prof. Ayrton pointed out that it was to the advantage of the electrical engineer himself to use a well-insulated return-circuit.

In the discussion on the results of the recent solar eclipse expeditions, Prof. Turner classified the work of solar eclipses as referring chiefly to the shape, movements, nature and brightness of the sun's surroundings. The success of Mrs. Maunder in photographing a long coronal streamer has led to a discussion on the efficacy of triple-coated plates and a small camera, such as she used. Again, evidence is very conflicting concerning the relations of coronal extensions and solar prominences; from their positions they appear to be connected, but spectroscopically there is no evidence of any such connection. Another

unsettled point is the question whether the corona takes part in the sun's rotation. Sir Norman Lockyer explained the connection between the spectra of stars and their temperature, and referred to the discovery that the spectrum of the sun's chromosphere is similar to that of the principal absorbing layer in γ Cygni, which he characterised as a Rosetta stone of solar and stellar spectroscopy. He showed how the spectra of the various layers of the chromosphere indicate a gradual increase of temperature from without inwards, and announced with reserve, that the Indian photographs suggested that the wave-length of the chief coronal line required revision. Sir William Crookes suggested the appointment of a joint committee of chemists and physicists to examine quietly the question of solar spectra. Captain E. H. Hills exhibited his photographs of the spectrum of the inner corona. Captain Abney and Prof. Thorpe, who intended to take part in the discussion, were unable to be present at the meeting.

In meteorology, the Ben Nevis Committee sent a report of extended work, a station having been established at a point halfway up the mountain, and observations taken hourly during a portion of the year. The Committee on Meteorological Photography reported through Mr. Clayden that the work of simultaneously photographing clouds near the sun from two stations in an east and west line had been continued, the results showing that in hot, thundery weather the alto-cumulus and cirro-cumulus clouds attain great heights, sometimes reaching 90,000 feet. In order to make observations in the early morning and late afternoon a change of base line to a north and south direction is contemplated. The report of the Seismological Observations Committee deals with many phases of earthquake work, and in introducing it Prof. Milne emphasised the importance of securing better accommodation for seismological apparatus. He compared the seismological laboratories of Italy and Japan with the only one of this country, namely his own house at Shide, Isle of Wight. The Sectional Committee has taken steps towards securing the aid of the Government in providing suitable housing for seismological apparatus. The Montreal Meteorological Observatory reports having obtained successfully in McGill University Physical Laboratory records of the temperature on the top of Mount Royal; the installation of other apparatus recording at a distance is being proceeded with. Prof. Callendar described an application of his platinum thermometer as a sunshine recorder, by registering the temperature-difference between a bright and a blackened thermometer. Mr. A. L. Rotch recorded an ascent of the Hargrave kite to a height of 11,440 feet at Blue Hill, Mass., U.S.A. Dr. van Rijckevorsel drew attention to a similarity, even in details, between the annual curves of temperature, air-pressure, rainfall, magnetic declination, vertical and horizontal magnetic force. He considered this to be a proof of similarity of origin of magnetic and meteorological phenomena. Mr. Douglas Archibald indicated a classification of weather types in western Europe, lasting for several days, and thus permitting the possibility of extending the present daily forecast. Simultaneous telegraphic reports from a greater number of stations would be necessary. Mr. Hopkinson read a paper on the climate of south-western England.

Among papers on general physics, Mr. W. N. Shaw exhibited a pneumatic analogue of the potentiometer, in which air-currents set up by gas jets at the lower ends of two tubes take the place of electric currents. The author pointed out its application to some problems of ventilation. Mr. A. W. Warrington described hydrometers of total immersion, which are hydrometers loaded with platinum weights until they are on the point of sinking; a slight rise of temperature of the liquid then causes them to do so. For liquids, the method is accurate to one part in a million. For solids, a kind of Nicholson hydrometer without tray is used, and the temperature is determined at which the instrument has no weight in water (1) loaded with mercury alone, (2) loaded with the solid and mercury. The results are accurate to one part in 100,000. Mr. W. R. Barker described and exhibited some interesting old weights and measures of Bristol. In sound, if we except Lord Kelvin's communication on the continuity of undulatory theory for sound, elastic-solid and electric waves, the only paper presented was that of Dr. R. J. Lloyd on the articulation and acoustics of the spirate fricative consonants. In this paper the differences between the articulation and resonance of the consonants *f*, *th*, *h*, *s*, *sh* and *ch* are discussed, and the author points out that the first three differ in the length and width of the frictional passage of the throat producing them, whereas the last three require some kind of fore-cavity which modifies and subdues the frictional noises. In the case of *s* and *sh* there is strong resonance from both the fore-cavity and the hinder cavity, the two sounds being differentiated by the second friction against the tips of the lower teeth in producing *s*.

We shall take another occasion to refer to the proceedings of the Magetic Conference.

During the meeting a collection of physical apparatus was exhibited in the physical laboratory of University College by Messrs. J. J. Griffin and Sons. It included an assay balance entirely free from steel, carrying 5 grammes and weighing to 0·00002 gramme, and a chemical balance weighing to 0·0001 gramme, both of which were provided with arrangements for weighing fractions of a gramme without opening the case. Holloway's crucible furnace, Davis' induction coil and X-ray bulbs, were also exhibited, as well as a simple form of apparatus for the measurement of expansion of solids, in which a rod fixed in a water bath between two glass rods is heated and displaces the glass rods; these pass through the sides of the water bath, and their displacement is measured directly by micrometer screws. The absence of optical devices for measurement increases greatly the simplicity of the instrument, which is said to yield fairly good results for lecture purposes.

MATHEMATICS AT THE BRITISH ASSOCIATION.

SATURDAY in the British Association week is a holiday for most of the Sections; the mathematicians and physicists, thus freed from competition, bid for two audiences instead of one, and take papers on mathematics and meteorology in separate rooms. This year the mathematical session, over which Lord Kelvin presided, was very well attended.

The first paper, read by Colonel Allan Cunningham, was a report on the work of the Committee appointed some years ago, with Lord Kelvin as chairman, for calculating tables of certain mathematical functions. It was explained that a set of tables has been prepared, giving the residues of powers of 2 for all prime moduli less than 1000. The plan is much the same as that of Jacobi's Canon Arithmeticus; but Jacobi uses as base a primitive root of the prime number concerned, which is inconvenient in practical calculations. The tables are now complete in MS., and nothing remains but to print them. It is to be hoped that the Association will see its way to printing them separately in quarto, as their usefulness will be much diminished if they are printed on the smaller page of the Annual Report; but it seems likely that, partly for financial reasons, they will not be published at all for another year.

The next paper, "The mathematical representation of statistics," by Prof. Edgeworth, was read in abstract by one of the Secretaries, in the absence of the author; and the following one, "On the use of logarithmic co-ordinates," by Mr. J. H. Vincent, was taken as read, but is to be published in full in the Annual Report.

One seldom sees lantern illustrations to a paper read at the mathematical session. But the next two subjects on the list can be treated experimentally as well as mathematically. In the first, "A new method of describing cycloidal and other curves," Prof. Hele-Shaw, of Liverpool, showed a new instrument for drawing the curves which can be got by rolling one circle on another. Perhaps its most striking feature is that the radii of the fixed and rolling circles may be as great as we please, their centres not being restricted, as in the ordinary instruments, to the limited range of a drawing board. Thus the radius of the fixed circle may be made infinite, when its circumference becomes a straight line, and the common cycloid is traced on the paper.

Another considerable advantage is, that the complete curve required can be drawn in many cases where the ordinary methods would only give a portion of it, or would only give the whole curve after several operations.

Since an ellipse of any eccentricity may be described by means of a point attached to a circle rolling within another of twice its diameter, it is clear that this instrument can be used for drawing ellipses. It differs from the elliptograph of Messrs. Alexander and Thomson, which depends on the same property, in having two pairs of toothed wheels instead of one; this improvement gets rid of some of the defects of the older arrangement, with which ellipses can only be got under limited conditions.

The inventor expressed his opinion that mathematicians would

find this instrument a help in explaining to beginners the properties of roulette curves in general. While most teachers will probably reply that machines of this kind are more trouble than they are worth in teaching, no one will question their interest to the full-grown mathematicians themselves.

A second paper by the same author dealt with his experiments on the motion of a viscous fluid between two parallel plates. A remarkable theorem, due to Sir George Stokes, which was communicated together with the experimental paper, renders this work of great importance. In Prof. Hele-Shaw's arrangement, liquid is forced between close parallel plates, past an obstacle of any form; and the conditions chosen are such that, whether from closeness of the walls, or slowness of the motion, or high viscosity of the liquid, or from a combination of these circumstances, the flow is regular. This is best attained by using glycerine as the fluid; then by colouring the jets which enter between the plates at certain points, the lines of flow in the liquid are made visible, and can be thrown on a lantern-screen or copied. Now Sir George Stokes's discovery is this, that the stream-lines thus experimentally obtained are the same as the stream-lines in the steady motion of a *perfect* (*i.e.* absolutely inviscid) liquid flowing past an infinitely thin long rod, a section of which is represented by the obstacle between the parallel walls which confine the viscous liquid. A complete graphical solution is thus experimentally obtained of a problem which, from its complexity, baffles the mathematician except in a few simple cases.

Owing to the similarity, so far as mathematics are concerned, between problems relating to the motion of a perfect fluid and the problems of electricity and magnetism, this gives also a method of investigating electrical and magnetic problems, in which the effect of placing a body of any required form and resistance (*i.e.* with any value of μ) in a uniform field can be obtained.

The beauty of the experiments greatly interested the audience, many of whom were probably unable to follow easily Sir George Stokes's mathematics; it is to be hoped that some of the results will figure before long as diagrams in hydrodynamical text-books.

Of the next paper, "Graphic representation of the two simplest cases of a single wave," by Lord Kelvin, an account will subsequently appear in these columns.

At meetings of the mathematical session in future years it is proposed to have a number of reviews of recent progress in various branches of pure mathematics, similar to those frequently prepared by German and American mathematicians. Several such reports are being arranged for next year, and this year a paper on "The recent history of the theory of the functions used in analysis" was given by Mr. E. T. Whittaker. The paper traced some of the more notable developments in the theories of special classes of functions, notably the automorphic functions and the functions of harmonic analysis. Then, speaking of the way in which most of the knowledge reviewed has been gained, "Isolated functions are invented, as Legendre's and Bessel's functions were invented, for the solution of physical problems. The work of the pure mathematician is to find the connection between them, to assign them places in an ordered series, and to develop their common theory. The arrangement once made, the gaps in the series are manifest. Every gap points to a function hitherto unknown, which is discovered and returned to the physicist, as the interest on his original deposit."

Two papers by Dr. Johnstone Stoney followed. The first, "The dynamical explanation of certain observed phenomena of meteor streams," attempts to account for the facts observed in meteoric showers on the earth, by considerations as to the streams of meteors which cause them. A shower may be very short, or it may last several days; its radiant—the point in the sky from which the stars appear to shoot—may remain fixed, or it may move; the disposition of the shower about its maximum may be symmetrical, or it may not; and in all these respects, the showers due to the same stream of meteors may behave differently in different years.

At each encounter of the meteors with the earth a number are caught and blaze themselves out in the atmosphere; a still larger number narrowly escape, and are deflected from their course by the earth's attraction. Dr. Stoney showed how the subsequent history of these "clino-meteors" will account for the facts noticed. This is especially interesting in view of our approaching encounter with the Leonid meteors.

In a second paper, "A survey of that part of the scale upon which nature works, about which man has some information," Dr. Stoney reviewed the range of our knowledge of magnitudes, and discussed what might be if the scale of our conceptions were of another order.

The last paper on the day's list was by Prof. G. J. Stokes, of Cork, on "The imaginary of logic." The search for a philosophical theory of $\sqrt{-1}$ has occupied men's minds ever since it was found that "impossible" quantities were useful. After classifying various views on the matter, the author said that the generally adopted position, that $\sqrt{-1}$ is uninterpretable in single or pure algebra, is paradoxical; for how can what is essentially meaningless possess an important meaning in its extraneous use? Then explaining the logical theory of the imaginary, he applied it to De Moivre's Theorem. The paper concluded with a comparison of the Calculus of Boole's Laws of Thought with that of Grassmann's Ausdehnungslehre, and some remarks on the relation of non-commutative algebras to ordinary mathematics.

FORTHCOMING BOOKS OF SCIENCE.

IN the list of M. Félix Alcan (Paris) are to be found:—"Névroses et Idées Fixes," by Prof. Raymond and Prof. Pierre Janet; ii. "Fragments de leçons cliniques sur les névroses, les maladies produites par les émotions, les idées, obsedantes et leur traitement"; "L'education de Sentiments," by P. F. Thomas; "La Méthode dans la Psychologie des Sentiments," by Prof. F. Rauh; "Operçus de Taxinomiè," by Durand de Gros; "Cherurgie du péricarde et du cœur," by Prof. F. Terrier; "L'auditiers et les organes," by le Dr. Gellé (Bibliothèque scientifique Internationale); "La céramique anciênne et moderne," by Guignet and Garnier (Bibliothèque scientifique Internationale); "La géologie expérimentale," by Prof. Stanislas Meunier.

The list of Messrs. Baillière, Tindall, and Cox includes:—"Aids to Psychological Medicine," by T. A. Beadle; "Chronic Nasal Obstruction, and Deformities of the Upper Jaw, Teeth, and Palate," by Dr. M. P. Mayo Collier; "Dictionary of Medical Terms," by H. de Méric, Part i., English-French, Part ii., French-English; "A Text-book of Operative Veterinary Surgery," by Dr. George Fleming, Part ii.; "Cattle Tuberculosis; a Practical Guide to the Farmer, Butcher, Meat Inspector, by Dr. T. M. Legge; "Aids to Materia Medica," by Dr. W. Murrell; "Essays for Students," by Stephen Paget; "The Analysis of Food and Drugs," in five parts, by T. H. Pearmain and C. G. Moor, Part ii., "The Chemical and Biological Examination of Water"; and new editions of "Heart Disease, with Special Reference to Prognosis and Treatment," by Sir Wm. H. Broadbent, Bart., F.R.S., and Dr. J. F. H. Broadbent; "The Throat and Nose and their Disease," by Lennox Browne, illustrated; "Manual of Physiology, with Practical Exercises," by Prof. G. N. Stewart, illustrated; "Handbook of Surgical Pathology," by Drs. W. J. Walsam and A. A. Kanthack; "Aids to the Diagnosis and Treatment of Diseases of Children (Medical)," by Dr. J. McCaw; "A Guide to the Examinations of the Conjoint Board in England, and for the Fellowship of the College of Surgeons, with Examination Papers," by F. J. Gant; "Handbook for Attendants on the Insane, Prepared by Authority of the Medico-Psychological Association; "Practical Guide to the Public Health Acts, and Correlated Acts for Officers of Health and Inspectors of Nuisances," by Dr. T. W. Hime.

Messrs. Blackie and Son, Ltd., promise:—"Recent Advances in Astronomy," by Dr. A. H. Fison; and "The Science of Life," by J. Arthur Thomson.

Messrs. W. Blackwood and Sons give notice of:—"A Text-Book of Agricultural Zoology," by Fred. V. Theobald, illustrated; "Intermediate Text-Book of Geology," by Prof. Lapworth, F.R.S., founded on Dr. Page's "Introductory Text-Book of Geology." illustrated; and a new edition of "Introductory Text-Book of Zoology," by Prof. Henry Alleyne Nicholson, F.R.S., and Alexander Brown, illustrated.

The list of the Cambridge University Press includes:—"Collected Mathematical Papers," by Prof. P. G. Tait; "The Scientific Papers by John Couch Adams," vol. ii., edited by Profs. W. G. Adams and R. A. Sampson; "A Treatise on Octonions," a development of Clifford's bi-quaternions, by Prof. Alexander McAulay; "On the Kinetic Theory of Gases," by S. H. Burbury, F.R.S.; "A Treatise on Spherical

Astronomy," by Prof. Sir Robert S. Ball, F.R.S.; "A Treatise on Geometrical Optics," by R. A. Herman; "A Treatise on Dynamics of a Particle," by Dr. E. J. Routh, F.R.S.; "The Strength of Materials," by Prof. J. A. Ewing, F.R.S.; "Zoological Results based on material from New Britain, New Guinea, Loyalty Islands, and elsewhere, collected during the years 1895, 1896, and 1897," by Dr. Arthur Willey; the work will embody the zoological results of the expedition, and will, it is expected, be completed in five or six parts; it will be illustrated. "Fossil Plants," a manual for students of botany and geology, by A. C. Seward, F.R.S., in two vols., vol. ii.: "Vertebrate Palæontology," by A. S. Woodward; "The Soluble Ferments and Fermentation," by Prof. J. Reynolds Green, F.R.S. (Cambridge Natural Science Manuals, Biological Series). "Electricity and Magnetism," by R. T. Glazebrook, F.R.S.; "Sound," by J. W. Capstick (Physical Series). "Crystallography," by Prof. W. J. Lewis; "The Principles of Stratigraphical Geology," by J. E. Marr (Geological Series). "Man, Past and Present," by A. H. Keane (Geographical Series). "An Introduction to Psychology," by G. F. Stout and Johns Adams; and "The Teacher's Manual of School Hygiene," by Dr. E. W. Hope and E. Brown.

In Messrs. Cassell's list we find:—"Wild Life at Home: how to Study and Photograph It," by R. Kearton, illustrated; and "Michael Faraday: his Life and Work," by Prof. Silvanus P. Thompson, F.R.S.

Messrs. Chapman and Hall, Ltd., announce:—"Wild Animals in Captivity," being anecdotes and reminiscences of the birds and beasts of the Zoological Gardens, with descriptions of their habits, food, management, &c., compiled from the notes and writings of A. D. Bartlett, and edited by his son, Edward Bartlett, illustrated; "Rambles in Lion Land," by Captain Francis B. Pearce, illustrated; "The Exploration of the Niger"; personal narrative of Lieut. Hourst, commander of the 1895–96 expedition from Timbuktu to Bussa; translated by Mrs. Arthur Bell (N. D'Anvers), illustrated; "Medical Works of the Fourteenth Century," consisting of transcripts with notes, from four MS. volumes (contemporary with the works of Wiclif and Chaucer); three being in the British Museum and one in the possession of Prof. Henslow; with an alphabetical list of upwards of 700 medical and other plants mentioned in works of the fourteenth century; compiled and identified with their modern English and Latin equivalent names, by the Rev. Prof. George Henslow; "Measurement and Weighing," a first year's course in elementary practical physics, for organised science schools, by Edwin Edser; and a new edition of "A Text-Book of Mechanical Engineering," by Wilfrid J. Lineham.

Messrs. J. and A. Churchill promise:—"A Text-Book of Materia Medica," by Prof. Henry G. Greenish; and new editions of Allen's "Commercial Organic Analysis," vols. i., ii., iii., Part 1; Thresh's "Simple Method of Water Analysis," with a section added on "Sewage Effluents"; Morris's "Human Anatomy"; Clouston's "Clinical Lectures on Mental Diseases," with nineteen plates, four of which are new; Taylor's "Manual of the Practice of Medicine"; Hartridge's "Refraction of the Eye"; and Goodhart's "Diseases of Children."

Among the books to be issued by the Clarendon Press may be mentioned a translation of Goebel's "Organographie der Pflanzen," by Prof. I. Bayley Balfour, F.R.S.

Messrs. Duckworth and Co. promise:—"Tom Tit Tot," an Essay on Savage Philosophy in Folk-Tale, by Edward Clodd; "A Glossary of Botanic Terms," by B. Daydon Jackson; and "A Text-Book of Agricultural Botany, Theoretical and Practical," by Prof. John Percival.

Messrs. R. Friedländer and Sohn (Berlin) announce:—"Icones Fungorum in Pannoniis Observatorum," C. Clusius, Cum Commentariis mycologicis edidit Prof. Gy. de Istvánffi, illustrated; "Das Tierreich," edited by the Deutschen Zoologischen Gesellschaft, General Editor, Franz Eilhard Schulze; Lieferung (5) Sporozoa, by Dr. A. Labbé; (6) Sarcoptidae et Demodicidae, by Prof. G. Canestrini und Prof. P. Kramer; (7) Pedipalpi et Scorpioninae, by Prof. K. Kraepelin; (8) Copepoda I., by Dr. W. Giesbrecht und Dr. O. Schmeil; (9) Trochilidae, by E. Hartert; (10) Hydrachnidae et Halacaridae, by R. Piersig und Dr. H. Lohmann. "Gerberti (Papae Silvestri II) Opera Mathematica," primum collegit et edidit N. M. Bubnow; "Supplement zum Zoologischen Adressbuch," edited by the Deutschen Zoologischen Gesellschaft; "Geschichte und Systematik der Indigo-Synthese," Dr. A. Reissert,; "Catalogus Mammalium tam viventium quam fossilium," Dr. E. L. Trouessart, v. Fasciculus, nova editio.

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The list of Messrs. Gauthier-Villars et Fils (Paris) contains:—"Bibliographie générale de l'Astronomie," Houzeau et Lancaster, Tome iii. Observations; "Compositions d'Analyse, de Mécanique et d'Astronomie," Prof. E. Villié, III^e Partie; "Traité pratique de Radiographie et de Radioscopie," A. Londe; "Les Objectifs," P. Moëssard; "Le développement de l'image latente, Théorie et pratique," A. Seyewetz; "Traité pratique de Photogravure en relief et en creux," Léon Vidal; "La Photolithographie, la Photogravure et leurs applications aux impressions monochromes et polychromes," Léon Vidal; and several volumes in the "Encyclopédie scientifique des Aide-Mémoire" Series.

The list of Messrs. Gebrüder Borntraeger (Berlin) includes:—"Allgemeine Dermatologie oder Allgemeine Pathologie, Diagnose und Therapie der Hautkrankheiten," by Dr. Ernst Kromayer; and a new edition of "Flora des Nordostdeutschen Flachlandes (ausser Ostpreussen), by Drs. P. Ascherson and P. Graebner.

The list of Messrs. Ginn and Co. (Boston, Mass.) contains:—"General Physics," by Prof. Charles S. Hastings and Frederick E. Beach; "Elementary Physical Geography," by Prof. William M. Davis; and a new edition of "Elements of the Differential and Integral Calculus," by Prof. James M. Taylor.

The list of Messrs. Charles Griffin and Co., Ltd., is as follows:—"The Design and Construction of Locomotive Engines," with an historical introduction, by William Frank Pettigrew, with a Section on American and Continental Engines, by Albert F. Ravenshear, illustrated; "Engine-room Practice," by John G. Liversidge, illustrated; "Light Railways at Home and Abroad," by William Henry Cole, illustrated (Griffin's Engineering Series); "A Manual of Algebra," by Richard C. Buck; "A Text-book of Physics: comprising Properties of Matter, Sound, Heat, Magnetism and Electricity, and Light," by Prof. J. H. Poynting, F.R.S., and Prof. J. J. Thomson, F.R.S., illustrated; (the volume on "Sound"); "The Metallurgy of Lead," by H. F. Collins, illustrated; "Dairy Chemistry for Dairy Managers, Chemists, and Analysts," by H. Droop Richmond (Griffin's Technological Manuals); "The Art of the Goldsmith and Jeweller," by Thos. B. Wigley, assisted by J. H. Stansbie, illustrated; "Atlas of Urinary Sediments: with Special Reference to their Clinical Significance," by Dr. Hermann Rieder, translated by Dr. Frederick Craven Moore, edited and annotated by Prof. Delepine; "The Microbic Diseases of Animals," by Prof. Ed. Nocard and Prof. E. Leclainche, translated, with annotations and additions, by Prof. John Rose Bradford, F.R.S.; "The Diseases of Children," by Dr. George Elder and Dr. J. S. Fowler, illustrated; "Outlines of Bacteriology," by Dr. L. H. Thoinot and E. J. Masselin, translated and adapted for English use, with additions, by Prof. Wm. St. Clair Symmers, illustrated; and new editions of:—"The Chemistry of Gas Manufacture," by W. J. Atkinson Butterfield, illustrated; "Aids in Practical Geology," by Prof. Grenville Cole; "Jamieson's Elementary Manual of Steam and the Steam Engine," with many illustrations and examination questions; "Jamieson's Applied Mechanics (Introductory Manual)," with numerous illustrations and examination questions; "Photography: its History, Processes, Apparatus, and Materials," by A. Brothers, illustrated; "Mental Diseases: with Special Reference to the Pathological Aspects of Insanity," by Dr. W. Bevan Lewis, illustrated.

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The list of Messrs. Macmillan and Co., Ltd., includes:—New volume of the Cambridge Natural History: vol. ix., "Birds," by A. H. Evans, illustrated; "A Manual of Zoology," by the late Prof. T. J. Parker, F.R.S., and Prof. W. A. Haswell, F.R.S.; "General Physiology: an Outline of the Science of Life," by Prof. Max Verworn, translated and edited by Dr. Frederic S. Lee, illustrated; "The Living Organism: an Introduction to the Problems of Biology," by Alfred Earl; "Elements of Palæontology," by Prof. Karl A. von Zittel, translated and edited by Dr. Charles R. Eastman; this English edition is revised and enlarged by the author and editor in collaboration with numerous specialists; "Steam, Gas, and Oil Engines," by Prof. John Perry, F.R.S., illustrated; "A System of Medicine," by many writers, edited by Dr. Thomas Clifford Allbutt, F.R.S., vols. vi. and vii.; "Diseases of the Breast," by Dr. Marmaduke Sheild; "Vaccination: with Special Reference to its Natural History and Pathology," Milroy lectures by Dr. S. Monckton Copeman; "The Witwatersrand Goldfields Banket and Mining Practice," by S. J. Truscott, with numerous plans and sections; "Australasian Goldfields," by R. Schmeisser, translated and edited by Prof. Henry Louis, illustrated; "A Text-Book of Metallurgy," by Carl Schnabel, translated and edited by Prof. Henry Louis, 2 vols., illustrated; "West African Studies," by Miss Mary Kingsley, illustrated; a translation of "In the Australian Bush and on the Coast of the Coral Sea: being the Experiences and Observations of a Naturalist in Australia, New Guinea, and the Moluccas," by Prof. Richard Semon, illustrated; "Observations of a Ranch-woman in New Mexico," by Mrs. Nicholl; the completion of "The History of Mankind," by Prof. Friedrich Ratzel, translated from the second German edition by A. J. Butler, 3 vols., illustrated; "The Valley of Light: Studies with Pen and Pencil in the Vaudois Valleys of Piedmont," by W. Basil Worsfold, illustrated; and new editions of "A History of Chemistry from the Earliest Times to the Present Day: being also an Introduction to the Study of the Science," by Prof. Ernest von Meyer, translated, with the author's sanction, by Dr. George M'Gowan; and "An Atlas of Practical Elementary Biology," by Prof. G. B. Howes, F.R.S.

Messrs. Methuen and Co.'s announcements include:—"Through Asia," by Sven Hedin, 2 vols., illustrated; "The Highest Andes," by E. A. FitzGerald, illustrated; "Volumetric Analysis," by J. B. Russell; Handbooks of Technology: "Carpentry and Joinery," by F. C. Webber, illustrated; and "Practical Mechanics," by Sidney H. Wells, illustrated; a new edition of "British Central Africa," by Sir H. H. Johnston, K.C.B., illustrated.

Mr. John Murray calls attention to:—"Organic Evolution Cross-examined: or, some Suggestions on the Great Secret of Biology," by the Duke of Argyll, K.G., F.R.S.; "The Tides and Kindred Phenomena in the Solar System," by Prof. George Howard Darwin, F.R.S., illustrated; "Early Chapters in Science," by Mrs. Awdrey, illustrated; "Among the Celestials," abridged from "The Heart of a Continent," with additions, by Captain Francis Younghusband (illustrated); "Marine Boilers," a treatise on the construction and working of boilers of all classes, dealing more especially with recent developments of tubulous boilers and the results obtained, based on the work of M. Bertin, translated and edited by Leslie S. Robertson, illustrated; "The Story of Marco Polo," for children and young people, edited by N. Brooks, illustrated; "The Five Windows of the Mind," by Edward Hamilton Aitken; "A History of Astronomy," by Arthur Berry (University Extension Manuals); "Colour in Nature," by Marion Newbigin.

In Messrs. T. Nelson and Sons' list we notice:—"The White North, with Nordenskiöld, De Long, and Nansen," by M. Douglas.

Messrs. George Newnes, Ltd., announce:—"Flashlights on Nature," by Grant Allen, illustrated. In the Library of Useful Stories:—"The Story of the Cotton Plant, its Cultivation and the Manufacture of its Product," by F. Wilkinson, illustrated; "The Story of the Mind," by Prof. J. M. Baldwin, with diagrams: "The Story of the British Race," by John Munro, with maps; "The Story of Geographical Discovery: How the World became Known," by Joseph Jacobs, with maps, &c.; "The Story of the Metals." by H. C. Fyfe.

The announcements of Messrs. C. Arthur Pearson, Ltd., include:—"The Land of the Pigmies," by Captain Guy Burrows, illustrated; "Spinifex and Sand, a Narrative of five years' Pioneering and Exploration in Western Australia," by the Hon. David W. Carnegie, illustrated.

Mr. Young J. Pentland's announcements are:—"Contributions to Clinical Medicine," by Dr. T. McCall Anderson; "Text-Book of Physiology," by British Physiologists, edited by Prof. E. A. Schäfer, F.R.S., vol. ii.; "Diseases of the Heart and Aorta," by Dr. G. A. Gibson; "The Principles of Treatment," by Dr. J. Mitchell Bruce; "Lectures on Giddiness and on Hysteria in the Male," by Sir Thomas Grainger Stewart; "Text-Book of Medicine," by British teachers, edited by Dr. G. A. Gibson; "The Radical Cure of Hernia, Hydrocele, and Varicocele," by C. B. Lockwood; "Manual of Midwifery," by Dr. R. Milne Murray; "The Journal of Pathology and Bacteriology," edited by Dr. G. Sims Woodhead, vol. v.; and a new edition of "The Principles and Practice of Medicine," designed for the use of practitioners and students of medicine, by Dr. William Osler, F.R.S.

Messrs. G. P. Putnam's Sons announce:—"Electricity in the Diagnosis and Treatment of Diseases of the Nose, Throat, and Ear," by Dr. W. Scheppegrell, illustrated; and a new edition of "Camping in the Canadian Rockies, an Account of Camp Life in the Wilder Parts of the Canadian Rocky Mountains, together with a description ot the Region about Banff, Lake Louise, and Glacier, and a Sketch of the Early Explorations," by Walter D. Wilcox, illustrated.

The Rebman Publishing Company, Ltd., will issue:—"Atlas of Legal Medicine," by Dr. E. R. von Hofmann, edited by Dr. Frederick Peterson; "Atlas of Laryngology," by Dr. L. Grünwald, edited by Dr. Charles P. Grayson; "Atlas of Operative Surgery," by Dr. O. Zuckerkandl, edited by Dr. J. Chalmers Da Costa.

Messrs. Lovell Reeve and Co., Ltd., announce:—The fifth and the seventh volumes of the "Flora of Tropical Africa"; the seventh volume of the "Flora Capensis"; the third volume of Mr. F. Moore's Lepidoptera Indica"; the fifth volume of Mr. Barrett's "Lepidoptera of the British Islands"; and further instalments of Miss Bowdler Sharpe's "Teracolus" and Mr. Alfred Fryer's "Potamogetons."

Mr. Grant Richards announces :—"The Philosophy of Greece, considered in relation to the Character and History of the People," by Alfred W. Benn.

Messrs. Routledge and Sons' list contains :—New editions of Stonehenge's "The Horse," revised by Harold Leeney ; and of "The Microscope : its History, Construction, and Application," by Dr. Jabez Hogg.

Messrs. Schleicher Frères (Paris) call attention to :—"La Fatigue intellectuelle," by A. Binet and V. Henri, illustrated ; "Contribution a l'Etude de la Méthode dans les Sciences expérimentales," by Louis Favre ; and "Traité complet des Variations du Système Musculaire de l'Homme et de leur signification au point de vue de l'Anthropologie Zoologique," by Prof. le Double.

Mr. Gustav Schmidt (Berlin) will issue :—"Die Alpenpflanzen in der Gartenkultur der Tiefländer," by Erich Wocke, illustrated.

The list of the Scientific Press, Ltd., is as follows :—"An Atlas of Bacteriology," by Charles Slater and Edmund J. Spitta ; "Hospital Expenditure : the Commissariat," reprinted from the *Hospital* ; "Some Medical Aspects of Education," by Dr. Percy G. Lewis. The "Burdett Series"—"The Rational Use of Antiseptics in Midwifery Practice," by Dr. James Morrison ; "Nursing of Sick Children," by Dr. J. D. E. Mortimer ; "Mental Nursing," by Dr. William Harding.

Messrs. Walter Scott, Ltd., promise :—"The Natural History of Digestion," by Dr. A. Lockhart Gillespie, illustrated ; "Degeneracy : its Causes, Signs, and Results," by Prof. Eugene S. Talbot, illustrated (the Contemporary Science Series).

The S. P. C. K's. list contains :—"British Birds," by Dr. R. Bowdler Sharpe, illustrated in colours ; "Matter, Ether, and Motion, the Factors and Relations of Physical Science," by Prof. A. E. Dolbear, with diagrams.

Messrs. Swan Sonnenschein and Co., Ltd., give notice of :—"Aristotle's Psychology, including the Parva Naturalia," translated and edited, with Commentary and Introduction, by Prof. William A. Hammond ; "Ethics," by Prof. W. Wundt, translated from the second German edition, vol. iii. "The Principles of Morality and the Sphere of their Validity," translated by Prof. E. B. Titchener ; "Physiological Psychology," by Prof. W. Wundt, translated by Prof. E. B. Titchener, 2 vols. illustrated ; "History of Contemporary Philosophy," by Prof. Friedrich Ueberweg, edited by Prof. Max Heinze, translated by Prof. W. A. Hammond ; "Text-Book of Palæontology for Zoological Students," by Theodore T. Groom, illustrated ; "Text-Book of Embryology : Invertebrates," by Profs. Korschelt and Heider, vol. ii. "Crustacea and Arachnoids," translated by Matilda Bernard, and edited by Martin T. Woodward, illustrated ; "Elementary Text-Book of Botany," by Prof. Sydney H. Vines, illustrated ; "Eclipses of the Moon from A.D. 300 to 1900," by Robert Sewell ; "Common Salt, its Use and Necessity for the Maintenance of Health and the Prevention of Disease," by C. Godfrey Gümpel ; "Fishes," by the Rev. H. A. Macpherson (Young Collector Series) : "Grasses, Handbook of," by W. Hutchinson, illustrated (Young Collector Series) ; "Mammalia," by the Rev. H. A. Macpherson (Young Collector Series) ; "Birds' Eggs and Nests," by W. C. J. Ruskin Butterfield (Young Collector Series) ; and new editions of "Text-Book of Embryology : Man and Mammals," by Prof. Oscar Hertwig, translated by Prof. E. L. Mark, illustrated ; "Handbook of Practical Botany, for the Botanical Laboratory and Private Student," by Prof. E. Strasburger, edited by Prof. W. Hillhouse. illustrated ; "Ants, Bees, Wasps, and Dragon-flies," by W. H. Bath ; and "Fungi, Lichens, &c.," by Peter Gray, in the Young Collector Series.

The list of Messrs. Thacker and Co. contains :—"The Medical Monograph" Series, edited by Dr. David Walsh. A new series of medical monographs, dealing with subjects of everyday practice, and embodying all recent scientific advances.

The announcements of the University Correspondence College Press include :—First Stage "Physiology," "Botany," "Hygiene," "Inorganic Chemistry (Practical)," by Dr. F. Beddow ; "Agriculture," "Advanced Magnetism and Electricity," by Dr. R. W. Stewart ; "Advanced Inorganic Chemistry (Theoretical)," "Tutorial Algebra," Part ii. "Advanced Course," Part i. "Elementary," by Wm. Briggs, and Prof. G. H. Bryan, F.R.S. ; "Manual of Psychology," by G. F. Stout, vol. i. ; "Text-Book of Botany," by J. M. Lowson ; and "Introduction to Carbon Compounds," by Dr. F. Beddow.

In Mr. Fisher Unwin's list we find :—"Through New Guinea and the Cannibal Countries," by Captain H. Cayley-Webster ; "The Psychology of Peoples," by G. Le Bon, translated by M. Derechef ; and "Life of Man on the High Alps : Studies made on Monte Rosa," by Prof. A. Mosso, translated by Mr. and Mrs. Kiesow.

Messrs. Ward, Lock, and Co., Ltd., announce :—"With Nansen in the North," by Lieut. Hjalmar Johansen, illustrated ; and "Fishing and Fishers," by J. Paul Taylor.

Messrs. Whittaker and Co. will issue :—"The Inspection of Railway Material," by G. R. Bodmer ; "Electro-Mechanical Series," adapted from the French of Henry de Graffigny by A. G. Elliot, vol. iii. "Electro-Chemistry," vol. iv. "Electric Distribution" ; "Central Station Electricity Supply," by Albert Gay and C. H. Yeaman ; "Elementary Mathematics : Arithmetic, Geometry and Algebra," by J. L. S. Hatton and G. Bool ; "Lathes : English and American," by J. Horner ; "Electric Wiring, Fittings, Switches and Lamps," by W. Perren Maycock ; "Outlines of Physical Chemistry," by Prof. A. Reychler, translated by Dr. J. McCrae ; "Electric Traction," by J. H. Rider (Specialist's Series) ; "Horseless Road Locomotion : its History and Modern Development," by A. R. Sennett, 2 vols. illustrated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE distribution of medals, prizes, &c., to students of the Royal College of Science, South Kensington, will take place on Thursday, October 6, at 2.30 p.m., in the Lecture Theatre of the Museum of Science and Art. Sir Norman Lockyer, K.C.B., F.R.S., will deliver an address upon this occasion.

DR. GEORG KLEBS, professor of botany at Basle, has been called to Halle, and is succeeded at Basle by Dr. Wilhelm Schimper, assistant professor at Bonn.

DR. JAMES LEICESTER, late chief lecturer on chemistry and metallurgy at the Merchant Venturers' Technical College, Bristol, has been appointed as head of the chemical department at the Municipal Technical College at Derby.

THE anniversary of the birth of Michael Faraday was commemorated on Thursday last at the "Michael Faraday" Board School, Walworth, by a gathering of the boys and girls of the upper standards in one of the large rooms to hear a commemoration address from Dr. Gladstone, F.R.S. A bust of Faraday which had been presented to the school by the Royal Institution was prettily decorated with plants brought by the children, and round the walls were cards giving some of the chief facts relating to Faraday's career. Every encouragement should be given to the adoption of such means as these for keeping in mind the work and high character of men like Faraday, and so inspiring a spirit of emulation.

THE following items from the *London Technical Education Gazette*, concerning the new session just commenced in the eleven polytechnics of London, are worthy of mention :—At Battersea Polytechnic special attention is being devoted to the organisation of preliminary courses in technical arithmetic, mensuration and elementary physics, chemistry and mechanics, adapted to the requirements of trade students. It is of great importance that young students before commencing the regular technical and trade classes should be provided with a sound elementary training in the above subjects. The syllabus recently issued by the Technical Education Board has called attention to the need for such instruction, and at many of the polytechnics and technical institutes students can now find opportunities for acquiring it.—Among the principal developments at the Borough Polytechnic is a new bakery, which has been built and equipped in the most complete manner, and provides exceptional accommodation and facilities for the teaching of baking. A new physical laboratory has also been erected.—At the Woolwich Polytechnic great additions have also been made last session by the erection of a new wing containing chemical and physical laboratories and increased accommodation for art teaching. A special laboratory has also been erected for the teaching of mechanical engineering, a subject which is naturally much in demand among the employees of the Arsenal.—In the day engineering department at the South-Western Polytechnic a civil engineering section has been added to the sections for mechanical and electrical engineering.—At the Regent Street Polytechnic a

new departure has been made by the establishment of a school for carriage builders.—The opening of the new session at the Northampton Institute is marked by several important developments. Rooms have been specially fitted up for the teaching of electro-chemistry in special relation to the trades of the district, and valuable courses in electrolysis, electro-plating and electrotyping have been arranged. A metallurgical department has also been established, and a special laboratory has been fitted up in connection with it. Special classes for opticians have been arranged in conjunction with the Spectaclemakers' Company, a laboratory has been equipped for the practical teaching of optics, and a graded series of examinations has been drawn up.

THE work of the two London polytechnics which are independent of the Board's Technical Education aid, the East London Technical College and the Goldsmiths' Institute, continues to show increased activity. In the chemical department at the Goldsmiths' Institute a special course has been organised for brewers and sugar refiners; while the art department continues to take a leading position among the art schools of the country. At the East London Technical College (People's Palace) last year's work has been marked by conspicuous success, the college having secured an open science scholarship at Merton College, Oxford, two Whitworth exhibitions of 50*l.*, and two National scholarships, besides numerous other distinctions.

A SERIES of articles upon Dr. John Radcliffe, the generous benefactor of Oxford University, has recently appeared in the *Pharmaceutical Journal*. Dr. Radcliffe was born in 1650, the year after the execution of Charles I. He went to London in 1684, and rapidly became a most successful, though eccentric, physician. He died in the year 1714, leaving the great bulk of his large fortune, consisting of money and of lands and houses in Yorkshire, Northamptonshire, Bucks, and Surrey to Oxford University. He bequeathed 40,000*l.* to build a library in Oxford, with 150*l.* a year for the salary of the librarian, and another yearly 100*l.* for the purchase of books. The Radcliffe Library, one of the finest buildings in Oxford, was opened in 1749, and furnished mainly with medical and scientific books. The building has since been annexed to the Bodleian as a reading room, when the contents of the library, greatly increased in the course of years, were transferred to a building specially affected to them in the new University Museum. It is now a magnificent collection of books on medical, physical, natural, biological and general science, kept up to date, easily accessible, and has given a considerable impulse to scientific study at Oxford. In order to make provision for select Oxford alumni studying medicine, to learn what was doing in medical science abroad, Radcliffe made over for ever to his own first and favourite Oxford College—University—his Yorkshire estates, for the foundation of two travelling fellowships of 300*l.* a year each and tenable for ten years, to be given to carefully selected alumni studying medicine at Oxford. At present there are three such Radcliffe travelling fellowships, with an annual income of 200*l.* each and tenable for only three years instead of the original ten. Besides this he left 5000*l.* to enlarge the buildings of University College. Any surplus accruing from the Yorkshire estates after the foregoing objects were effected was to be applied to the purchase of advowsons to be given to members of University College. Finally, mention of minor benefactions to Oxford and to individuals being omitted, he left, after payment of his specified bequests, all his estates in the various counties already enumerated to trustees to be applied to such useful purposes as they in their discretion should think best. And well have the Radcliffe trustees fulfilled their duty, remembering the claims both of philanthropy and science. With the funds at their disposal was built the Oxford Public Infirmary, opened for the reception of patients in 1779, and the Radcliffe Observatory at Oxford, supplied with all the instruments and appliances of modern astronomy, and a dwelling house for the Observer.

SCIENTIFIC SERIALS.

American Journal of Science, September.—Transition temperature of sodic sulphate, a new fixed point in thermometry, by T. W. Richards. Sodium sulphate, $Na_2SO_4+10H_2O$, "melts" at almost exactly 32·48° according to the mean mercury thermometer, and this temperature is so easily obtained by means of that salt and so constant as to be of great use in the future for thermometric and thermostatic purposes.—Distribution and quantitative occurrence of vanadium and molybdenum in rocks of the United States, by W. F. Hillebrand. Vanadium occurs in quite appreciable amounts in the more basic, igneous and metamorphic rocks, up to 0·08 per cent. or more of V_2O_3, but seems to be absent, or nearly so, from the highly siliceous ones. The heavy ferric aluminous silicates like biotite and amphibole are indicated as sources. Molybdenum is probably confined to the more siliceous rocks, where it occurs in very minute quantities.—Electrosynthesis, by W. G. Mixter (second paper). Gaseous mixtures are subjected to a glow discharge in a eudiometer. Concentration of the discharge does not affect the total amount of compound formed. Thus, a mixture of hydrogen and oxygen will give the same amount of water vapour whatever the form of the glow discharge. The combination increases with the pressure, but not in proportion to it. A mixture of oxygen and ammonia forms ammonium nitrite, which is deposited as a white coating.—Notes on species of *Ichthyodectes*, including the new species *I. cruentus*, and on the related and herein established genus Gillicus, by O. P. Hay. The supposed new species is primarily founded on a somewhat imperfect left maxilla from Butte Creek Canyon in Western Kansas. It differs from Cope's *I. anaides* in having larger teeth. For Cope's *I. arcuatus* and Crook's *I. polymicrodus* the author proposes the new generic name Gillicus, being a saurocephalid with maxilla falciform, relatively short. Gape of mouth smaller than in *Ichthyodectes*.—Origin and significance of spines, by C. E. Beecher (continued). Natural selection could not originate a spine, but after a spine had appeared this agency would tend to preserve and allow the spine to develop along certain lines. The simple antlers of the Tertiary deer may have reached the highest degree of efficiency as weapons by ordinary natural selection. The subsequent increasing complexity of the antlers cannot have improved their usefulness, and probably arose according to the law of multiplication of effects, aided by a process of sexual selection.

Symons's Monthly Meteorological Magazine, September.—British local meteorological publications. Some important additions have been made to the list given in the last number of this journal, among which we may mention (1) an annual report of about thirty pages, by Mr. Chandler, Borough Meteorologist of Torquay, and a separate report on the climate of Devon; (2) a valuable summary of all Manx meteorological observations, by Mr. A. W. Moore; and (3) some remarks on the climate of Oban, with averages for the ten years 1887–96, by the Medical Officer of Health.—Evaporation and temperature, by Prof. Carpenter. This is an abridgment of a paper in the *U.S. Monthly Weather Review* of May 1898, showing the difficulty of determining from ordinary observations of the vaporimeter the quantity of water added to the atmosphere daily by evaporation from the oceans, lakes and continents. The principal elements of uncertainty in determining the quantity of evaporation from a surface of water are the temperature of the water and the velocity of the wind at the surface.—Rockall. The August number of the *Scottish Geographical Magazine* contains an excellent account of this rocky islet, by Mr. M. Christy. The possibility of building a lighthouse and observatory, and connection by a telegraphic cable, is discussed. The value of the latter would be very great for the purpose of weather telegraphy, but at present the difficulty of expense is insurmountable.—Results of meteorological observations at Camden Square, London, in August, for forty years, 1858–97. The mean of all the highest maxima was 84°·0, and the mean rainfall 2·39 inches; in this year the maximum temperature reading was 87°·9, and the rainfall 1·18 inches.

THE nineteenth volume of the *Memoirs* of the Caucasian branch of the Russian Geographical Society is perhaps even better than its remarkably good predecessor. Its chief feature is a map, on the scale of 13 miles to an inch, of Transcaucasia, upon which all the divisions into provinces, districts, cantons and villages are given, and the religions of the inhabitants of each village are shown in different colours. The map is accompanied by full ethnographical-statistical lists of the whole population. The next map of great interest is one of Kurdistan, upon which the distribution of the Kurd population (the Sunnites, the Kizilbashs, and the Yezids separately) is shown, together with the Armenian and Nestorian population and the percentage of Christians in each separate district. This map accompanies a paper, by Colonel Kartseff, on the Kurds,

in which their geographical distribution, their division into stems, their history, and their present institutions and general conditions are discussed. In the same volume we find a most valuable list of 597 trigonometrically-determined spots in Transcaucasia and the Terek province, with their latitudes, longitudes and altitudes, indexed according to latitudes and alphabetically; four very good geographical, economical and statistical descriptions of the provinces of Stavropol, Terek and Zakataly, with a map of the province of Stavropol giving the distribution of landed property; an interesting paper on the forests, the forestry, and the inhabitants of the woodlands of Ichkeria, in Daghestan; and a list of the Alpine plants (270 species) of Central Caucasus, by Prof. Akinfieff—the result of seven years' work. In an appendix we find two long papers, one, by N. Dinnik, containing a graphic account of his Caucasian journey—this time to the head waters of the Urushten and Byelaya rivers (with a large-scale map, 3½ miles to the inch); and another, on the common law of the Svanes, their habits and customs, written by such an excellent authority on this subject as Prince Raphael Eristoff.—The twentieth volume of the same periodical, just received, contains an admirable map of all Caucasia and Transcaucasia, with very carefully drawn mountains, on the scale of 27 miles to the inch. It accompanies the first instalment of a work, "Transcaucasia," in which Colonel Lisovskiy gives a general physico-geographical description of Transcaucasia—its physical features, its geology, its vegetation, and its animal world.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 19.—M. Wolf in the chair.—On the clinical value of the agglutination of Koch's bacillus by human blood serum, by MM. S. Arloing and Paul Courmont. The results of over one hundred cases show that the aggregation of the tubercle bacilli when the blood serum is introduced into a culture may furnish, very rapidly, an important element of information in the early diagnosis of true tuberculosis. There were, however, two remarkable cases where the test failed, though tuberculosis was undoubted and in an advanced stage. The fact that positive results were almost always obtained when the tuberculous lesions were in an early stage renders the serum reaction the more valuable. Feeble aggregation was induced in some cases where tuberculosis was not found by the ordinary clinical methods, and the inference is drawn that latent tuberculosis may be consistent with the appearance of perfect health. One of the latter cases afterwards developed into tubercular laryngitis.—Observations and elements of the Perrine-Chofardet comet by M. G. Fayet.—Observations on the Perrine-Chofardet comet, made with the large equatorial at the Observatory of Bordeaux, by MM. L. Picart and Courty.—Synopsis of the solar observations made at the Royal Observatory of the Roman College during the first quarter of 1898, by M. P. Tacchini.—On the colorations of the less fusible porcelain enamels, by MM. A. Le Charpentier and P. Charpy. A list of the colours obtainable from various metals, all of which have been tested upon the manufacturing scale. The compositions are given of erbium and neodymium blues, erbium and neodymium greens, neodymium violet and erbium red.—Influence of gravity and light upon the dorsiventral organisation of the branches in inflorescences, by M. H. Ricome.—On the balloon ascents of June 8, 1898, on the occasion of the fourth international experiment, by MM. Hermite and Besançon.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (Mathematico-physical Section), part 2 for 1898, contains the following memoirs communicated to the Society:—

April 30.—W. Voigt: Thermo-dynamical contributions on the interrelations of galvanism and heat.

May 14.—E. Riecke: Second memoir on the theory of galvanism and heat. W. Voigt: On the magnitude of the stresses and strains involved in the production of shearing in Iceland spar. E. Marx: The dispersion of the electrical spectrum of water. P. Stäckel: On transformations of motions.

June 11.—W. Voigt: Is the pyroelectricity of crystals entirely referable to piezoelectric action?

June 25.—E. Riecke: The reactive pressure of kathode rays. J. Orth: Fifth report on the work of the Göttingen Pathological Institute.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Nine Years at the Gold Coast: Rev. D. Kemp (Macmillan).—Stories of Starland: Mary Proctor (Bacon).—The Discharge of Electricity through Gases: Prof. J. J. Thomson (Constable).—Canalisations Électriques: R. V. Picou (Paris, Gauthier-Villars).—Organographie der Pflanzen, &c.: Prof. K. Goebel, Zweiter Teil, 1 Heft (Jena, Fischer).—Fourteenth Report of the U.S. C.S. Commission (Washington).—Second Stage Mathematics: edited by W. Briggs (Clive).

PAMPHLETS.—A Determination of the Ratio of the Specific Heats at Constant Pressure and at Constant Volume for Air, Oxygen, Carbon-Dioxide, and Hydrogen: O. Lummer and E. Pringsheim (Washington).—Meteorology in Mysore for 1897: J. Cook (Bangalore).—Cape of Good Hope: Report of the Meteorological Commission for the Year 1897 (Cape Town).—Contributions to the Morphology of Lepidoptera: Dr. K. Jordan.—An Examination of the Classificatory and some other Results of Eimer's Researches on Eastern Papilios; Dr. K. Jordan.—Zweckmässigkeit und Anpassung: Prof. J. W. Spengel (Jena, Fischer).—Clinical Observations on 2000 Obstetric Cases: Dr. G. P. Mathew (Simpkin).

SERIALS.—L'Anthropologie, Tome ix. No. 4 (Paris, Masson).—Zoologist, September (West).—American Naturalist, August (Ginn).—Boletim do Museu Paraense, Vol. 2, No. 3 (Pará).—Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 1897-98, Vol. 42, Part 4 (Manchester).—History of Mankind. F. Ratzel, translated, Part 29 (Macmillan).—Zeitschrift für Physikalische Chemie, xxvii. Bd. 1 Heft (Leipzig, Engelmann).—Archives of the Roentgen Ray, August (Rebman).—Botanische Jahrbücher, Funfundzwanzigster Band, 4 Heft (Leipzig, Engelmann).—Jahrbücher der Central-Anstalt für Meteorologie und Erdmagnetismus, 1894, 2 Vols., 1895, 1896. 1897 (Wien).—Bulletin de l'Académie Royale des Sciences, &c., de Belgique, 1898 (Bruxelles).—Annuario p.p. Observatorio do Rio de Janeiro, 1898 (Rio de Janeiro).—Proceedings of the American Philosophical Society, July (Philadelphia).—Economic Journal, September (Macmillan).—Records of the Botanical Survey of India, Vol. 1, No. 2 (Calcutta).

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