THURSDAY, JULY 2, 1896.

THE CELL-THEORY.

Leçons sur la Cellule Morphologie et Réproduction faites au Collège de France pendant le semestre d'hiver 1893-94. Par Félix Henneguy. Pp. xix + 541. 362 figures. (Paris: Georges Carré, 1896.)

THE cell occupies, and has for half a century occupied, so important a position in biological science, that the literature dealing with it and the number of general works called up by this literature has become enormous, and is daily increasing. Nor is this a matter to be wondered at, for the subject is one of supreme importance to the biologist, and contains within its border the very innermost mysteries of life. But in saying this, we do not wish to be understood as giving our adhesion to this or to that modern school of thought with regard to the importance of the cell in organisms. It is sufficient for us to note the fact that, great as has been the influence of the conception of cell on biological investigations in the last fifty years, the chief merit of the founders of the cell-theory lay less in giving us that conception than in fixing attention upon the matter of which the organism is composed. To the cell-theory we owe our conception of the organism as a body composed of protoplasm—the real living matter, and of formed material—the non-living or semi-living framework. The former is the true seat of life, and the latter is produced as a result of its vital activity. This conception has been an analytical tool of the most powerful kind, and has assisted very considerably in the task of unravelling the complexity of structure and function of the parts of organisms. The cell-theory first fixed our attention upon protoplasm, and upon that most important part of protoplasm the nucleus; and it is to the study of protoplasm and of the nucleus, of their structure, relations, and activities, that the great advances in modern biology are due. This, we repeat, was the great work of the founders of the cell-theory. But they did more than this: they first showed us that the living substance is often arranged in and works through small structural units called cells; and they first gave us the idea that the organism is composed of independent or semi-independent individuals associated together in a colony for the common good. It is this idea, this hypothetical explanation of cellular structure, which constitutes the cell-theory; and it must be clearly borne in mind that the promulgation of this hypothesis was the least important part of the work of the founders of that theory. At the same time it is an undeniable fact that this hypothesis was held, and indeed is held largely at the present day; and that it has had a most important influence upon biological research. Of its value we express no opinion, but we should be wanting in our duty if we did not point out that of late years a slowly increasing number of biologists have cast doubts upon its validity and utility as an explanation of cellular structure, and are content to hold for the present that cellular structure has not received any adequate explanation, or, to use the somewhat vague words of Sachs, is a phenomenon of secondary significance, and merely one of the numerous expressions of the formative forces which reside in all matter, and in the highest degree in organic substance.

It is obvious that a work dealing with the cell in this wide sense, viz. as an equivalent for protoplasm and nucleus, must have a very large scope indeed; for if complete, it would include the whole of vegetable and animal histology and physiology. Owing to human limitations, it is in these days impossible for a single author to take this wide outlook, and we find in works dealing with the cell restrictions of various kinds. As a general rule, an author will limit himself to animal or to vegetable protoplasm, and a full consideration of the formed material is nearly always excluded. The part of the subject to which special attention is devoted—at any rate in recent works—is the structure of protoplasm, and of the nucleus and the behaviour of the nucleus in division and in conjugation. M. Henneguy is not content with any restriction of this kind, and though modestly disclaiming all idea of giving a complete account of the subject, and of having written a treatise on Cytology, he has in our opinion produced a more complete work on protoplasm and the nucleus than any of his predecessors. The work represents a course of thirty-one lectures given at the College de France in the winter of 1893-4, and is an admirable account of the state of our knowledge to that date. The author deals both with animal and vegetable protoplasm, with its chemical and physical constitution, with its structure, with the nucleus, the change which it undergoes and its relation to the cytoplasm, and with its division and its conjugation. An account of the nutrition of the cell, of the products of cellular activity, and of its functional differentiation, occupies a prominent place in the work. Finally he has a chapter on the relation of cells to each other, and another on the most important hypotheses on the constitution of protoplasm, and he begins the work by an excellent account of the growth of knowledge on the subject.

The work is of course a didactic one, and in no sense is to be regarded as an original contribution to knowledge. The author's object is to give an account of the facts which have been definitely established, relegating to the second place controversial or doubtful matters.

And in this he does well, for, as he points out, the tendency at the present day among a certain class of small workers to premature publication and to hasty generalisation, leads to most disastrous results in the accumulation of third-rate literature. A single fact, which often turns out to be no fact at all, is hidden in pages of raw and worthless speculation. "Another cause assists in accentuating this pernicious tendency. In certain schools far too much emphasis is laid upon new and still controverted observations, and classical works confirmed by numerous and reiterated observations are too often neglected, and future observers thus deprived of a sure and solid basis." He devotes a special section to the consideration of the effects of the different kinds of reagents used by histologists in altering the structure of protoplasm, and he calls the attention of his readers to the importance of the study of living protoplasm, and of checking all their results by it. This is a most important point, too often lost sight of in the rush and petty ambition of modern laboratories, and one which cannot be too strongly impressed on young workers.

The author's treatment of that most important subject of protoplasmic fusion is not entirely satisfactory. He distinguishes two kinds: (1) fusion in which several cells unite to form a multinucleated mass, as in the *Mycetozoa* and some *Rhizopoda*; (2) conjugation, in which two or more cells fuse to form one cell; the distinction being that while in the latter case the process is accompanied by nuclear fusion, in the former it is not. In the first place it must be noted that conjugation does not always result in the formation of one cell from two, *e.g.* many ciliate infusoria; and in the second, that it is by no means certain that nuclear fusion does not occur between the nuclei of the multinucleated masses resulting from fusion. Moreover the author falls into the common error, found even in some of the best text-books, of calling conjugation a mode of reproduction. On p. 416 he says, "J'arrive maintenant à une mode spécial de reproduction, cellulaire que nous connaissons déjà, à celui que nous avons désigné sous le nom de *conjugaison* et que nous avons distingué de la *fusion*." It is perhaps hardly necessary to point out that by reproduction the number of individuals of a species is increased, while by conjugation it is generally diminished. It is true that conjugation results in the formation of a new individuality, but not in the increase in the number of individuals.

It is hardly going too far to say that conjugation is the opposite of reproduction. It is curious that this mistake should so often be made, and it is most important to call attention to it; for the confusion between the two processes, which has no doubt resulted from their accidental association in sexual reproduction, has considerably interfered with the proper appreciation of that most mysterious and important of vital processes—fusion of nuclei and protoplasm.

With regard to technical terms, we may be allowed to call attention to our author's use of the word *Cytodieresis.* He proposes this word for the process of cellular division, which is accompanied by those characteristic transformations of the nucleus which are ordinarily termed karyokinetic, reserving the word *division* for those cases in which the nucleus divides directly. We do not inquire whether such a word is required, but we desire to point out that on the very next page (296), our author uses the word Cytodieresis as the equivalent of *Caryodieresis* (indirect nuclear division). He says: "*Division indirecte* (of the nucleus) = *karyokinesis* (Schleicher) = *cytodieresis* (Henneguy) = *mitosis* (Flemming)." The looseness of thought implied by this confusion in the use of his own word is unsatisfactory, and would by some biologists be pointed to as an example of the result of too strongly holding to a theory which does not conform with all the facts.

In criticising Weismann's suggestion that the Protozoa are immortal, he says that "a Protozoon which divides dies in the sense which we attach to the death of the higher animals, *i.e.* that its individuality disappears." Though we are quite willing to admit that Weismann's statement was more of the nature of a gallery phrase designed to catch the ear of the readers of the modern magazine article, than a serious contribution to science, and that it conveyed no new idea or suggestion, we cannot follow M. Henneguy in his criticism quoted above. For do not the higher animals also undergo numerous successive divisions in the production of their reproductive cells, which differ in no essential particular from the successive binary fissions which a Paramœcium passes through in its life-history. The only difference which can be pointed to is one merely of degree; for there is no more an absolute similarity between the two products of fission in an infusorian than there is between the products of the fission (ovum or spermatozoon and parent) which is continually taking place in the higher animals. You might just as reasonably assert that a hen dies whenever it lays an egg, as make the statement that a Paramœcium dies at each process of fission. With the words death and individual a philosopher can do much; but it behoves practical men to keep a sharp look-out on the use made of those convenient terms.

The book is well printed and illustrated; and though it is not a complete and carefully elaborated treatise on protoplasm, as the author himself is the first to admit, yet it constitutes a valuable addition to the biologist's library, and cannot fail to be of great use to the teacher as well as to the student.

A ROMANTIC NATURALIST.

From North Pole to Equator, Studies of Wild Life and Scenes in many Lands. By the Naturalist-Traveller, Alfred Edmund Brehm. Translated from the German by Margaret R. Thomson. Edited by J. Arthur Thomson, M.A., F.R.S.E. (London: Blackie and Son, Ltd., 1896.)

"BETWEEN North Pole and Equator" might have been a less attractive, but would have been a more accurate title for this book, for Siberia and northern Norway are not as far north as the Pole, nor are Nubia and the Blue Nile as far south as the Equator. Between these limits, however, the late Dr. A. E. Brehm made extensive journeys, visiting most of the principal types of country that may be found therein, and studying the characteristic faunas with the enthusiasm of a born naturalist. His great "Thierleben" is a rich repository of information on the habits of animals, the various groups of which are taken in zoological order. The present book appears to be intended as a supplement to this; for it is geographical in arrangement, and consists of a series of graphic sketches of wild life in many lands.

The work opens with a brief homage to the author by his son, and then an admirable introductory essay by the editor upon the work of naturalist-travellers in general, and of A. E. Brehm in particular. Mr. Thomson gives a list of works by English naturalist-travellers, in which we notice Fred Burnaby's "Ride to Khiva," although such books as Lamont's "With the Sea Horses," Butler's "Great Lone Land," and Whymper's "Travels among the Andes of the Equator," are not mentioned.

Mr. Thomson classifies naturalist-travellers into five groups—the Romantic (including Sir John de Maundeville and other mediæval story-tellers); the Encyclopædists of the sixteenth and seventeenth centuries; the General Naturalists, ranging from Ray to Humboldt; the Specialist Type—the naturalists of the naval expeditions of the present century; and the Biological Type, such as Darwin, Wallace, and Bates. Mr. Thomson includes Brehm in the last group; but if we accept his definition of the Romantic Type (p. xvi.), Brehm has certain claims to be placed among these. "In days when the critical spirit was young," Mr. Thomson tells us, and "verification hardly possible; there could not but be a strong temptation to tell extraordinary 'traveller's tales.' And they did. Nor need we scoff at them loudly, for the type dies hard; every year such tales are told." We have only to turn to p. 38 to see a proof of this. There we learn that in the fiords of northern Norway "the fish swim so thickly that the boat has literally to force a way among them, . . . that an oar placed upright among the densely-packed crowd of swimmers remains for a few moments in its position before falling to one side." Or on p. 83, where we are told that in the tundra "every grass-stalk, every moss-blade, every twig, every branch, every little leaf sends forth hundreds and thousands of them [mosquitoes] all day long." After this we are prepared to learn that the mosquitoes "form swarms which look like thick black smoke; they surround, as with a fog, every creature which ventures into their domains; they fill the air in such numbers that one hardly dares to breathe; they baffle every attempt to drive them off; they transform the strongest man into an irresolute weakling, his anger into fear, his curses into groans." These are samples of the author's style, and of the precision of his descriptions. His book is written in superlatives, which appear to be laboured, and is full of humour, which is generally unintentional. But in spite of the author's command of impressive language, he is very modest; the heat of Africa, he tells us, is "indescribable," and then does his best in a page full of sentences, such as the following. "The torments are inconceivable." "Nor can any one who has not groaned through these nights, when one tosses on the couch, prevented by the sultriness from resting or sleeping, adequately sympathise with the torments to which men and animals are subjected at this season." "Men and beasts seem to wither as the grass and leaves withered." "In vain does manly courage endeavour to bear up under the burden of these days; the most resolute will give way to sighs and moans. Every piece of work fatigues, even the lightest covering is too heavy, every movement is an effort, every wound becomes a virulent sore." After this we are not surprised to find an account of a tropical thunderstorm and its effects, written in language that reads like an American journalist's report of the Johannesburg dynamite explosion; and that, in escaping the steppe fires, "antelopes, zebras and ostriches speed across the plain more quickly than the wind"; or that a view of the baobab is described as "a sight which stamps itself ineffaceably on the memory," and that nothing in the African forest can compare with it "in charm and impressiveness," as when it flowers "this incomparable giant is transformed, as if by magic, into an enormous rose-bush of indescribable beauty, the sight of which stirs the heart of even the most matter of fact of men with admiration." This appears in a chapter on the "Primæval Forests of Central Africa," though as a matter of fact the author never seems to have entered any of the real African forests; in these, indeed, the baobab is not found, it being characteristic of the steppes and scrub-covered plains. In respect to the doleb palm, we are told on the same page that "its trunk is a pillar which no artist could have surpassed; its crown a capital worthy of such a pillar." After such a compliment, this palm cannot complain at the description of the shape of its stem being exactly contrary to the facts, it thickening at half its height from the ground instead of thinning. According to the author's account, although he tells us that Northern Africa "is desert, must be desert, and will be desert for ever," it appears to be a remarkably well-peopled desert. He says that one of the most indispensable articles in an African traveller's outfit is a pair of long-legged tongs, with which to seize the vermin that swarm into camp at night, drawn by the fire. "Attracted by the light, noxious creatures come running and creeping, first one and then another, but soon in tens and in hundreds. First appear gigantic spiders, which, with their eight legs spread out, cover a surface as large as an outstretched hand. After the spiders, or sometimes along with them, the scorpions come hurrying. Both spiders and scorpions rush with sinister rapidity to the fire, clambering over carpet and coverlet, among the dishes of our simple supper, retreating when the radiating heat becomes too strong for them, turning back again under its mesmeric influence—in truth a fearsome invasion.' After these "hellish brood" come the vipers, "unmistakably on the spot," in "terrifying numbers," which "drive one almost to despair." We fear that any one who imagines that he has only to light a fire on an African steppe to be able to fill his cases with all sorts of interesting animals, which rush to him, like rats to Bishop Hatto, would find zoological collecting less exciting and profitable than he would have expected from Brehm's description.

We have given many extracts from this work, as the best method of illustrating its nature. The book is well printed and illustrated, and the translation is very readable. Only we do not see that there is very much in it worth reading. Every page is distorted by such ludicrous exaggeration, that the descriptions run dangerously near to bathos and caricature.

OUR BOOK SHELF.

The Spas and Mineral Waters of Europe, with Notes on Balneo-Therapeutic Management in Various Diseases and Morbid Conditions. By Hermann Weber, M.D., F.R.C.P., and F. Parkes Weber, M.D., M.R.C.P. 8vo, pp. 380. (London: Smith, Elder, and Co., 1896.)

THIS book contains in a brief space a large amount of most useful information in regard to the spas and mineral waters of Europe. It gives the position of the various spas, their climate, baths, and mode of access, with a list of doctors and general indications of the class of cases which are benefited by the waters. Besides an enumeration of the various spas, there is a second section dealing with diseases, and mentioning the spas most likely to be useful in each. In addition to this, a full bibliography is given.

The value of the book consists, not merely in its convenient arrangement, and in the information it gives, but in the fact that most of this information is the outcome of personal knowledge on the part of the authors This gives it a precision and value which is not always to be found in works on this subject, because the time and expense involved in visiting personally all the spas of Europe is very great, and few physicians are able to accomplish such a feat.

Domestic Science Readers. By Vincent T. Murché. Book iii. Pp. 176. (London: Macmillan and Co., 1896.)

IN the subject of domestic economy, for Standard III., the Education Department require knowledge of the chief materials used in clothing and washing, *e.g.* silk, linen, wool, cotton, fur, leather, and washing materials. This book supplies that knowledge in a form attractive to juvenile minds. The children who read the book will acquire useful information in an easy manner.

The Story of Electricity. By John Munro. Pp. 194. (London: George Newnes, Ltd., 1896.)

A SIMPLE and accurate story, containing brief but clear descriptions of the principles and applications of electrical science. The book will educate the public in the knowledge of the great achievements of electricity, and will create an interest in scientific things.

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.*]

Zoological Publications.

WHEN the rules for zoological nomenclature are next under discussion, it might be advisable to include a clause relative to the discretion of editors in dealing with authors' contributions to scientific journals.

My paper (*Journal* of the Linnean Society, xxv. p. 325), before publication, was entitled "The Egg-case of Port Jackson Sharks," and it was presumed that the Port Jackson sharks, popularly so known, would be thereby understood.

As the length of time occupied by postal transit to and from London might unnecessarily delay publication, I did not ask for a proof. On receiving my copy of the *Journal*, I found that the title was altered to "On the Egg-cases of some Port Jackson Sharks;" thus the purport of the title was destroyed. Perhaps this is a small matter. One affecting me more nearly is the substitution of the name "*Cestracion*" for *Heterodontus*, which I used.

Heterodontus may be right or it may be wrong; but, as author of the paper, having adopted that name, I submit that it should have been retained. At the same time, there could be small objection to an editorial foot-note. EDGAR R. WAITE.

Australian Museum, Sydney, April 28.

THE appellation "Port Jackson Shark" is customarily applied to *Cestracion Philippi*. Macleay, as is well known, doubted the justice of including in this species the Japanese *Heterodontus zebra* (Gray); and as Mr. Waite, admitting the independence of the latter species, extends the vernacular name to *C. galeatus*, the alteration in the title of his paper is regretable, though not serious. It was made without my sanction, and I am sorry to say that it escaped my notice in the performance of my editorial duties. Had I detected it, I should not have allowed it to pass.

Concerning the substitution of *Cestracion* for *Heterodontus*, I would point out that although the latter name has priority by a year, no recent writers but Maclay and Macleay, so far as I am aware, have allowed it to stand; and that even were this not so, *Heterodontus* (1816) on the strict rules of priority in nomenclature is preoccupied by *Heterodon*, applied by Latreille to a snake in 1800.

When Mr. Waite's paper came before the Council of this Society, the matter was carefully considered, and, in accordance with instructions, I wrote him to the above effect, pointing out that I should substitute *Cestracion* for *Heterodontus* unless I heard from him to the contrary during the passage of his paper through the press. My letter was written early in July 1895, and the paper was published last February, ample time being thus allowed its author in which to reply. To this day no reply has been received. G. B. HOWES.

Linnean Society, London, June 19.

The Salaries of Science Demonstrators.

WILL you allow me to protest in your columns against what is nothing less than a public scandal, namely the advertisement by a University College, in your last issue, for a Demonstrator of Chemistry at a salary of £70 per annum?

A science demonstrator at a University College is, or should be, in some sense "a scholar and a gentleman"; and how, I ask, is a man of that type to support a decent existence on such a salary? The effect of this policy of accepting the lowest tender will be either to close such posts to those not possessed of private means—a result utterly at variance with the spirit of the time, and destructive of true efficiency—or to fill them with men of an inferior class, which would be no less harmful to the quality of our scientific education. Have we not a right to expect a more enlightened policy from the governing bodies of our University Colleges? Surely they must see that the haggling of the market does not afford the best means of fixing a teacher's reward. Even the general public cannot but recognise it to be in its own interest, that those who are chosen to educate its sons should be men of as deep knowledge and as wide culture as possible. And what width of culture and depth of knowledge can be attained on £70 a year, with the day fully occupied in the routine work of teaching, the general public itself can judge. Demonstrators of chemistry have, too, I think, peculiar cause for complaint; as a rule their duties are heavier than those of other science demonstrators, whilst their salary is the same.

In these days, even the miner has his minimum wage: cannot one be fixed for science demonstrators? It should not be less than £150, I think; certainly anything under £100 is scandalous, even in the present state of public opinion.

CHARLES FREDERIC BAKER.

Halley's Chart of Magnetic Declinations.

WITHIN the last few days I have come into possession of another early map showing Halley's lines. The date of this map is 1725, and it was published by John Senex, F.R.S. It is entitled "A Map of the World, corrected from the Observations communicated to the Royal Societys of London and Paris." The map consists of the two hemispheres, each of which is 21 inches in diameter. Around the margin in small print is Sir Isaac Newton's "Theory of the Tides," and "An attempt to Assigne the Physical Cause of the Trade Winds and Monsoons, by Dr. Ed. Halley." The map is particularly interesting, as it was evidently intended to give a full account of the winds, the directions of which in the trade winds and monsoons are indicated by arrows. Another interesting note in the margin is "Of the quantity of Vapour exhaled from the Sea, of its Circulation, and of the Cause of Springs," "Extracted from a Discourse published in the Philosoph. Transact., No. 189, 192. Writ by Dr. Ed. Halley." What makes the map so interesting is the notes printed upon it referring to the magnetic declinations. The lines of magnetic variation for every 5° east and west of the line of no variation, are given in the Atlantic and Indian Oceans, but not in the Pacific.

The line of no variation is described as "The line of no variation in the year 1700." The following note is printed upon the Atlantic Ocean between the Azores and Cape Verd Isles. "These curve lines w^ch express y^e variation of y^e magnetical needle ware observed by D^r Edmond Halley for y^e year 1700, but it must be noted that there is a perpetual tho' slow change in the variation almost everywhere (viz.) about C. Bona Esperanza y^e W. variation increases about a Deg. in 9 years, in our Channel a Deg. in 7 years, on y^e Guinea Coast a Degree in 11 or 12 years, on y^e American side y^e W. variation alters but little: and y^e East variation on y^e S. America decreases y^e more Southerly y^e faster; y^e L. of no variation moving gradually towards it." In the South of the Pacific Ocean called the Great South Sea or Mar del Zur is the following note. "The Line of no Variation y^t passes near y^e coast of China divides again y^e West from y^e East variations y^t in all probability is to be met with allmost all over this Immense Ocean ; but have not attempted to describe the Curves therein wanting accounts and journals to ascertain the same." The line of no variation referred to in this note is marked on the map as passing to the west of Van Diemens Land—through New Holland and the East Indian Islands to China, and thence through China to the north of Pekin. In the Indian Ocean, just north of the Antarctic Circle, is the following note. "By the Variation of the Magnetical Needle or Mariners Compass is meant its deflection from the true Meridian, for it has been observed that there are but few places where its direction is true North but varies therefrom either to y^e Eastward or Westward in some places more in others less. Now this variation is of that great concernment in the Art of Navigation that the neglect there of does little less than render useless one of the noblest Inventions Mankind ever yet attained to, for which reason we have here inserted them as they ware found by D^r Halley in y^e year 1700. The Curve Line passing over those places whose degrees of variation are superscribed."

The map is dedicated to the Right Honourable Richard Boyle, Earl of Burlington and Cork, &c., by John Senex, by whom it was drawn and engraved. It was "sold by J. Senex at the Globe against St. Dunstan's Church in Fleet Street, London, 1725." THOS. WARD.

Northwich, June 13.

P.S.—I have just discovered the following note in the Indian Ocean to the South of Madagascar. "In this Indian or Eastern Ocean after you pass Madagascar y^e Westerly Variation was in y^e year 1700 on y^e decrease y^e faster y^e more Westerly and Southerly, and it was then in a manner at a stand when you came to the length of Java."

THE TOTAL ECLIPSE OF THE SUN.

THE following suggestions were compiled for a special purpose. As it is probable that many amateurs will take advantage of the coming occasion to observe the various phenomena, the suggestions are published here in the hope that they may prove useful to some who are witnessing a total eclipse for the first time.

J. NORMAN LOCKYER.

(1) *Time Observations.*

Observers who are supplied with a first-rate chronometer, of which the error and rate are known, may make valuable observations of the four contacts.

For the first contact a telescope is necessary to observe the first small encroachment of the moon on the sun's limb ; of course, if a spectroscope is used to observe the gradual eclipse of the chromosphere indicated by the gradual shortening of one of the lines of hydrogen (C for choice), so much the better, but care must be taken by sweeping along the limb to secure that the chromosphere immediately above the first contact is under observation ; here, of course, the line will be shortest.

The second contact will be heralded by the sweep of the moon's shadow through the air. Mr. Crommelin has calculated that in Norway this will move at the rate of two miles a second ; the shadow on the land- or sea-scape will, of course, be best seen from the most elevated stations.

To observe the exact time of contact, a green shade should be used, as the disappearance of the white light of the photosphere and the appearance of the red light of the chromosphere will be emphasised. Prof. Harkness has also pointed out that the exact moment of second contact is also clearly indicated by the "seemingly miraculous appearance of the complete outline of the moon, round and black, reposing upon the wondrous radiance of the corona."

The approach of the third contact is indicated by the rapid brightening of the chromosphere at the point of the moon's limb where the sun is about to reappear. The green shade should again be used, and two or three seconds later a fine cusp of photosphere will make its appearance, announcing the termination of totality.

The green shade is here especially useful, as often the reappearance of the lower brighter chromospheric level has been mistaken for the reappearance of the sun itself.

For the fourth contact a telescope should be used if possible, otherwise a smoked glass.

It is desirable that, if possible, each party observing the contacts should consist of three persons ; one to watch, without any interruption whatever, the face of the chronometer and to count the seconds immediately before each contact is expected, another to make the observation, and another to record the exact time, minute, second, and part of second at which the signal is given by the second observer.

(2) *Disc Observations.*

These observations are for noting the greatest extent of the corona, and can only be made by shore parties.

Calculate the altitude and azimuth of sun's centre, at place, at mid-eclipse. Make a disc of such a size that at a distance *from the eye* of 20, 30, or 40 feet, as may be decided on, it will cover the sun, and extend three minutes of arc beyond the limb all round.

Erect this on a vertical pole, so that from the chosen observing point it will eclipse the dark moon and the lower parts of the corona (3' high) at mid-eclipse.

A hole should be cut in a piece of wood or cardboard, fixed at the proper height, to show the exact position of the eye. This should be free to move in altitude and azimuth to secure exact adjustment.

Test the accuracy of everything, if possible, the day before at the time the sun is nearest the mid-eclipse position.

Before totality one observer should make the adjustments before referred to, and should see that at ten seconds after the beginning of totality the lower part of the corona all round the dark moon is completely covered by the disc.

Another observer, whose eye has been lightly bandaged to make it as sensitive to faint light as possible, should then be placed at the eye-hole, and should look for the faintest extensions. He should dictate to an amanuensis the length of extensions in diameters of dark moon; and their bearing, the vertex representing magnetic north.

Immediately the totality is over, the actual observer should draw what he has seen on a card similar to that used by the sketchers of the corona (see later). This drawing should include everything seen, but the extensions should be noted with the greatest care.[1]

(3) *Eye Observations of the Corona.*

All can do serviceable work by sketching very carefully the corona during the time of totality. The observers should provide themselves with a card (or cards) one foot square, on which a circle two inches in diameter is drawn in ink, and darkened to represent the moon's disc. The diameter will serve as a scale, so that the distance the boundaries and rays of the corona extend from the dark moon may be carefully noted. Imagine both the dark moon and dark disc to represent a compass card, then the various details may be sketched at their appropriate bearings, the top of the card representing mag. N. (The points may be marked on the card in any detail that may be required, but eight should suffice.)

These observations should, if possible, be made by

[1] For phenomena thus observed in eclipse of 1878 see "Lockyer's Astronomy," p. 115.

observers in pairs, and they should not compare notes. If telescopes are used, two inches aperture and a power of twenty should be employed for choice.

Before Totality.

(I.) Note how long the corona is visible before totality, along the edge of the dark moon opposite the point at which the sun is about to disappear.

(II.) Sketch any rays visible before totality; give length, colour, and structure as well as position.

At Commencement of Totality.

(III.) Sketch general outline and rays (streamers) and rifts (dark intervals between bright rays.)

(IV.) Note if there be a blaze of light or glare where the sun has just disappeared, and whether the base of the corona is brightest near or away from prominences.

Middle of Totality.

(V.) Sketch general outline rays (streamers) and rifts; note colour and direction of greatest extension.

Near End of Totality.

(VI.) Sketch general outline, and any rays or streamers or rifts; note colours.

(VII.) Note if there be a blaze of light or glare where the sun is about to reappear.

After Totality.

(VIII.) Sketch any rays that may be visible; give length, colour, and structure, as well as position.

Questions to be answered in writing immediately Totality is over.

(*a*) Has there been any change in the appearance of the corona during the eclipse? If so, specify what change.

(*b*) Have especially the dark rays or rifts changed during the eclipse.

(*c*) Describe what has been unchanged throughout, and define its structure.

(*d*) State the colours you observed outside the red prominences.

(*e*) Were the colours anywhere arranged in layers round the sun?

(*f*) Were the colours anywhere arranged radially?

(*g*) State colours of rays, and of spaces between them.

(*h*) Did the dark rifts extend down to the moon, or did they stop short above the denser layers of the chromosphere?

(*i*) Were the rays brightest near, or far away from the moon?

(*k*) What was the comparative brightness of the rays, the bright ring near the sun, and the outer corona?

(4) *Colours of Land- and Sea-scape.*

Some time before totality there will be a notable change in the colours of sky, cloud, and land and water surfaces.

Each of these should be noted separately, and the gradual changes, both as totality is approached and after it is over, should be carefully recorded.

This apparent change of colour has its origin in the coloured chromosphere and prominences; those witnessing the eclipse are thus enveloped in coloured—generally red—light, which bathes the landscape. The sky, ordinarily blue, is seen through a red haze, and therefore puts on a purple tint.

That the sky appears more purple at some eclipses than at others, is owing to the fact that the quantity of red light is not always the same, but varies with the brightness and magnitude of the prominences visible at the time.

The following table will give an idea of the colours, both of the corona and landscape, which have been previously recorded.

Year	Inner corona	Outer corona	Rays	Landscape, &c.
1605	Reddish hue (Kepler)			
1715	Pale whiteness or rather pearl coloured (Halley)			
1733	Ruddy (Vatterini)	Greenish colour		
1766	Ruddy	Yellow and white		Livid yellow (Le Gentil).
1778	Reddish hue, pale yellow to white (Ulloa)			
1806			Bluish tint (de Witt)	
1842	Yellow			
1842	Peach colour (Airy)			Greenish olive (Pinaud) Greyish violet heavens at Lipesk.
1851	White first and then blue			Land dusky yellow, water deep purple, clouds yellow, sky purple.—Dunkin.
	Dull rose colour			
	Light violet			
				Sea and land dark green. Deep yellow colour beneath clouds in south. (Snow).
	{ Pure white Brightest	More feeble } (Carrington)		Landscape dark olive tint (Hind).
	Silvery white (Swan)			Clouds deep purplish grey (Dawes)
	Light violet, nearly white (Silverstolpe)			A sickly neutral green coloured sea and tinged atmosphere.
	A cold unearthly light (Adams)			
	Orange (Liveing)			
1860	Yellow (Rümker)			
1869	Silvery grey (Farrell)		Fine violet mauve coloured white and yellowish white (Farrell)	
	Silvery white. Greenish violet (Eastman)			
	Clear yellowish	Pinkish green (Myer)	Silvery	Bands of pink, purple, yellow, orange, fiery red, no green or blue except a blue tinge in purple, all divided by black stripes.

(5) *The Visibility of Stars during the Eclipse.*

The light radiated by the solar surroundings varies very much from eclipse to eclipse. Hence sometimes lamps are necessary for certain of the operations, while at others they are superfluous.

The number of stars visible, therefore, varies considerably. The sun this year at the time of the eclipse will be near the chief stars in the constellation Leo, which will be to the left of the sun.

Note, by means of a star map, what is the magnitude of the faintest stars visible, whether first, second, third, or fourth.

Suggestions for Timing the Progress of the Eclipse.

In Sicily, in 1870, the following method of recording the lapse of time during totality was introduced, and was found to prevent all excitement, and made the 80 seconds seem a long time.

Determine the number of seconds of totality at the station—say 100.

Then, at the moment of totality, let a person attached to each party of observers, carefully observing the face of a chronometer or watch, say, "You have now 100 seconds." After 5 seconds, "You have still 95 seconds." After another 5 seconds, "There are still 90 seconds remaining." And so on.

A clever man can do this in a very encouraging way. The time counter should take care not to distract himself by losing sight of the face of the watch or chronometer; and it is to be impressed upon him that much of the success of the observations will depend on his undivided attention, as his statement of time in the case of parties with large instruments, is an order to individual observers to do certain work. Hence there should be two time counters, who should change over at the middle of the eclipse, care being taken that the counting is not interrupted. *The times at which any of the phenomena occur must be noted by another observer.*

Caution with regard to the use of Telescopes.

Observers equipped with telescopes, whether they be small instruments or equatorially mounted, must be very careful about not observing the sun before or after totality without the aid of dark glasses. For small hand-telescopes a dark glass will be found sufficiently safe; but with instruments of greater power, the dark glass should be supplemented by a solar or diagonal eye-piece. If one half of the reflecting surface of the glass be silvered and the glass be made to slide, it may be used during totality. In any case, *do not forget, immediately before totality, to remove the dark glasses.*

THE KELVIN JUBILEE.

WE are glad to be able to supplement our report of the celebration of Lord Kelvin's jubilee with the address presented by M. Mascart on behalf of the Institute of France. By such cordial expressions as those in which the Institute addressed our distinguished countryman, men of science are made to feel that they belong to a universal brotherhood, all the members of which have but one aim—the accumulation of scientific knowledge. The following is the address:—

MILORD ET CHER CONFRÈRE,—L'Académie des Sciences de Paris, dans laquelle vous êtes aujourdhui le doyen des associés étrangers, a voulu se joindre aux savants de tous les pays du monde, à vos admirateurs, à vos amis, pour vous apporter des félicitations chaleureuses à l'occasion du cinquantenaire de votre arrivée comme professeur à l'Université de Glasgow que vous avez tant illustrée.

Il y a quelques mois, l'Institut de France célébrait le centième anniversaire de sa fondation, ou plutôt de la reconstitution des anciennes Académies sur des bases plus larges. Nous ne pouvons oublier l'élévation de langage avec laquelle le Président de la Société Royale de Londres vint alors traduire les sentiments de cordialité de cette grande et célèbre Institution.

Dans une autre réunion, où vous parliez en votre nom personnel, vous nous avez causé une profonde émotion en déclarant que vous aviez une dette de reconnaissance envers notre pays, que nos grand esprits tels que Fourier, Laplace et Sadi Carnot avaient été vos inspirateurs et que vous considériez la France comme l'"alma mater" de votre jeunesse scientifique.

Si la dette existe, vous l'avez payée avec usure. Dans la longue série de travaux et de découvertes qui jalonnent; votre admirable carrière, une des plus nobles que l'on puisse rêver, vous avez abordé toutes les questions des cette science a laquelle la littérature anglaise conserve le beau nom de "philosophie naturelle," soit pour contribuer aux progrès des conceptions théoriques, soit pour en déduire des applications utiles au développements de l'industrie et au bien de l'humanité.

Quoi que l'avenir réserve au génie inventif de l'esprit humain, votre nom restera comme ayant été le guide le plus sûr dans une époque féconde, et le véritable éducateur de la génération actuelle dans le domaine de l'électricité.

Je suis particulièrement heureux que l'Académie des Sciences m'ait confié le soin de vous remettre une médaille d'or à l'effigie d'Arago, médaille qu'elle réserve pour rendre hommage aux services exceptionnels rendus à la science et qui porte cette devise, "Laudes damus posteri gloriam."

Vos confrères de l'Institut de France espèrent que vous voudrez bien considérer ce souvenir comme un témoignage de haute estime et de leurs sentiments les plus affectueux.

It is due to the Council of the Royal College of Science to state that they were not less desirous than the rest of the scientific world of doing honour to Lord Kelvin. An address was prepared and signed by every member of the Council of the College, with the exception of one who was temporarily out of reach. This address was presented to Lord Kelvin at the same time as the addresses from other Colleges in London, but mention of it was inadvertently omitted from our report. A congratulatory address was also sent by the Institute of Chemistry.

THE BRITISH ASSOCIATION MEETING IN LIVERPOOL.—LOCAL ARRANGEMENTS.

THE preparations for the British Association Meeting in Liverpool next September are now going on rapidly. A large and influential Local Committee of about 500 of the leading citizens, under the chairmanship of the Lord Mayor (the Earl of Derby), was appointed a couple of years ago. The smaller Executive Committee has broken up into Sub-Committees dealing with the subjects of—(1) Finance, (2) Hospitality, (3) Buildings, (4) Excursions, (5) Publications, and (6) Evening Entertainments. Most of these Sub-Committees have been actively at work for the last few months, and a report embodying the results of their deliberations has just been submitted to a meeting of the large Committee held in the Town Hall. The following is an outline of the arrangements completed so far:—

The reception room and the general offices will be at St. George's Hall, in the centre of the town, a few yards from Lime Street Station, the London and North-Western Terminus. One of the Sections (Geography) will occupy the concert room of St. George's Hall, and three other Sections (Geology, Anthropology, and Mechanical Science) have been allotted rooms in the closely adjoining Public Museum and Walker Art Gallery. The Section of Economics will be located in the Town Hall, opening on to the Exchange flags, and in the centre of the business life of the city; while the five remaining Sections (Physics, Chemistry, Zoology, Physiology, and Botany) will be placed in the laboratories and lecture theatres of University College, about 1050 yards from the reception room. A main artery, and tramway route, leads from Lime Street to Ashton Street, from which the College opens, and arrangements will be made for a constant service of convenient omnibuses in addition to the tram-cars. Permission to use these various buildings has been obtained from the Lord Mayor and the Corporation, and the Council of University College; and the Philharmonic Hall, which holds about 3000, has been engaged for three evenings, on the occasions of the President's address and the two evening discourses. The lecture to the working classes will be given in the Picton Lecture Hall. The first conversazione will be given by the Lord Mayor (Lord Derby) in the Town Hall, and the second by the Local Committee in the range of Corporation buildings occupied by the Public

Museum and the Walker Art Gallery. The autumn exhibition will be open in September, and the Arts Committee propose to admit members of the British Association to the galleries during the week of the meeting on presentation of their tickets of membership.

A new museum, given to the zoological department of University College by the late Mr. George Holt, has been rapidly hurried on with the special view of use at this meeting, and will be available for the exhibition of specimens, models, &c., brought in illustration of papers read before the Sections, or for other objects of scientific interest sent on loan.

A number of the owners of works of manufacturing and engineering interest have offered to open their buildings for inspection during the week. Several gentlemen have intimated their intention of giving garden parties, and a number of excursions to places of interest in the neighbourhood of Liverpool have now been arranged, including the following: Half-day excursions on Saturday, September 19—(1) River excursion with the Mersey Dock Board; (2) Overhead Electric Railway; (3) Speke Hall, Hale Hall, &c.; (4) Thurstaston, Storeton Quarry (where the reptilian footprints are found), and the Leasowe Submarine Forest; (5) Bidston Observatory; (6) Chester and Hawarden; (7) Dredging excursion with the Lancashire Sea-Fisheries Steamer. Whole-day excursions on Thursday, September 24—(1) Chester and Eaton Hall; (2) Rivington Water Works, &c.; (3) Llandudno and Beaumaris by sea; (4) Manchester Ship Canal, &c.; (5) Prestatyn, Tremerchion Caves, and Corwen; (6) Northwich, Weaver Navigation, and Delamere Forest.

At the end of the meeting there will be longer excursions, extending over several days, to the Vyrnwy Water Works in Wales and to the English lakes; and a specially scientific excursion to the Isle of Man, for which a separate programme has been prepared, covering five days—Thursday to Monday inclusive.

The Earl of Derby has invited a party to Knowsley, the Duke of Westminster has also invited a party to Eaton Hall, and Mr. Gladstone will receive another party at Hawarden. In connection with the Isle of Man excursion, the Governor of the island (Lord Henniker) has invited the members to a reception at Government House, and will preside at a dinner to be given on the concluding evening.

The Publications Sub-Committee have drawn up a scientific handbook to Liverpool and the neighbourhood, containing articles on the history and antiquities, the geology, the entomology, the marine biology, the botany, the vertebrate fauna, the climate, the river and the tides, the docks and other engineering works, the trade and commerce, and the chemical industries. A complete guide to the various excursions is also in course of preparation.

The Hospitality Sub-Committee have invited as guests a large number of distinguished scientific men from the continent and America, and although many have not yet been able to give, at this early date, a decided answer, a considerable number have already definitely accepted. These include, amongst others, Prof. van Rijckevorsel (Rotterdam), M. J. Violle (Paris), Prof. V. Bjerknes (Stockholm), Prof. Lenard (Aachen), M. L. de la Rive (Geneva), Prof. Knorr (Jena), Dr. Credner (Leipzig), Prof. Renard (Gand), Prof. Mœbius (Berlin), Prof. Julin (Liège), Prof. Gilson (Louvain), Prof. Minot (Boston), Prof. Le Conte (Berkeley), Graf von Pfeil (Vienna), Prof. Cohn (Göttingen), Prof. Stainier (Gembloux), Prof. Schröter (Munich), Prof. Topinard (Paris), Dr. E. Dubois (Hague), Prof. C. Bohr (Copenhagen), Prof. Goldmann (Freiburg), Prof. Schimper (Bonn), Prof. Zacharias (Hamburg), and M. C. de Candolle (Geneva). As a number of others are still uncertain, and answers are now coming in every day, this can only be regarded as a provisional list. Probably the attendance of foreigners at this meeting will be unusually large. The Hospitality Sub-Committee is now busily engaged in arranging private hospitality for the foreign guests, and also for as many as possible of the home members of the Association who have intimated their intention of being present at the meeting.

W. A. Herdman.

THE DAVY-FARADAY RESEARCH LABORATORY.

Scientific investigators have long needed a central laboratory where researches can be carried on without interruption, and have urged the establishment of a national physical laboratory for the United Kingdom. Twenty years ago the Duke of Devonshire's Commission recognised the advantages which our national industries would derive from physical and chemical investigations, and pointed out the need of a more generous recognition of such research by the State. Since then the Physikalische Reichsanstalt, at Charlottenburg, has been established, and, through the facilities it offers, Germany is reaping a rich harvest of natural knowledge; but, so far as State recognition is concerned, we have made little advancement. True, a Committee of the British Association has considered the question of a national physical laboratory, and another Committee is now reconsidering it; but there is no immediate prospect that any recommendations they might make will induce the Government to give a substantial grant, either for the extension of an existing institution in the direction of facilities for research, or for the establishment of an institution on the lines of the Reichsanstalt. For the perspicacity which sees in pure scientific research a means of developing industries, and which is content with knowledge accumulated, whether the practical bearings are apparent or not, we have to go to Germany, where many of our national industries have gone as a consequence of neglect by our Government.

Fortunately for British science, individuals occasionally arise who see how severely investigation is handicapped on account of the lack of organisation and encouragement by the State. One such benefactor is Dr. Ludwig Mond, whose munificent gift to the Royal Institution of a laboratory for physical and chemical research was warmly announced in these columns two years ago. We are now able to state that on June 12 Dr. Mond formally transferred to the managers of the Royal Institution the freehold of No. 20 Albemarle Street, adjoining that Institution, for the purpose of the laboratory of research in pure and physical chemistry referred to in our announcement, to be known as the Davy-Faraday Research Laboratory of the Royal Institution. In order to make the building suitable for this purpose, Dr. Mond has carried out very extensive alterations. He has also equipped the laboratory with the necessary apparatus, appliances, &c., for carrying on delicate investigations in physical and chemical science. An idea of the generous nature of Dr. Mond's endowment may be obtained from a statement of rooms included in the new institute.

The Laboratory contains:—

On the Basement.—A room for thermochemical research; a room for pyrochemical research; mechanics' workshop; room for electrical work; battery of twenty-six accumulators; constant temperature vaults; boiler-house and store-rooms.

On the Ground Floor.—A room for research in organic chemistry; a room for research in inorganic chemistry; a fire-proof room for experiments in sealed tubes; a balance room; entrance hall and cloak-room.

On the First Floor.—The Honorary Secretary's room; a large double library connected with the library of the Royal Institution.

On the Second Floor.—A museum of apparatus.

On the Third Floor.—Seven rooms for research in physical chemistry.

On the Fourth Floor.—A room for inorganic preparations; a room for organic preparations; a photographic room; four rooms for researches in physical chemistry.

On the Roof.—An asphalted flat with a table, gas and water.

All the floors are connected by a hydraulic passenger-lift.

Dr. Mond has not only furnished the laboratory with the most modern instruments and appliances for researches in pure and physical chemistry, but he has also placed in the hands of the managers of the Royal Institution an ample annual endowment, so that the laboratory may be maintained in a state of thorough efficiency, the object of the donor being to give every assistance and encouragement within the limits of the endowment to scientific workers.

The laboratory (the affairs of which will be managed by a Laboratory Committee appointed by the managers of the Institution) will be under the control of two directors, who will be aided in the work by competent assistants. The managers of the Royal Institution have appointed as directors Lord Rayleigh and Prof. Dewar.

It is intended to open the laboratory for work by the middle of October. The trust deed provides that no person shall be admitted to the laboratory as a worker who has not already done original scientific work, or in the alternative, who is not, in the opinion of the Laboratory Committee, fully qualified to undertake original scientific research in pure or physical chemistry; and that no person shall be excluded from admission by reason of his or her nationality or sex.

Admission to the laboratory, and the supply of gas, water and electricity, as far as available, will be free of charge; but any person using the apparatus, will be responsible for any damage done while in his possession.

Applications for admission are to be made to Mr. Robert L. Mond, Honorary Secretary to the Laboratory Committee, at 20 Albemarle Street.

The conditions of Dr. Mond's endowment are as liberal as the gift itself, and we have no doubt that the results which will follow will demonstrate the importance of both as means of advancing science. We regard the foundation of the laboratory as marking a most important step in the history of British science; for it provides a means whereby the edifice of scientific knowledge can be built up by master hands. British Governments are said to base their assistance to science mainly on the principle of helping voluntary effort. Perhaps, now that Dr. Mond has shown what can be done, the Government will show its interest in science by establishing a similar laboratory of a national character.

BORING A CORAL REEF AT FUNAFUTI.

LETTERS have just come to hand from Prof. Sollas stating that he has started from Sydney to carry out the project of putting down a boring through the atoll of Funafuti. By this time, if all has gone well, the expedition has probably started work.

It may be remembered that about six years ago, a strong committee was formed by the British Association, with Prof. Bonney as its chairman, and Prof. Sollas as secretary, "to investigate a coral reef by sounding and boring." The intention was to carry out the suggestion made by Darwin in his book on "Corals and Coral Islands," and to put to the test of fact the rival theories on the origin of these extraordinary limestone masses. After some years of preliminary thought and suggestion, a definite project began to take shape in 1894, when an application for a grant was made to the Government Grant Committee. The outcome of this was an application to the Admiralty for the service of a surveying vessel, which was most generously given for May of this year, and grants of money in aid were made by the Government Grant Committee and the Royal Society itself. A smaller executive committee of the latter body was formed, including the following names: Prof. Bonney (chairman), the President and Officers of the Royal Society, Mr. Wolfe Barry, Mr. Crookes, Mr. F. Darwin, Prof. Edgeworth David, Captain Field, Sir A. Geikie, Prof. Judd, Dr. J. Murray, Prof. Anderson Stuart, Admiral Wharton, with Prof. Sollas and Mr. W. W. Watts (secretaries), and preparations were concluded for making a start in time to leave Sydney in H.M.S. *Penguin* on May 1, under the command of Captain Field.

Meanwhile Prof. Anderson Stuart, of the University of Sydney, whose sympathy had been enlisted, entered warmly into the proposal. He took immense trouble in discussing with missionaries, sailors and travellers, the prospective merits of a large number of islands for the purpose of the investigation. Further he obtained from the Department of Mines in New South Wales the loan of a valuable set of diamond-drilling plant, and used his influence to overcome the natural difficulties which presented themselves in obtaining permission to use such apparatus on a waterless island in the Pacific. The committee is greatly indebted to this gentleman and to Mr. W. H. J. Slee, the Chief Inspector of Mines and Superintendent of Diamond Drills to the Government of New South Wales, for all the care and trouble they have taken in selecting the machinery and stores for this purpose, in engaging for the use of the expedition some of the most experienced foremen in the colony, and in obtaining a contribution towards the wages expense of the expedition.

Prof. Stuart's recommendation of the Island of Funafuti agreed with Admiral Wharton's knowledge of the island and the group to which it belongs, and it fortunately happened that further sounding and exploring of the group would furnish results of use to the Admiralty, so that a topographical and magnetic survey, together with sounding and current observations, could be carried on while the boring was being executed in the island.

Prof. Edgeworth David, from the University of Sydney, happened to be visiting England while preparations were in progress, and he furnished a most valuable means of communication with helpers in Sydney; and through this fortunate circumstance, the committee was able to come into closer touch with the Sydney committee in order to provide more completely for the regular work and such emergencies as could be foreseen. It was hoped that either Prof. David, or Mr. Pitman, the Government Geologist of New South Wales, would be able to take part in the expedition, but unfortunately neither gentleman could arrange to be away at the time requisite. Mr. Hedley, from the Australian Museum, has, however, been able to go, and he will utilise his opportunities for collecting and making observations in natural history.

Prof. Sollas, who is sent out by the committee in chief charge, will regard the boring work as the principal aim of the expedition, and will only be able to utilise his spare time in any other work. All of his observations, however, he intends to devote to the primary object of elucidating the structure and origin of the reef. It is therefore a good thing that Mr. Stanley Gardner, an enthusiastic Cambridge naturalist, has been able to accompany him, and he purposes to devote himself to biological work of such a nature as to bear directly on the origin and growth of reefs.

Funafuti is a typical atoll, submerged for the most part on its western side, but above water for a long strip on its eastern side. It is about fifteen miles in circumference and about seven miles in longest diameter, is one of a group of atolls situated due north of the Fiji group, and is about in latitude 10° S., and longitude 179° E. The lagoon has a good entrance, and provides firm anchorage. There are about 400 inhabitants, with a native missionary and a white trader; but there is no good supply of water on the island.

Apparatus is being taken for boring about 1000 feet, but it is not anticipated that the bore will reach more than 700 feet in the time allotted, although three shifts will be working night and day, but not on Sundays, for the inhabitants are strict Sabbatarians. Delays are almost certain to occur, for the rock will be in places soft and cavernous, and the occasional dropping of the crown, resulting in probable injury to the diamonds, is not unlikely. For this reason the Department of Mines in New South Wales has provided steel cutters, which will be used whenever the nature of the rock permits it. The hole will start at four inches diameter, and it may be necessary in the later stages to drop to three inches, for which apparatus will be at hand.

The necessity for an investigation into the submarine structure of a coral reef is so well known to the readers of NATURE, that it is unnecessary to enter into any minute particulars. The explorers are instructed to bring back a core which will show what the under parts of a typical atoll are made of, and thus make known, what there has never been an opportunity of studying before, the foundations and under-structure of a reef which has not received sufficient uplift to clear the water. The different parts of this core will almost certainly indicate how its component rocks have originated—by living coral growing on coral *in situ*, on coral débris, on other types of organic rocks, or on a platform of denudation or deposition.

"Of the cores and of such other specimens as may be collected by the expedition (not referring to specimens collected by the volunteers in their private capacity), the first set will be ultimately presented to the British Museum, the second to the Ministry of Mines at Sydney."

In conclusion, I may be allowed to point out that though a large sum of money has been granted by the Government Grant Committee and by the Royal Society, it would have required very much more if the Admiralty had not made a most speedy and generous response to the request of the Royal Society. Even with that help, it would have been impossible to do the work so soon, or even probably at all, if further ready and kindly assistance had not been received from individuals mentioned above, and from the Department of Mines of the Government of New South Wales. The help thus rendered has probably reduced by three-fourths the total cost of the exploration, and it will be readily understood that the English committee feels a lively gratitude, not only to the Admiralty and its advisers, but to our good friends in New South Wales, amongst whom it is a pleasure to name Prof. Anderson Stuart, Mr. Slee, and Prof. Edgeworth David, not forgetting Sir Saul Samuel, the Agent-General of the Colony in England.

W. W. WATTS.

SIR JOSEPH PRESTWICH, D.C.L., F.R.S.

THE most eminent of British geologists has just passed away, and those who last Saturday stood around his grave amid the chalk hills of his pleasant country home at Shoreham, near Sevenoaks, felt that they were paying a last tribute to a veteran who had outlived all the associates of his prime, who had completed all his earthly tasks, and had gone to rest full of honours, and revered by all who knew him.

Joseph Prestwich was born in 1812 at Clapham, and after passing through elementary schools in London and in Paris, he proceeded to the famous grammar school of Dr. Valpy at Reading, and completed his education at University College in Gower Street. At this college his thoughts were directed to science by the lectures of Edward Turner on chemistry, and of Dionysius Lardner on natural philosophy. Turner, moreover, introduced the subjects of geology and mineralogy into his course, and thereby Prestwich gained those first lessons which aroused his interest and led him by force of circumstances to devote his leisure to geological studies. Had he been free to take up a profession he might, indeed, have given his special attention to chemistry. He was, however, destined to enter into commercial life, and until he was sixty years of age he was busily engaged in the city as a wine merchant. Assiduous and successful as a man of business, he yet contrived, from his earliest years in the office, to give great attention to geology, and he devoted all the leisure he could command to this subject, first of all as a means of relaxation, and finally because his interests were centred in the study. In early years his business-journeys enabled him to see and learn much about the general geology of England and Scotland; and when still a youth he spent his holidays during two successive years in studying the district of Coalbrook Dale in Shropshire, in mapping the various strata exposed at the surface from the Silurian rocks to the New Red Sandstone and Drifts, in marking the lines of fault, in noting in detail the character of the Coal-measures, and in gathering together the fossils from the several formations. The masterly memoir which he wrote on this area was communicated to the Geological Society of London in two portions in 1834 and 1836, being completed when the author was but twenty-four years of age. Meanwhile he had paid a visit to the north of Scotland, and had given some account of the Ichthyolites of Gamrie in Banffshire, a task which he undertook at the suggestion of Sir Roderick (then Mr.) Murchison. This was his first paper published in the *Transactions* of the Geological Society, of which he had been elected a Fellow in 1833.

Later on he came to devote his special attention to the Eocene formations in the neighbourhood of London, and in course of time he thoroughly investigated the entire area of the London Basin. In particular he defined and named the Thanet Sands and the Woolwich and Reading Beds; and he studied the sequence of organic remains in the London clay, and the subdivisions of the Bagshot series. In these researches he paid especial attention to the lithological changes of the strata and to their fossils, so that he could picture the physical conditions under which the several formations were deposited. He extended his observations into the Hampshire Basin, and showed that the Bognor beds formed part of the London clay, and eventually he proceeded into France and Belgium to correlate the subdivisions there made with those he had established in this country. This great work among the Eocene strata occupied much of his time for nearly twenty years, and it served to fully establish his reputation not only as a keen and accurate observer, but as a most philosophical geologist. Another great achievement soon awaited Prestwich, and that was the investigation of the valley gravels supposed to contain the works of man in association with extinct mammalia. Boucher de Perthes had in 1847 announced such discoveries in the Somme Valley, but they had received little attention. The somewhat similar discoveries in Kent's Cavern, by MacEnery, had likewise been neglected. Attention was, however, forcibly directed to the subject by the discoveries made in Brixham Cave in 1858, and Dr. Falconer then induced Prestwich to examine the evidence brought forward in the valley of the Somme. The results of these researches, which were carried on in conjunction with Sir John Evans, and which were followed by a study of the English evidence at Hoxne, in Suffolk, in the Ouse Valley, and elsewhere, are well known. The contemporaneity of man with the Mammoth and other Pleistocene mammalia was fully established, and the antiquity of man came to be the most absorbing topic of the day. That vexed question still remains a matter under discussion, although Prestwich, in some of his later articles, has sought rather to reduce than to extend the time-limits of man's existence.

Subjects of practical importance from time to time engaged his attention. In 1851 he published "A Geological Inquiry respecting the Water-Bearing Strata of the country around London," a work which at once became the standard authority on the subject, and has lately been reissued with appendices. The author took a prominent part on the Royal Commission on Metropolitan Water Supply in 1867, and his services were again in request on the Royal Coal Commission, to the reports of which, published in 1871, he contributed accounts of the Bristol and Somerset Coal-field, and of the probable extent of Coal-measures beneath the Secondary rocks of the south and south-east of England. Agreeing generally with the conclusions of his friend Godwin-Austen, he was led to infer that concealed coal-fields might extend from Somersetshire eastwards to the neighbourhood of Folkestone. Subsequent explorations at Dover have shown the correctness of these theoretical views.

Prestwich was elected a Fellow of the Royal Society in 1853, and was appointed a Vice-President in 1870. In that same year he was chosen President of the Geological Society, and in the course of his two addresses he dealt with the subjects of deep-sea researches, and water-supply.

His attention had been given at various intervals to the later Tertiary deposits, and in 1871 his three great papers on the structure of the Crag-beds of Suffolk and Norfolk were published by the Geological Society. So much had been written by others on these very fossiliferous strata, that the author had not scope for so much originality as was the case with his Eocene researches. These later papers were, however, characterised by the same exhaustive treatment of the subject, in the record of many sections, and in the enumeration of the organic remains. His memoirs on the Pliocene or Crag formations were eventually followed by a series of articles dealing with more recent deposits. In the meanwhile Prestwich, who had retired from business in 1872, was offered the chair of Geology at Oxford, vacant through the death in 1874 of John Phillips. It came rather as a surprise to his friends that a man who had achieved such distinction and had earned repose should again go into harness. A young and ardent teacher would, however, at that time have been out-of-place, and, as events proved, no one better than Prestwich could have been selected to fill the post with such advantage to the University.

One result of his labours in Oxford was his large and handsomely illustrated work, in two volumes, entitled "Geology Chemical, Physical, and Stratigraphical"—a work in which he opposed the strictly uniformitarian teachings of some geologists, and urged that, though the agents were similar in kind in past ages, they were not similar in degree to those of the present day. Retiring from Oxford in 1888, Prestwich again surprised his many friends by his renewed activity. Paper after paper issued from his pen, dealing with the most difficult problems connected with the later superficial deposits—notably his memoir read before the Royal Society on the "Evidences of a Submergence of Western Europe and of the Mediterranean Coasts at the close of the Glacial or so-called Post-Glacial Period." He dealt also with the rudely-made plateau flint-implements of the Chalk Downs, many of them found near his Kentish home. Although individually they would not attract much notice, he maintained that these rudely-chipped flints bore traces of human workmanship, and collectively showed evidence of a peculiar type of earlier date than the ordinary Palæolithic implements.

These later writings of Prestwich have initiated many new lines of inquiry, even if they have failed to carry conviction to all his readers.

The last honour bestowed upon him, in the early part of this year, was that of knighthood, which he was unable to accept in person from Her Majesty owing to his feeble health. He died on June 23, at his home, Darent Hulme, near Shoreham. H. B. W.

NOTES.

THE Albert Medal of the Society of Arts has been awarded, with the approval of H.R.H. the Prince of Wales, the President of the Society, to Prof. David Edward Hughes, F.R.S., "in recognition of the services he has rendered to arts, manufactures, and commerce by his numerous inventions in electricity and magnetism, especially the printing telegraph and the microphone."

THE Swiss Society of Electrical Engineers is organising an International Electrical Congress, which is to take place at Geneva from August 4 to August 9 next, under the presidency of M. Turrettini. The following subjects are to be discussed at the Congress: (1) Magnetic Units, (2) Photometric Units, (3) Transmission and Distribution of Power to Great Distances by means of (*a*) Direct Currents, (*b*) Alternate Currents, (4) Protection of High-pressure Overhead Electric Lines against Atmospheric Discharges, (5) Various Disturbances caused by Electric Traction. Further information can be obtained from the Bureau du Congrès International des Électriciens, Université, Genève.

IT has been proposed that some token of esteem be presented to Prof. N. Story-Maskelyne in recognition of his distinguished services to mineralogical science, and to commemorate his long connection with the University of Oxford. The presentation is intended to take the form, if possible, of a portrait, and it is believed that contributions not exceeding £2 in amount will be sufficient for the purpose. A number of men of science, both at home and on the continent, have already promised their support. Contributions will be received by Prof. A. H. Green, F.R.S., or Prof. H. A. Miers, F.R.S., University Museum, Oxford.

THE Board of Managers of the New York Botanical Garden have issued the first number of a *Bulletin*, containing the Act of Incorporation, and a map of the site for the Garden granted by the Commissioners of Public Parks. By agreement with the Trustees of Columbia College, the botanical library and herbarium belonging to that institution will be deposited in the Botanical Garden. The endowment fund of 250,000 dols. required by the Act of Incorporation has now been fully subscribed. The President of the Board of Managers is Mr. Cornelius Vanderbilt; the Secretary, Prof. N. L. Britton.

MR. AUSTIN CORBIN, who was killed a few days ago in New Hampshire, had acquired a herd of fifty buffalo, which he kept in his preserves in that State. It was his intention to lend the animals for an indefinite period to the city of New York, and a plot of eighty acres in Van Cortlandt Park, in the northern (annexed) portion of the city, had been prepared for them, having been surrounded by a fence seven feet high. The plan will be carried out by his representatives, and the herd will be moved in the autumn; the delay being caused by apprehension that change of climate during hot weather might prove pernicious. This measure may avert the threatened extinction of the buffalo, which has now been almost extirpated on the western plains.

MR. J. H. T. TUDSBERY has been appointed Secretary of the Institution of Civil Engineers, in succession to Mr. James Forrest, who has retired.

A REUTER telegram from St. Petersburg says:—"Despatches from Irkutsk announce that M. Hansen, the Norwegian trader, left that town on June 1 for the north of Siberia. His journey is primarily for trading purposes, but he will also inquire into the truth of the recent rumours regarding Dr. Nansen, and see if the store of provisions left by Baron Toll in the New Siberian Islands for Dr. Nansen is still intact. M. Hansen's mission has been confided to him by the Russian Imperial Geographical Society."

THE cruellest deed committed for the gratification of feminine vanity is the destruction of small white herons or egrets, during the season in which they have their nests and young, in order to supply plumes for ladies' hats. By persistent appeals the Society for the Protection of Birds have induced a small proportion of the gentler sex to give a thought to the conditions under which their borrowed plumes are obtained, and a slight feeling against the fashion of wearing feathers has been aroused. But fine feathers are so essential to feminine decoration, that the slightest excuse is sufficient to salve the conscience. Happy were the ladies, therefore, when they were told by shopkeepers that lovely delicate plumes for the decoration of hats were now artificially made, and no peculiar cruelty was necessary to obtain them. But their complaisance has been disturbed. Sir William Flower has examined numbers of plumes, the wearers of which were priding themselves on their humanity, trusting to the assurance of the milliner that they were not real egret's feathers, but manufactured, and he has found in every case that they were unquestionably genuine. The only "manufacture" consisted in cutting the plume in two, and fixing the upper and lower half side by side, so that a single feather does duty for two in the "brush." Simply to keep up their trade and dispose of their stock, the purveyors of female raiment have invented and widely propagated a monstrous fiction, and are everywhere selling the real feathers warranted as artificial! "Thus," concludes Sir William Flower, "one of the most beautiful of birds is being swept off the face of the earth, under circumstances of peculiar cruelty, to minister to a passing fashion, bolstered up by a glaring falsehood."

IN order to determine the highest possible speed that may be attained on railways, trial runs were lately made between Berlin and Lübbenau on the Berlin and Görlitz line, states the *Engineer*; and for these runs a special express engine of new design with four cylinders and driving wheels of 2 metres (6ft. 6in.) diameter has been constructed, thus giving the engine a much greater height above the rails than usual. The composition of the trains was very various, amounting sometimes to 100 axles. With a train of 30 axles the highest performance, viz. 106 kiloms. (65¾ miles) per hour was recorded, being 20 kiloms. (12 miles) more than the highest speed hitherto attained by the quickest German lightning train (Blitzzüge), viz. the Berlin Hamburg D-Zug, which runs through a distance of 286 kiloms. (177½ miles) in 3½ hours, while the speed of ordinary German expresses is only 70 kiloms. (43½ miles) per hour. The portions of lines chosen for the runs were tolerably horizontal over their whole length, and had very few curves.

OUTBREAKS of anthrax are by no means easy to trace to their fountain-head; and the Canton of Zürich has recently been much exercised over the appearance of anthrax in a district where this disease had previously been unknown. Dr. Silberschmidt, one of the assistants of the Hygienic Institute attached to the University of Zürich, has been entrusted with the task of ferreting out, if possible, the means by which anthrax has been introduced. Suspicion had fallen upon a horse-hair factory in the vicinity of the infected area, where the raw material employed emanated principally from Russia, from which country it is imported direct *viâ* Leipzig, in large bundles weighing over a hundredweight. These bundles are subjected to no process whatever of sterilisation or cleansing; and as cases of anthrax, whilst rarely met with amongst horses in Switzerland and other European countries, are comparatively frequent in Russia, the suspicion of this factory being the probable source of the trouble seemed justified. Careful examinations of some of this horse-hair, and also of the dust in the factory, revealed the undoubted presence of anthrax germs; thus the dissemination of anthrax appeared to be readily accounted for, and its distribution in the spore form as dust, in consequence of the extraordinary vitality of anthrax spores, renders it a particularly dangerous foe to deal with. It has been suggested to the authorities that Russian horse-hair should be sterilised on the frontier, or at any rate in Leipzig, in special apparatus arranged for the purpose, as, after the raw material has been distributed to small factories, the expense of sterilisation renders its being successfully carried a matter of great difficulty.

THE vexed question in the theory of fluid friction, whether finite slipping does or does not take place at the surface of a solid in contact with a liquid, forms the subject of a contribution, by Dr. Antonio Umani, in a recent number of the *Nuovo Cimento*. The experiments were conducted in the physical laboratory of the University of Parma, the apparatus used consisting of a cylindrical box filled with mercury, and suspended by a torsion fibre. In one series of experiments the sides of the box were nickel-plated, so that the mercury did not actually wet the metal; in another series, the mercury was made to bathe the sides of the box by thoroughly amalgamating the latter. In the former case, the presence of a film of air between the mercury and nickel was obviated by filling the box *in vacuo*. The observed values for the logarithmic decrement of the amplitude of the oscillations were found to differ in the two series of experiments by an amount which, Dr. Umani considers, indicates finite slipping between the mercury and the box when the latter is nickel-plated. The author further proceeds to calculate the internal coefficient of viscosity of mercury from the results of his second series of experiments, and obtains the value $\eta = 0{\cdot}01577$ C.G.S. units at temperature 10° C. Warburg, employing Poiseuille's method, had previously obtained at temperature 17°·2 C. the value 0·01602.

IN the *Bulletin* of the Royal Academy of Belgium, M. Léon Gerard contributes the results of some observations on the seat of emission of Röntgen rays, and their mode of propagation in air. The rays emanating from a Crookes' tube were allowed to pass through three diaphragms, and the emergent pencil of light was received on a photographic plate placed in different positions, so as to give both transverse and oblique sections of the pencil. By comparing these various sections, M. Gérard has been led to the conclusion that Röntgen's statement, according to which air is much less absorbent to Röntgen rays than to kathodic rays, is inexact. He considers that both kinds of rays possess the analogy of not travelling exactly in straight lines, and that, in accordance with the views of Lénard, atmospheric air is a turbulent medium for kathodic manifestations, and that their transmission takes place as in a turbulent medium, such as stearin or milk. M. Gérard's second conclusion, namely, that Röntgen rays only emanate from the surface of the glass on which kathodic rays fall, is in accordance with the numerous investigations described in previous numbers of NATURE.

THE action of Röntgen and other rays on the higher animals has been studied by Prof. Stefano Capranica (*Atti R. Accad. dei Lincei*). The subject selected for observation was *Mus musculus*, and the experiments referred chiefly to the quantity of carbon dioxide exhaled in the process of respiration. Prof. Capranica states the following conclusions: (1) The amount of CO_2 is the same in darkness as in diffuse daylight. (2) The respiration of *Mus musculus* is greatly affected by strong sunlight, even when all heat-rays have been screened off; and the effect is the same for rays from all parts of the spectrum. (3) Artificial lights, such as the electric light or incandescent gas, act like sunshine when concentrated on the animals, but have no effect when merely used to light a room. (4) The light from Geissler's tubes has no effect. (5) Röntgen rays have no action on the quantity of CO_2 eliminated from the animal, whatever be the conditionof the latter; that is, whether fasting or after feeding, whether previously kept for several hours in darkness, or *vice versâ*. (6) What was observed with each of the six moles experimented on was strong excitement, which continued for several hours after the experiments with Röntgen rays had ceased. The moles, after being exposed to Röntgen rays for one hour, ran about in a nervous and excited way, and would not eat. (7) This excitement Prof. Capranica attributes to the electrical effects of the Röntgen rays. (8) Experiments on cold-blooded animals (*Coronella*) give, as yet, no appreciable results.

THE meteorological and astronomical work accomplished during 1895 in the Observatory of the Mersey Docks and Harbour Board, are stated by Mr. W. E. Plummer in a report just received. Appended to the general tables is a catalogue and short discussion of all the gales of wind that have been automatically recorded with velocities equal to, or exceeding, fifty miles per hour. Several interesting points are brought out by the catalogue. It appears that the average length of a storm at Liverpool, as defined by the condition that the wind velocity shall exceed fifty miles per hour, is about six hours; while the average number of stormy hours in a year does not greatly exceed sixty. With regard to the time of year in which these disturbances occur, general experience points to a connection between them and the observed temperature. This agreement is very clearly shown by Mr. Plummer in a diagram having a curve exhibiting the number of stormy hours in each month, and an inverted temperature curve. The two curves very markedly coincide with one another. By means of two other diagrams Mr. Plummer shows the connection between barometric height and wind velocity; the variation of the barometer being taken from the time when no indications of a gale were apparent to the time when the disturbance ceased. There is a distinct difference between these variations and the wind velocity in the cases of winter and summer storms. In the winter, the fall of the barometer coincides with some approximation to the increase in the severity of the storm, but on the average the time of minimum barometer precedes the time of maximum velocity by about four hours. The mean length of time from the beginning to the end of the storm is twenty-six hours, of which twelve are occupied in the increase, and fourteen in the decrease of violence. The rise in the barometer after the time of maximum velocity is more marked than in the fall, and the mercury stands considerably higher at the end than at the beginning In the summer, the average length of time embracing the whole of the disturbance is reduced to twenty-two hours. The fall of the barometer as the storm gathers force is very slight, and on the average only amounts to 0·04 inch, while the minimum barometer occurs five hours before the maximum wind velocity. In nearly half the storms examined the barometer rose steadily throughout the whole of the disturbance. Mr. Plummer could find no instance of a storm occurring in the summer months when the barometer stood above 30 inches: in winter, 10 per cent. of the storms were developed at that pressure.

THE seventh volume of the *Geographical Journal* (new series), containing the monthly numbers from January to June of this year, has been published with commendable promptitude. The volume is a wonderfully interesting record of travel and discovery, and, with its notes, descriptive lists of geographical literature, new maps, and illustrations, it is an invaluable publication to geographers.

A SERIES of sixteen reproductions of photographs obtained by means of Röntgen rays, together with text (in Japanese) explanatory of the methods by which they were obtained, has been received from Prof. Y. Yamaguchi and T. Mizuno, of Tōkiō University. The photographs are much less distinct than those obtained since the introduction of the focus tube, but they nevertheless show that Japan means to keep in the van of scientific progress.

A CONTRIBUTION to the theory of warning colours and mimicry appears in the *Journal* of the Asiatic Society of Bengal (vol. lxv. Part ii. No. 1, 1896). Mr. Frank Finn, Deputy Superintendent of the Indian Museum, has tested the taste of the common garden lizard of India (*Calotes versicolor*) for various insects, and especially for butterflies protectively coloured and plain. Mr. Finn thinks the behaviour of the reptiles at liberty does not afford support to the belief that the butterflies, at any rate, usually considered nauseous, are distasteful to them.

WE understand that the next instalment of the "System of Medicine," which Prof. Clifford Allbutt is editing for Messrs. Macmillan and Co., will deal with Gynæcology, and will appear in the course of September. Dr. Playfair is associated with Prof. Allbutt as editor of this volume, which, though uniform with the system, will be complete in itself. The second volume of the "System of Medicine" proper may be expected by the end of the year. Messrs. Macmillan and Co. will also shortly issue a work on "Deformities," by Mr. A. H. Tubby. It is a comprehensive treatise on orthopædic surgery, and is fully illustrated by two hundred original plates and figures, and notes of one hundred cases.

THE June number of the *Journal* of the Chemical Society is an exceptionally bulky one; it runs into nearly four hundred pages, seventy-five of which are taken up with abstracts of papers. A distinguishing feature of the number are the four detailed accounts contained in it of Hofmann and his work. These are:—"Personal Reminiscences of Hofmann and of the conditions which led to the establishment of the Royal College of Chemistry and his appointment as its Professor," by Lord Playfair; "The History of the Royal College of Chemistry and Reminiscences of Hofmann's Professorship," by Sir F. A. Abel; "The Origin of the Coal-Tar Colour Industry, and the Contributions of Hofmann and his Pupils," by Dr. W. H. Perkin; and "Notes on Hofmann's Scientific Work," by Dr. H. E. Armstrong. Students of chemistry will find these descriptions full of interesting personal reminiscences, and will derive from them an idea of the marvellous amount of work which Hofmann accomplished.

THE Lepidoptera collected in Eastern Africa by Dr. W. L. Abbott have been determined by Dr W. J. Holland, and a list of them, with some other collections, is given in an excerpt from the *Proceedings* of the U.S. National Museum (vol. xviii. pp. 229-279). The collection from Eastern Africa was found by Dr. Holland to contain only a small number of species new to science, the great majority being species well known from other localities, and noticeably from temperate South Africa, many of them species named in the last century. It is pointed out that the presence of an *Argynnis* and a *Chrysophanus* in the collection is peculiarly interesting, and suggests to the student the thought that when a more thorough exploration of the lofty heights of Kilimanjaro, Kenia and Ruwenzori shall have been made, there will be some very remarkable, if not astonishing, facts brought to light as to the geographical distribution of animals. A collection made by Dr. Abbott in the islands lying west and north of Madagascar in the Indian Ocean, also possesses interest as illustrating the geographical distribution of genera and species. Dr. Holland finds it to be made up of certain genera possessing great capabilities for migration, and apparently a strong power to resist change under varying conditions. The other collections of Lepidoptera described by Dr. Holland in the excerpt referred to, were obtained from Somaliland, by Mr. W. A. Chanler and Lieut. von Hoehnel; and from Kashmir, by Dr. Abbott.

THE Connecticut Agricultural Experiment Station was established in 1877 "for the purpose of promoting agriculture by scientific investigation and experiment." The nineteenth annual report, containing an account of the work carried on during 1895, shows that both the science and practice of agriculture are advanced by the researches at the Station. The papers on the agricultural value of fertilisers and the availability of nitrogen alone furnish the materials for a liberal education in agriculture. Hundreds of analyses have been made in the chemical laboratory, while diastase—the sugar-forming ferment of sprouting seeds—and the proteids of the potato, malt, pea, vetch, and other plants have been studied, and new results obtained with reference to them. Experiments on the efficacy of the corrosive sublimate treatment of potato seed, where the land which is planted with potatoes is already fully infested with the potato-scab fungus, showed that the treatment was of little avail in preventing scab upon the crop. It was found that the addition of lime in quantities to the soil of the experimental field increased the amount of scab. The dreaded San José scab appeared in Connecticut for the first time in 1895, and great credit is due to the State Experiment Station for the prompt and thorough manner in which they gave nurserymen information regarding the occurrence, characteristics, and life-history of the insect, and the methods which have proved successful in eradicating it. Many other matters occupied the attention of the staff of the Station during the year covered by the report, and the results have been made known to the farmers of Connecticut. All the work proper to the Station that can be used for the public benefit is done without charge. Further, we read: "Every Connecticut citizen who is concerned in agriculture, whether farmer, manufacturer, or dealer, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond to all applications as far as lies in its power." This announcement is sufficient guarantee that the Station is never in want of subjects for investigation, and the *Bulletins* and Reports published from time to time testify to the great value of the work undertaken and results obtained.

THE additions to the Zoological Society's Gardens during the past week include three Indian Stock Doves (*Columba eversmanni*), a —— Duck (*Nyroca baeri*), three —— Hemipodes (*Turnix dussumieri*) from India, presented by Mr. Frank Finn; a Peba Armadillo (*Tatusia peba*) from South America, eight Bell's Cinixys (*Cinixys belliana*) from Angola, a Maximilian's Terrapin (*Hydromedusa maximiliana*) from Brazil, a Madagascar Boa (*Pelophilus madagascariensis*), a Madagascar Tree Boa (*Corallus madagascariensis*) from Madagascar, deposited; two Plantain Squirrels (*Sciurus plantani*) from Java, an Occipital Vulture (*Vultur occipitalis*) from Africa, two Burmeister's Cariamas (*Chunga burmeisteri*) from the Argentine Republic, two Crowned Partridges (*Rollulus cristatus*) from Malacca, twelve Spotted Tinamous (*Nothura maculosa*) from Buenos Ayres, two Chilian Teal (*Querquedula creccoides*) from Antarctic America, two Shamas (*Cittacincla macrura*), a Malabar Green Bulbul (*Phyllornis aurifrons*) from India, a —— Sand Snake (*Psammophis schokari*), a Hissing Sand Snake (*Psammophis sibilans*) from Egypt, purchased; a Brush-tailed Kangaroo (*Petrogale penicillata*), two Spotted Pigeons (*Columba maculosa*), two Triangular-spotted Pigeons (*Columba guinea*), two Vinaceous Turtle Doves (*Turtur vinaceus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

DECLINATIONS OF FIFTY-SIX STARS.—The definitive declinations and proper motions of fifty-six stars have been determined at the Columbia College Observatory (*Contributions*, No. 8). The stars in question were selected by Profs. Fergola and Jacoby for observation at Naples and New York by the Talcott method, for the determination of the variation of latitude, and for the calculation of the constant of aberration by Küstner's method. Prof. Jacoby commenced the investigation, but ill-health compelled him to relinquish it, and it was continued by Mr. Davis. The discussion of the declinations was undertaken with the object of obtaining results based upon all available observations, so as to make this part of the work of value as an independent research. The memoir involves observations recorded in no less than 130 star catalogues, and represents an enormous amount of painstaking computation.

GRAPHICAL PREDICTION OF OCCULTATIONS.—The usual methods of deriving the local circumstances of an occultation, either graphically or by calculation, are somewhat lengthy and tedious, but a new construction, described by Major Grant, R.E., in the June number of the *Geographical Journal*, is rapid, simple, and sufficiently accurate for most purposes. With the aid of a convenient diagram the parallaxes in declination and right ascension of any heavenly body are readily determined, and when applied to the moon the elements of an occultation are easily deduced. It is stated that after a little practice the whole process can be performed in about twenty minutes, and that, with moderate care, the error of the time of disappearance or reappearance should not exceed ten minutes, while the angles of ingress and egress need not differ more than one or two degrees from those calculated. Separate copies of the paper, with the diagrams suitably mounted, can be obtained on application to the Royal Geographical Society.

MASS OF THE ASTEROIDS.—In a paper under the title of this note (*Ast. Nach.*, No. 3359), G. Ravené attempts to determine the most probable mean value of the total mass of the minor planets, on the basis of the secular perturbations of the perihelion point of Mars. The best result given in Newcomb's recent work on the subject (*Bull. Ast.*, xiii., January 1896), shows that the perihelion motion of Mars is not entirely that given by theory, unless an empirical amount of about 5″·55 in a century be taken into consideration. It is obvious that at least part of these perturbations may be attributed to the disturbing force of the minor planets, and this is rendered more probable when Barnard's recent measures of the diameters of the four chief asteroids are taken into account. From these it was concluded that the asteroids are by no means so small as the previous photometric measurements had indicated, and it is not certain that such data are useful for a precise estimate of the mass of these small bodies.

An asteroid like Ceres, having a diameter of about 485 miles, will have a mass of about 1/4000th part of the earth's mass, if we assume it to have an equal density. It is thus quite likely that in a considerable length of time the total mass of all the asteroids will be sufficient to cause appreciable perturbations of the elements of a neighbouring planet.

In considering the theory of this action, it is assumed that the asteroids are distributed in an elliptical ring round the sun, and by noting the excess of perturbation produced on neighbouring bodies, using Gauss's method for calculating secular perturbations, the mean mass of the ring is found to be = 1/37,130,000 the sun's mass, or = 1/115 the earth's mass.

VARIABLE STARS.—Harvard College Observatory *Circular*, No. 7, gives particulars of the discovery of seven new variables, and also of the confirmation of variability in three stars previously suspected by other observers. Three of the variables have spectra of the *third* type, showing also bright hydrogen lines. Three others have spectra of the *fourth* type. The star −33° 14076 was found to be variable by Colonel E. E. Markwick, of Gibraltar, but no photographic confirmation was obtained until Mrs. Fleming ascertained that a star having a peculiar spectrum was identical with this. Detailed examination of all the plates of this region, eighty-nine in number, then showed it to vary in magnitude from 11·3 to 6·4. The spectrum of the star has bright lines which show evidence of change.

A large number of observations has been made with the meridian photometer to determine the forms of the light curves of variable stars of the Algol type. S. Antliæ has usually been regarded as belonging to this class, and is specially interesting on account of its short period of 7h. 46·8m., and because it is said to retain its full brightness for *less* than half its period, this last peculiarity being opposed to the probability of the variation being due to a dark eclipsing body. On constructing a curve from a series of 177 measures, the conclusion is that S. Antliæ is not a star of the Algol type, but its light is *constantly* changing, and that it should rather be classed among the variables of the δ Cephei or η Aquilæ type. An interesting feature of the light curve for this star is that the increase of light is slower than the diminution. As this ratio (0·62) in most other short-period variables is from 0·20 to 0·33, there seems reason for dividing the two classes.

The star β Lyræ is commonly regarded as a variable of short period of the same class as the above. "Observations of its spectrum, however, show that two or more bodies, revolving round each other, are present. The light curve found by Argelander may be closely represented by assuming that the primary minimum is caused by the eclipse of the brighter body by the fainter, and the secondary minimum by a similar eclipse of the fainter body by the brighter. This star should therefore be taken from the class of ordinary short-period variables and included among the stars of the Algol type." Lockyer finds, however, that there is evidence of greater complication in the system; and the theory of eclipses alone fails to account satisfactorily for the velocities in the line of sight which are obtained from the measurements of photographs of the spectrum of the star.

AWARD AND PRESENTATION OF THE RUMFORD PREMIUM.

IN conformity with the terms of the gift of Benjamin, Count Rumford, granting a certain fund to the American Academy of Arts and Sciences, the Academy is empowered to make, at any annual meeting, an award of a gold and silver medal, being together of the intrinsic value of three hundred dollars, as a premium to the author of any important discovery or useful improvement in light or in heat, which shall have been made and published by printing, or in any way made known to the public in any part of the continent of America, or any of the American islands; preference being always given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind.

At the annual meeting of 1885, the Academy awarded the Rumford premium to Thomas Alva Edison for his investigations in electric lighting, and the presentation of the medals took place at the meeting of May 13, 1896.

Vice-President Goodale, in presenting the medals, made the following remarks:—

"It would be highly presumptuous for one whose knowledge of physics is of the most elementary character to occupy the time of the Academy by any statement of his own in conveying these medals. Happily such a course is unnecessary. The Chairman of the Rumford Committee has placed at our command a brief statement which makes clear the ground of the award.

"'The Rumford Committee voted, June 22, 1893, that it is desirable to award the Rumford medal to Thomas Alva Edison in recognition of his investigations in the field of electric lighting, and they confirmed this vote on October 9, 1893, in the following words: "Voted for the second time to recommend to the Academy that the Rumford medal be awarded to Thomas Alva Edison for his investigations in electric lighting."

"The Committee reached the conclusion expressed by these votes after long deliberation and after careful sifting of all the evidence which was at their disposal in regard to Mr. Edison's claim for priority in the construction of the incandescent lamp, the conception of the central lighting station together with the multitude of devices, such as the three-wire circuit, the disposition of the electric current feeders, and the necessary methods for maintaining the electric potential constant.

"The Committee felt that they could not decide upon Mr. Edison's claim for priority in any particular invention in this new industry. Indeed, Courts of Law, after prolonged litigation, have found it difficult to decide how far Mr. Edison was in advance of contemporary workers. The task given to the Rumford Committee to decide who is most worthy of the Rumford medal, especially in the field of the application of electricity for the production of light and heat, is not an easy one. The number of investigators is now so large that it is no longer possible, in general, for one man to claim to be the first to apply electricity to a new field. The successful application is the result of many minds working on the same problem. Although the Committee did not feel justified in expressing the opinion that Mr. Edison invented the incandescent carbon filament lamp, or that he was the first to arrange such lamp in multiple on the circuit, thus producing what is popularly termed a subdivision of the electric light, or that the Edison dynamo had greater merits than the machine of Gramme and Siemens and others; still, they are convinced that Mr. Edison gave a great impulse to the new industry, and that he was the first to successfully instal a central electric lighting plant with the multitude of practical devices which are necessary. They believe that this impulse was due to his indefatigable application, to his remarkable instinct in whatever relates to the practical application of electric circuits, and to his inventive genius. They, therefore, have unanimously recommended to the Academy to bestow the Rumford medals upon him, feeling that the work of Mr. Edison would especially appeal to the great founder of the medals—Count Rumford—if he were living.

"The Academy has accepted the report of the Rumford Committee, and has voted to confer the gold and the silver medal upon Mr. Edison. The recipient finds it impossible to be present at this meeting of the Academy, and has requested Prof. Trowbridge to act as his proxy and to receive the medals for him.

"In the name of the Academy, I beg you, Prof. Trowbridge, to accept the charge of conveying these medals to Mr. Edison's hands. It would be most ungracious for us who are assembled in this room, which is flooded by this steady and brilliant electric light, to withhold our personal thanks for what Mr. Edison's investigations and practical activities have done for us all. And, hence, I may venture to say that our thanks and all good wishes are to be conveyed with the Rumford medals."

Prof. Trowbridge replied as follows:—

"Mr. President, and gentlemen of the Academy, I accept the medals for Mr. Edison; and at his request I wish to express his deep sense of the great honour the Academy has conferred upon him. His work in the field of electric lighting has been the subject of prolonged litigation, and at times he has had doubts, in reading the opinions of learned experts, whether his work has been original, or whether he had really contributed anything to the world's progress. The recognition of his labours by the American Academy of Arts and Sciences, regarded by Count Rumford in his gifts as the coequal of the Royal Society of London, is, therefore, especially grateful to him. Acting as his proxy, I thank the members of the Academy for the distinction which they have, by their votes, conferred upon him."

CAUSES OF DEATH IN COLLIERY EXPLOSIONS.

A REPORT, by Dr. John Haldane, on the causes of death in colliery explosions, with special reference to the Tylorstown, Brancepeth, and Micklefield explosions, was published in a Blue-book a few days ago. The report contains a vast amount of valuable information on the composition of after-damp, the action on men and lights of the gases present in, or mixed with, after-damp, the action of after-damp, heat and violence, along the track of an explosion, the distribution of after-damp and other gases in a mine after an explosion, the distribution of smoke in underground fires, the positions at which bodies are found after an explosion, and the means of saving life in colliery explosions and fires. To understand the dangers to life after a colliery explosion, and the possibilities of escaping these dangers, it is necessary to have a clear idea of the action, both on men and lamps, of the gases which are likely to be present in the air of the mine. These gases, so far as is known, are carbon dioxide, carbon monoxide, nitrogen, fire-damp, and sulphurous acid. Oxygen may be deficient or absent. Dr. Haldane discusses the effects of these gases *seriatim*, and the information he brings together, as well as his own careful observations, should be valued by colliery managers, while it will certainly interest chemists and physiologists.

In the case of the Tylorstown explosion, which, Dr. Haldane says, was evidently propagated through the three pits by coal-dust, fifty-seven men were killed. Of this number fifty-two, or 91 per cent. of the whole, were killed by after-damp, the remainder being killed instantaneously by violence. In nearly every case of death from after-damp, the parts of the skin or mucous membrane through which the colour of the blood could be observed, had a red or pink colour, instead of being leaden-blue or pale, as is the case in death from any other cause. This reddening, as seen in the face, hands, &c., often gave the bodies an extraordinary appearance of life. There seemed to be only one cause which could account for the carmine red colour of the blood, namely, the presence of carbon monoxide. To make certain, Dr. Haldane examined the blood from two of the bodies on the spot, by means of a spectroscope, and he found that not only was carbon monoxide present, but that the hæmoglobin was nearly saturated with it. A quantitative determination proved that in both bodies the hæmoglobin was 79 per cent. saturated. This result is of special interest, as it shows, for the first time, the percentage saturation of the blood at the moment of death from carbon monoxide poisoning.

The recognition of carbon monoxide in the air of mines is, as Dr. Haldane points out, a matter of much practical importance, and many lives have been lost through ignorance of the fact that the lamps, to which miners trust for the recognition of other gases, give no *direct* indication of carbon monoxide. A simple test, which there is every reason to think might be successfully introduced, is suggested: it is to observe the symptoms of a mouse or other equally small warm-blooded animal, when exposed to the doubtful atmosphere. In small animals the rate at which the blood becomes saturated with carbon monoxide is far more rapid than in man; hence a small animal, such as a mouse, shows the effects of the gas far more rapidly than a man. Practically speaking, the condition of a mouse which has been for a very short time in a poisonous percentage of carbon monoxide, indicates what will be the condition of a man carrying it after a much more prolonged stay in the same atmosphere. With a man at rest it takes about twenty times as long for the man as for the mouse to be distinctly affected by the gas. Dr. Haldane's experiments show distinctly how valuable the indications given by a mouse, or other small animal, would be to men exposed to danger from after-damp. It is therefore suggested that a few white mice might easily be kept for this purpose in the engine-room at the top of the downcast shaft, and be taken down in small cages by the rescue party.

Another point to which attention may briefly be directed is the colour-test described by Dr. Haldane for use in post-mortem examinations as a criterion for carbon monoxide poisoning. A drop of the blood of the subject is diluted with about 100 times its volume of water, and is compared with a solution of normal blood, and with a similar solution saturated with coal-gas. According to the percentage saturation of the sample of blood under examination, the tint of the first solution will approach to that of the normal blood, or of the blood saturated with coal-gas (that is, with carbon monoxide), and a rough estimate may be made of the percentage saturations. The test is said to be more delicate than that with the spectroscope.

INDIVIDUALITY IN THE MINERAL KINGDOM.[1]

IT might be expected of a new Professor that in his inaugural address he should avail himself of the possibly unique opportunity of an audience, and should give some account of his science and of the manner in which he proposes to teach it. In that case he would doubtless claim for his own subject that it is the most fascinating and the most important of all branches of human knowledge; he would doubtless, also, proceed to prove, to his own satisfaction, that it should be a necessary feature in any system of education.

It is well known that every specialist has an exaggerated view of the importance of his own subject; a view which is no doubt largely due to his ignorance of all others. I am deeply conscious of sharing this failing, and therefore do not propose to give any laboured account of mineralogical science; instead of stating exactly what in my opinion should be taught in this university, I will rather state presently what I think should not be taught; instead of attempting to *prove* that mineralogy possesses a true educational value, I will assume that this may be accepted without further argument from the very fact that it is recognised by the University.

[1] An inaugural lecture delivered at the University Museum, Oxford, by Henry A. Miers, F.R.S., Waynflete Professor of Mineralogy.

Perhaps none of the sciences is more of a special subject than mineralogy, in this sense—that it is familiar to few besides those who have made it their particular study; for this reason I may be pardoned if I assume total ignorance on the part of my hearers, and begin by removing a confusion which may possibly exist in the minds of many.

Mineralogy is not crystallography. Mineralogy is the study of minerals in all their relations, and from every point of view; it is a branch of natural history; the study of one class of natural objects, namely, all the inorganic parts of the earth, which we are accustomed to class together as the Mineral Kingdom. Crystallography, on the other hand, is a distinct science, and is the study of matter in the crystalline state, not being by any means confined to minerals; it is, like physics, or chemistry, or geology, one of the sciences whose aid is invoked in the study of minerals.

Since, however, the finest and most interesting examples of crystals have been found in the mineral kingdom, this study has been, by common consent, annexed by the mineralogist, and instruction in crystallography has been left entirely to him. The result has been in some ways disastrous; crystallography is in reality as essential to the student of chemistry or of physics as it is to the mineralogist, and yet remains in general a sealed book to them. They have been reluctant to go to the mineralogist for information, and consequently they have failed to make the acquaintance of crystallography. In this connection I may quote the forcible words of Mr. Lazarus Fletcher: "It seems obvious," he says in an address delivered a few years ago, "that in a satisfactory system of education every chemist should be taught how to measure and describe the crystalline characters of the products which it is his fate to call into existence. A knowledge of the elements of crystallography, including the mechanics of crystal-measurement, ought to be made a *sine quâ non* for a degree in chemistry at every university."

To this I would add that crystallography is not merely a matter of theoretical interest to the chemist, but is absolutely essential for the practical determination and description of any compound. It will scarcely be believed that there is only one teaching institution in the British Isles where crystallography forms a necessary part of the chemical student's course, namely the Central Technical College in London, where I was invited some years ago by Prof. Armstrong to found a class in the subject, and where excellent work is now being done by Mr. Pope. That it is found necessary to insist upon this study in a technical college of all places in the world is surely a remarkable confession that this, like every pure science, is far from being devoid of practical application.

If we turn now to mineralogy proper, the practical value of this science is obvious without any explanation.

In mining and metallurgy we have subjects of vast commercial importance in which a knowledge of scientific mineralogy is most desirable.

In particular it would be a great advantage to this country if all who are sent out to hold official positions in new or distant lands, could receive some previous instruction in the study of minerals which are of economic importance. We should not then hear of ruby companies formed through sheer ignorance to exploit what subsequently proved to be red garnets, neither would valuable ore deposits be overlooked for years simply because no one among the early settlers was familiar with the aspect of the common metallic minerals. I have no doubt that a course of lectures upon the detection of gold, silver, and precious stones, would prove attractive even in Oxford in these days of mining adventure and speculation, and I would not deny that they might be of some service to those whose future work lies in India or the colonies, or to those who travel in little-known regions. But I feel very strongly that our business here is with general education, and that the later the date in any educational system to which extreme specialisation or technical training can be postponed the better it will be for the student.

For this reason mining and metallurgy, which belong to technical education, have in my opinion no more place in such a university as this than any other branch of industrial or applied science. We do not seek here in the matter of practical engineering to compete with the great engineering workshops, or in the matter of clinical instruction with the great London hospitals; and in the same way, we should no more expect or desire to compete here with mining or metallurgical schools than to teach the jeweller's art.

A university can best serve the cause of technical education by teaching precisely those features of any science which can not well be learnt in later life, and yet are the very foundation of practical knowledge; to the engineer his abstract mathematics and physics, to the medical man his physiology and comparative anatomy. Nothing can better illustrate the enormous value to the manufacturer, for example, of a sound training in pure science than the manner in which Germany has taken the lead in certain chemical industries owing to the excellent scientific instruction received at the universities by the men employed in those industries. Or, to take another instance, it has been confessed by the electrical engineers that the marvellous rapidity with which their industry has grown is largely due to the fact that the mathematical theory had been mainly elaborated before electrical science found its application; there can be no doubt that years of blundering were saved by this fact, for the form and structure of the mechanism required could be almost from the first worked out by well-established principles instead of blind trials.

In the same way I believe that the study of scientific mineralogy has a very considerable value, both educational and practical.

For the successful pursuit of this science a student must combine no inconsiderable knowledge of chemistry, physics and crystallography, and must therefore be to some extent familiar with certain branches of mathematics; if he is further to study the interesting problems of the origin, growth and changes of minerals, he must also be acquainted with the kindred science of geology. There is no fear lest a student of mineralogy should too early become a specialist; as a branch of natural history his science encourages habits of minute observation, as an experimental science it involves accurate physical and chemical work. I am speaking, it will be understood, of scientific mineralogy, the study of the nature and properties of minerals in themselves quite independently of their uses and applications; one who is a master of these matters will not be slow to find the applications.

My predecessor in this chair always set before himself this high ideal, and during a period of forty years endeavoured to kindle among those who attended his lectures an interest in the more purely scientific aspects of mineralogy. As one of his pupils who, having conceived some degree of enthusiasm for the subject, was greatly encouraged by his inspiration, I am glad to have this opportunity of acknowledging my gratitude to Prof. Story-Maskelyne for directing the thoughts of his students in the ways of pure science; I believe it to be the proper course to pursue in the higher teaching at a university.

In this connection I should have been glad to devote the present address to the elucidation of a certain feature in mineralogy which has an educational interest; the fact, namely, that the order in which a subject can best be unfolded before a student's mind is very satisfactorily marked out by the historical development of the subject; that a profitable course of teaching is suggested by the history of a science; and that the order in which problems have presented themselves to successive generations is the order in which they may be most naturally presented to the individual.

It is a principle which comes out very forcibly in the case of mineralogy, and it may, for aught I know, be equally characteristic of other sciences.

First would come the examination of stones by all sorts of simple means; the study of the external characters by which they may be recognised; their colour and lustre; their hardness and weightiness; the methods of recognition employed by the miner; the system of study, in fact, which prevailed in the early part of the century, when the genius of Werner drew students from all parts of Europe to the Mining Academy of Freiberg; a system known as the natural history method. This is an exercise admirably adapted to train the faculty of inquisitive and careful observation in the schoolboy, and in my opinion should be unnecessary in the higher teaching of the science, although it does in an incongruous manner survive therein throughout the German and other universities.

Next, by a transition through the simpler chemical tests, the learner is led to the refined chemical analysis of minerals; a study to which far too little attention is paid at the present day, yet one from which the most fruitful results are to be expected.

Finally, as an inquiry suitable for the most advanced students, follows the investigation by exact methods of the internal structure and constitution of minerals; leading to such researches as are now being prosecuted in Oxford with remarkable success by Mr. Tutton.

Nothing can be more suggestive, from the educational point of view, than the curious history of mineralogy. An excellent account of the early phases is given in the "History and the Philosophy of the Inductive Sciences" of Whewell, who was, it will be remembered, Professor of Mineralogy at Cambridge before he became Professor of Moral Philosophy. But to dilate on these matters would be to do what I have already undertaken to avoid, to celebrate the educational virtues of my own science.

In choosing a subject to which I could more particularly devote an inaugural lecture, I have thought that one which is both interesting and suggestive, even from the scientific point of view, is to be found in the beauty of minerals. No one can glance through a collection of minerals, such as that which adorns this museum, without being impressed by their varied beauty of form and of colour; no one can read what has been written on the subject by Ruskin, without feeling that in their æsthetic aspect they possess a singular fascination. We are perhaps more familiar with them when they have been wrought into beautiful objects by the art of man; the beauty of marble and serpentine, of malachite and lapis lazuli, among decorative stones; that of sapphire and emerald and opal, among jewels; or of onyx and agate, among the less precious gem stones, is known to all. Yet their beauty is mainly that of the minerals themselves, and the hand of the artist does little more than make it visible. Few perhaps, save those who have had personal experience among minerals, are aware of their intrinsic beauty; let any visitor to a museum spend one half-hour among the mineral cabinets, and he will find his reward in the purely æsthetic pleasure to be derived from the contemplation of objects unrivalled in beauty of form and colour. The magnificent collection preserved in the British Museum is, of course, that from which the greatest pleasure can be derived; and in that collection there are no more interesting objects than the fine agates and chalcedonies brought together by Mr. Ruskin with the special purpose of illustrating their beauty of colour and structure. But even in a comparatively small collection like that of our university, there is much that will attract and gratify the eye.

Confronted by this wealth of beauty and interest, the reflective mind is led to propose to itself the question, What is the origin, and what is the object of all this beauty? what purpose does it serve in the economy of nature? In the beauty of the organic world it is possible to imagine both an origin and a purpose. The origin may conceivably be sought in utility. Even if it be denied that in the organic kingdom beautiful objects, whether plants, animals, or human beings, have become useful because they are beautiful, it may, at any rate, be suggested that they appear beautiful because they are useful. But in the mineral world it is altogether different; these wonderful spars and gems, with their infinite variety of form and colour, their intricate groupings of silky fibres and pearly flakes, may have been for ages hidden in dark recesses of the earth where they have led an unchanging existence; and when they are brought to the light of day for the use of mankind, we can admire their beauty, but we cannot see any purpose for which, or any process by which it has been acquired. It may be answered that herein is no cause for surprise; that there is no reason why inanimate objects should not be both beautiful and interesting in themselves apart from any teleological aspect; that, indeed, it is gratifying to find a branch of natural science into which utilitarian considerations do not enter. This may be so, but nevertheless the fact indicates a very remarkable distinction between minerals and other natural objects.

Let us pursue to its conclusion the inquiry which we have provoked, and see whither it leads us.

In the first place, I would point out that the distinction relates not only to the beauty, but to all the properties of minerals; we may equally inquire about them: What is their origin and what is their object? What purpose do they serve in the economy of nature? They have not been acquired by selection, they do not impart any advantage to the mineral itself.

The contrast between minerals on the one side, and animals and plants on the other, is very obvious. There is with the former no change or development, neither progress nor degeneration; no survival of the fittest, no variation of characters. They are perfect and complete, each in itself, immutable and immortal. No struggle for existence takes place in the mineral world as it does among the individuals of the animal and vegetable kingdoms.

It may be answered that this is natural, for such individuals do not exist in the mineral kingdom. In other objects which possess no individuality there is also no progress, and it is absurd to look for any development among ores, and stones, and rocks. That, however, is not so obvious.

Individuals exist in the mineral kingdom just as truly as they exist among animals and plants; each crystal is a distinct individual, capable of growth by itself, and independent of its fellows; each pursues its own existence; it is even in a sense capable of multiplication, for if a crystal growing from solution be broken in two, each half continues to grow as a distinct individual resembling in all respects the parent crystal.

Mutilate a growing crystal by breaking away one of its corners or edges, it will heal the fracture, restore the missing fragment, and become again a perfect crystal; thus asserting its individuality in an even more persistent manner than many a living organism. The experiment is one which may easily be performed with a crystal of alum.

Hence if a definition of life, or a distinction between organic and inorganic be based upon individuality, as it often has been, it will be exceedingly difficult to exclude crystals. This is precisely what many philosophical writers have found. One or two examples will suffice.

Schopenhauer, for instance, after stating that "in the inorganic kingdom of nature all individuality disappears," is obliged to confess that "the crystal alone is to be regarded as to a certain extent individual"; "in the forming of a crystal we see as it were a tendency towards an attempt at life." Having made this admission he goes on to say: "The crystal has only one manifestation of life, crystallisation, which afterwards has its fully adequate and exhaustive expression in the rigid form—the corpse of that momentary life." There is a constant tendency among philosophical writers to suggest that this individuality implies some relationship between life and crystallisation.

To take another illustration: St. George Mivart says that "in crystals and such forms as dolomite and spathic iron we have an adumbration of organic forms." There is a dubiously expressed feeling, even among writers upon evolution, that crystals may to some extent bridge over the great chasm between living and non-living objects.

Most striking and most surprising of the utterances upon this subject which I have encountered, considering its author, is a remark by Huxley in an article upon the origin of species, in which he says:—

"The inorganic world certainly has its metamorphoses and, very probably, a long Entwickelungsgeschichte out of a nebular blastema. Who knows how far that amount of likeness among sets of minerals in virtue of which they are now grouped into families and orders, may not be the expression of the common conditions to which that particular patch of nebulous fog which may have been constituted by their atoms, *and of which they may be in the strictest sense the descendants*, was subjected?"

What we are really led to see when we pursue further the comparison between minerals and organisms is not a resemblance, but an irreconcilable difference.

In the mineral world the forces of nature act upon the individual without producing any modification.

It is true that by chemical processes a crystal of olivine may have some of its constituents taken from it, and others added to it, whereby it becomes a totally different mineral, serpentine. Or by exposure to the air, a crystal of felspar is converted into crystals of a totally different mineral, china-clay; but until it is destroyed, there is no change or progress of the individual. Each remains, like Bishop Blougram, "calm and complete, determinately fixed, to-day, to-morrow and for ever." There is no response to external stimulus, no adaptation to environment.

The properties, the form, the beauty of living beings are due to continual interaction between external forces and the organism itself. In the organic world the teleological aspect, I imagine, can never be lost from sight; each individual works for its own salvation; unceasing change involves either unceasing progress or degradation. With the mineral this is not so. A crystal of natural quartz has doubtless been the same and has possessed the same properties for countless ages.

In an ever-changing world the crystal is a type of unchanging constancy—its properties remain as permanent as those of the very elements themselves.

The crystal and the organism differ herein, that in studying the latter we have to take into account not only the unknown properties of the organism itself, but the nature of its environment and the character of the forces to which it is subjected; whereas in studying the mineral, we find that its properties express only the nature of the crystal in itself, and are therefore the same whatever may be the conditions of its growth and existence.

When we pass from the crystal even to other inanimate objects, this is no longer the case; the beauty, the form, the characters of any other natural objects are the result partly of their inherent properties and partly of the forces which act upon them. They have been, to some extent at least, moulded by their environment. The form of a mountain is due partly to the nature of the rock of which it consists, partly to the action of the wind, the water, and the weather to which it is exposed. The curve of a coast-line and the contour of its cliffs are to be attributed partly to the durability or the weakness of the chalk or the slate of which it is composed, but partly also to the sweep of the prevalent currents, the direction of the winds, and the rise and fall of the tide.

In no character is this more conspicuous than in symmetry of form and character.

The symmetry of living things is obviously due largely to their environment or to their movement. The symmetry of a tree depends upon the fact that the conditions under which a root grows are different from those which prevail where the branches spread; the symmetry of a fish is intimately connected with the fact that it swims in one direction; the bilateral symmetry of a man can be, I presume, referred to a similar cause. There is no inherent symmetry which is absolutely independent of external force. Vary the conditions, and the symmetry of the organism is varied in response. But in the mineral it is otherwise—the symmetry is essential and inherent; it belongs to the mineral quite independently of external forces. In the study of crystals we are in an altogether unique manner brought face to face with the nature of the thing in itself; surely an uniquely interesting subject for study.

But the contrast can be pursued still further.

The symmetry of crystals is expressed not only in their external form, but in all their properties internal as well as external. They have been the object of much attention on the part of careful experimentalists using the most refined methods of modern physics, and the result has been to establish this fact in the most unmistakable manner. Their symmetry is one not only of external form, but of internal structure. Further it is of a peculiar character, which entirely differentiates crystals from all other things animate or inanimate. It absolutely distinguishes the crystalline individual from the organism. No crystal has the symmetry of any organism, no organism has the symmetry of any crystal.

The latter has recently been the subject of much geometrical investigation, which is probably unknown to others than mineralogists, and a very interesting and suggestive discovery has been made by geometers working independently in Germany, France, Russia and England. The physical study of crystals, their action upon heat, light and electricity, has disclosed another remarkable feature characteristic of them. They are without exception homogeneous. At any point within a crystal its properties are absolutely the same as those at any other point within the same individual. This must be due to homogeneity of structure.

Just as a man walking in an orchard of identical trees planted in a regular geometrical manner, the Roman quincunx for example, would not be able to distinguish one part of the orchard from another by reason of its homogeneity, so we must imagine that Clerk Maxwell's demon, able to transport himself from one point to another within a crystal among the crowd of molecules, or particles, or whatever they may be of which it consists, would not be able to distinguish the one spot from the other.

The geometricians have therefore inquired in what manner such a homogeneous structure can be symmetrical.

In other words, if you take an infinite number of identical things, no matter what they be—molecules, portions of matter, systems of forces, or anything else—and range them side by side, either parallel to each other, or facing different ways, or turned inside out; provided only they are so arranged that the distribution at any one part of the mass is the same as at every other part, what will be their symmetry? This is a purely geometrical problem. The solution leads in the most remarkable way to precisely that sort of symmetry which is characteristic of crystals and of nothing else. Hence it follows that the symmetry of crystals results from their homogeneity, and is not an independent feature.

The result of our inquiry has been, therefore, not to suggest any fanciful resemblance between life and crystallisation, but to disclose a fundamental difference; not to bridge over the chasm between animate and inanimate objects, but to widen the gulf.

Crystals are symmetrical individuals by virtue of their homogeneity. Organisms cannot be homogeneous in the same sense, or they would possess the symmetry of crystals. One is led to conclude that the organic individual is never homogeneous, but consists of parts which are essentially different, just as the head is different from the body, the leaf from the stem, or the shell from the kernel.

This I imagine to be the result to which biologists have been led by quite independent reasoning; every organic individual, even the simplest possible individual, the cell, whether animal or vegetable, consists of parts which are different; a nucleus, for example, and something distinct from the nucleus.

We may even proceed a step further, for more is implied in this homogeneity than mere similarity of parts. It is also necessary that the parts should not change places. A gas may be homogeneous by virtue of the rapid and irregular movements of its particles; it may be the same at every point, because it is throughout devoid of any orderly arrangement. But this is not the sort of homogeneity which leads to crystalline symmetry. In the case of crystals there can be no taking the average of crowds of irregularly moving particles, such as forms the basis of the kinetic theory of gases; there can be no talk of a drifting of Lucretian atoms, although this was actually put forward as a theory of crystal structure some years ago.

Lord Kelvin's Boyle lecture on crystal tactics, which was delivered in this very room three years ago, dealt with these subjects, and it will be remembered that a crystal was in that lecture regarded as constructed of a number of bodies placed side by side in regular order, and all facing the same way. There can be no doubt that the ultimate particles of a crystal are really in motion, but their motions must be so circumscribed that none encroaches upon its neighbour, and the crystal may therefore be regarded as constructed of immovable units. In contrast with this, I imagine that any organism, even any organic cell, consists of parts which are not only different, but possess differential motions; this fact is indicated, I presume, by the life of any organism, and its growth by intussusception.

Our final conclusion is, therefore, that the symmetry of a mineral differs entirely from that of an organism, and is due to its homogenity and the fixity of its parts. We have been led to something resembling, in some degree, the Homœomeria of Anaxagoras.

It is remarkable that the earliest writer concerning minerals, whose works have survived, uses language which might almost be applied to the discoveries of yesterday; Theophrastus, in his treatise on stones, says that the crystal must be regarded as formed by the concretion of matter pure and equal in its constituent parts, ἐκ καθαρᾶς τινὸς συνεστάναι καὶ ὁμαλῆς ὕλης.

Among modern writers, Herbert Spencer has most explicitly stated that there is some such distinction between living and non-living things. He says: "Matter has two solid states, distinguished as colloid and crystalloid, of which the first is stable and the second unstable. Organic matter has the peculiarity that its molecules are aggregated into the colloid and not into the crystalloid arrangement." This almost amounts to saying that matter which lives cannot crystallise, and that crystallisable matter cannot live.

You will now see that the inquiry with which we began has led us far from our starting-point, and that, under the guise of some reflections upon the beauty of minerals, I have really been inflicting upon you a dissertation upon one of the most abstruse problems of mathematical crystallography—that concerning the ultimate structure of crystals.

You will also see that having proposed the question—What is the origin and purpose of mineral beauty?—I have not been so foolish as to attempt an answer, or to explain why minerals are beautiful, but have merely asserted that their beauty, like all their other properties, cannot have been acquired, and that in this they differ from living things.

My object in venturing on this difficult subject was two-fold. In the first place, I was anxious to show that mineralogy, taken even on its most abstract and most highly specialised side, overlaps other sciences, even biology, with which it might be expected to possess absolutely nothing in common. It brings us face to face with problems relating to the nature of life. Those who study the nature of living things cannot afford to ignore the nature of crystals, any more than those who study the nature of crystals can ignore that of living things.

If to the chemist and physicist some knowledge of crystallography is an absolute necessity, to the biologist it is at any rate a matter of interest.

Those who heard Lord Kelvin's Boyle lecture will have realised both the importance and the difficulty of these speculations relating to the ultimate structure of crystals; speculations which have attracted the keenest interest among many acute thinkers.

It is often forgotten that the earliest scientific work of the great Frenchman, whose name is associated with some of the most magnificent biological discoveries of the age, was in this direction. Pasteur was, at the very outset of his career, attracted by the relation between crystallisation and life. He imagined that in a peculiar mode of symmetry which he discovered in certain crystals, he had found an essential difference between living and non-living material, and that only such crystals as present this particular symmetry are the products of life. It has now been proved that such a symmetry is one which results from crystalline homogeneity, and is therefore proper to crystals; but the interesting fact remains that Pasteur entered upon his study of organisms by the way of crystallography, and that the one was inextricably bound up with the other.

Buckle saw in the history of mineralogy the strongest confirmation of his own views upon organic life. He regarded the early discoveries of the great French mineralogist Haüy, concerning the form and structure of crystals, as one of the most important contributions "to the magnificent idea that everything which occurs is regulated by law, and that confusion and disorder are impossible." Referring to the remarkable power possessed by crystals, in common with animals, of repairing their own injuries, he says: "However paradoxical such a notion may be, it is certain that symmetry is to crystals what health is to animals. When therefore the minds of men became familiarised with the great truth that in the mineral kingdom there is, properly speaking, no irregularity, it became more easy for them to grasp the still higher truth that the same principle holds good of the animal kingdom."

And this leads me to the second reason which I had for selecting my subject, namely, the excellent illustration which it affords of the manner in which each branch of human thought not only overlaps every other, but requires its support.

If philosophic writers can illustrate their views by misleading statements, it is because their illustrations are drawn from subjects with which they have little personal acquaintance, and because they have not consulted those who have made a special study of such subjects. It seems to me that here in Oxford, above all places, more might be done in the matter of mutual assistance, and I am thinking not so much of the aid which might be given by science to philosophy, as of the benefits which philosophy might confer upon science.

I have chosen for my text an instance in which philosophic writers have confused two very different things—the individuality of organisms, and the individuality of crystals, owing to their imperfect acquaintance with the latter. It would have been much easier and far more amusing to select instances in which the scientific specialist has fallen into worse confusion owing to his want of philosophic training.

In Oxford, with our magnificent school of Literæ Humaniores, it seems disastrous that the science student should not receive some of the crumbs that fall from her bounteous table—some encouragement to that philosophic habit of thought in which he acquires far too little training. I can only speak as a specialist, but with the knowledge of what my own subject has suffered through this need, and with the suspicion that this is equally the case with others. It is not for me to suggest how such an object could best be attained; but even if questions were asked in the final school of natural science which would encourage attendance at certain lectures on philosophy, I believe that science students would gain much thereby. It would, no doubt, be equally profitable for the philosophic student to gain some insight into the matters and methods of modern science.

I will conclude by quoting what Goethe has said about crystallography. "It is," he says, "not productive; it exists for itself alone, and leads to no results. The mind derives from it within limits a certain pleasure of satisfaction; its details are so manifold that it may be said to be in exhaustible." "For this reason," he adds, "it has powerfully attracted the acutest intellects, and has kept firm hold upon them."

As regards the want of practical application in this science, the words of Goethe are no longer true. Elsewhere he says: "There is a flavour of the monk or the old bachelor about crystallography, and therefore it is self-sufficient. Practical application in life it has none; its rarest objects—the crystallised precious stones—have to be cut and polished before we can adorn our ladies with them." But you will remember that crystallography means now much more than the study of external form; what is done by the lapidary is really much what is done by the scientific investigator—the result in both cases is to reveal the inherent but hidden beauty of the crystal.

It is, however, very true that there is a self-sufficiency about the science, and for a reason which I have already indicated: crystals can be considered as things which exist for themselves, since their nature is independent of their surroundings.

The philosophic contemplation of these beautiful and unchanging objects among the fleeting scenes of a restless world, does bring with it a philosophic content. Nowhere is the evidence of the permanent order that prevails in nature written in more lustrous and indelible characters than in the mineral kingdom.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE University of Utrecht has just celebrated its 260th anniversary by a series of brilliant *fêtes*.

MR. JOHN R. FELLOWS, of New York City, has given 5000 dols. to Notre Dame University to found scholarships.

THE University of Virginia, which suffered serious damage by fire last autumn, is being rebuilt on the plans of its founder, Thomas Jefferson, friends having subscribed a fund of 250,000 dols. for that purpose.

DR. FRANK P. GRAVES, of Brooklyn, has been unanimously elected president of the State University of Wyoming, located at Laramie. President Graves was born in 1869, and is probably the youngest college president in America.

THE *Electrical Review* states that the Baden Chamber has voted £30,000 to the Technical High School at Karlsruhe, to build a new electro-technical institute. The whole cost of the building projected, exclusive of the cost of the land, is estimated to be about £25,000. The building is to be commenced immediately, and it is expected to be ready for occupation in two years.

THE following are among recent announcements:—Dr. Paul Eisler to be professor of anatomy in the University of Halle; Dr. L. Joubin to be professor of zoology in the Faculty of Science at Rennes; Dr. H. Prous to be professor of zoology in the Faculty of Science in Lille; Dr. J. A. Wislicenus to be professor at the School of Forestry at Tarandt; Dr. G. Frege to be professor of mathematics at the University of Jena; Dr. H. Klinger to be professor of pharmaceutical chemistry in the University of Königsberg, and Dr. Scholl to be assistant professor of chemistry at Karlsruhe.

FOR the evening exhibitions in science and technology offered for competition by the Technical Education Board of the London County Council in April last, and the awards of which have recently been published, 285 candidates entered as compared with 256 last year. There is a similar increase in the number of awards, there being eighty-eight as compared with seventy-seven last session. The examiners' report: "The most noticeable feature was that the performance of candidates who selected such practical subjects as building construction, machine construction, plumbing, metal plate work, &c., was greatly superior, as a rule, to that of candidates who selected branches of pure or experimental science such as mathematics, physics, chemistry, &c." The second conspicuous fact brought to light is the complete want of ability on the part of most of the industrial candidates to deal with the simplest applications of arithmetic to their own trades. This is an old complaint of teachers of technical subjects, and the pity is that it seems as just now as ever. The children from elementary schools leave off their tuition with no knowledge of the principles of arithmetic, though some of them are experts in working ordinary "rules" as they learn to call them. The majority of the successful candidates consist of men engaged in engineering, building, carpentering and plumbing trades. It is to be hoped that one result of their work during the coming session will be to introduce them to those general principles of science on a knowledge of which a successful career in their various avocations most certainly depends.

A BRIEF history of the City and Guilds of London Institute has been received. A glance through the pamphlet should be enough to make members of the Corporation and Liver Companies of London proud of the part they have played in th advancement of technical education in this country since 1876 when, at a meeting of representatives of Livery Companies, was resolved: "That it is desirable that the attention of the Livery Companies be directed to the promotion of education not only in the metropolis but throughout the country, and especially to technical education, with the view of educating young artisans and others in the scientific and artistic branches of their trades." It was this resolution which led to the foundation of the Institute in 1878. A few years later the Central Technical College—than which there is no more efficient institution for teaching the relations of science to industrial processes—was established. Other Colleges connected with the Institute are the Technical College, Finsbury, the South London Technical Art School, and the Leather Trades School. A very important part of the Institute's work consists of the technological examinations. These examinations have become a powerful agency in encouraging the establishment of technical schools and classes throughout the country, in assisting County Councils and other bodies in the organisation of their local schools and classes, and in securing the useful expenditure of the grants placed at their disposal under the Local Taxation Act, 1890. In 1881 the number of students in attendance at these classes was only 2500, but last year it reached 24,920. The Institute also takes part in establishing and assisting experimental classes in manual training, wood-work and metal-work, cookery, laundry-work, and housewifery, for boys and girls in elementary schools. For this provision and organisation of technical education in the metropolis and in the provinces, the total amount subscribed by the Livery Companies during the past eighteen years is, in round figures, £480,000, of which £150,000 has been expended on buildings and equipment, and the remainder on maintenance, scholarships, prizes, and grants-in-aid. The splendid work done by the various branches of the Institute more than justifies this expenditure.

ON Friday last the Prince of Wales was installed as Chancellor of the National University of Wales; and a large and brilliant company assembled at Aberystwith to witness this crowning of the movement for which educational pioneers in Wales have worked so zealously. After the installation, honorary degrees were conferred upon the Princess of Wales, Mr. Gladstone, Lord Herschell, and Lord Spencer. The three colleges comprised in the new University—Aberystwith, Cardiff, and Bangor—have all been founded within the last five-and-twenty years, and sums amounting to nearly £200,000 have been subscribed to support them. The Welsh people have from very early times shown a desire for knowledge, and now they have a truly national University they will doubtless take still greater pride in developing their heritage. The Vice-Chancellor, Principal J. Viriamu Jones, F.R.S., told the history of the foundation of the University to the Welsh National Society of Liverpool in November last, and a copy of his address, which is published at the offices of the *Western Mail*, Cardiff, was received a few days ago. The need for the University definitely emerged from a proposal adopted by the Cymmrodorion Section of the National Eisteddfod in 1887, that teachers in elementary schools should be trained at the University Colleges. The need was again felt when the Welsh Intermediate Education Bill became law in 1889, for a question which had to be considered in connection with the Bill was the nature and constitution of the authority to which the work of inspecting and examining the intermediate schools should be committed. For these reasons, and because educational pioneers in Wales felt that the existence of a national University was essential to the vitality of the colleges, the foundation of such a University was urged nine years ago, and now what was then ideal has become a fact. Some remarks by Principal Jones on the functions of a teaching University such as that of Wales are not without interest to those who cherish the hope that a teaching University of London may eventually be established. He says:—"It is certainly part of the ideal of any university institution that its professors should be leaders in the departments of scholarship or science which they profess, and that, as such, they should help to frame the courses of study leading to graduation.

Colleges incorporated in a teaching university have this opportunity. Originality of thought has fuller encouragement, and new educational methods have freer play than can possibly be the case in a college of which the students have no other avenue to a university degree than examination by a wholly external examining body like the University of London, however excellent be the conduct of its examinations. An atmosphere of intellectual independence is of the essence of true academic life. The true scholar must breathe it as his native air. And this is not the language of mere theory. It has its immediate practical application on the scientific side. The trained student of science, for instance, entering on manufacturing pursuits should do so with free inquiring eye, ready to believe that it may have been reserved for him to make a discovery of immense value to the industry to which he is devoting himself. I believe that this freedom of spirit is far more likely to be developed and fostered in a teaching university than in a college bound to teach on certain rigid lines laid down by an authority in which it has no part." The first object of the founders of the University of Wales is to ensure that all students of the University shall receive good teaching and thorough training before proceeding to graduation. By this means the University will be made a real force for the advancement of learning in the Principality.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, vol. ii. No. 8, May 1896.—"The Arithmetising of Mathematics" is an excellent translation, by Miss Maddison, of Bryn Mawr College, of an address delivered by Prof. Felix Klein, before the public meeting of the Royal Academy of Sciences of Göttingen, on November 2 of last year. In it Prof. Klein explains his position in regard to an important mathematical tendency which he remarks has for its chief exponent Weierstrass, whose eightieth birthday has been lately celebrated. This tendency he calls the *arithmetising* of mathematics. Like all the author's addresses, this one, now rendered easily accessible to English mathematicians, will repay study.—Next follow three carefully drawn-up reviews, viz. by R. A. Roberts, on a second edition of Darboux's classic treatise, "Sur une classe remarquable de Courbes et de surfaces Algébriques et sur la théorie des Imaginaires." It is matter of regret, Mr. Roberts says, that the author has not devoted some more time to a subject which offered him once such a fruitful field for original investigation.—Then Prof. Bôcher examines in detail the "Treatise on Bessel Functions, and their Applications to Physics," by Messrs. Gray and Mathews. He well shows that the writers have by their work filled a real gap in mathematical literature.—In his notice of Miss Scott's "Introductory Account of certain Modern Ideas and Methods in Plane Analytical Geometry," Prof. F. N. Cole states it to be a minor excellence of the book that it is written in the English of English speaking and writing people, *i.e.* there are no abbreviations, and such like, which necessitate constant reference to a "list of signs," &c. He looks upon Miss Scott's performance as a compact, scholarly work on the more accessible principles and methods of modern analytical geometry. "It exhibits to a marked degree that genial breadth of treatment and conciseness which are associated only with mature scholarship and extensive and accurate information." His summing-up of warm approval is that he knows of no introductory work which is better adapted, in the particulars he indicates, for the use of those who desire not merely to learn, but also to master geometry.—Prof. H. B. Newson, in a note on "A Remarkable Covariant of a System of Quantics," calls attention to a covariant of a system of n quantics in n homogeneous variables. He states two important geometric properties of this covariant which, *pro tem.*, he calls the Cremonian. (1) The Cremonian of U, V, and W is the locus of the point (x', y', z') whose first polars with respect to U, V, and W have a common point; the locus of these common points is, of course, the Jacobian. (2) The Cremonian of U, V, and W is also the locus of (x, y, z) the point of intersection of the polar lines of (x', y', z'), with respect to U, V, and W, *i.e.* it is the locus of the point of intersection of the polar lines of the points on the Jacobian. The author gives other results of interest, and hints at an extension of the conception of the Cremonian to spaces of higher dimensions.—Much interesting matter is given in the Notes, and a list of recent publications fills up a big number of 44 pages, in place of the usual 32 pages.

Symons's Monthly Meteorological Magazine, June.—The worst gale of the nineteenth century in the English Midlands (continued). A map is given showing the path of the storm from South Wales to Lincolnshire between 11 a.m. and 4 p.m. on Sunday, March 24, 1895. The average velocity of translation was about sixty miles an hour, and the disturbance appears to have been caused by a subsidiary depression formed over the south of Ireland, during a well-marked cyclone which lay over the northern parts of our islands on the same day. Great disaster was caused along its track, and fourteen deaths were reported. There were also more than a dozen cases of windows and gables being blown *out*, owing to the expansion of air inside the buildings during the passage of diminished atmospheric pressure.—Fog, mist and haze, by a Fellow of the Royal Meteorological Society. This is a continuation of the discussion raised in the preceding number of the *Magazine* (NATURE, June 4, p. 118). The writer agrees generally with the definitions proposed, as a practical scheme, based on a correct view of the phenomena, but he thinks that the difference between fog and mist should not rest upon what can be seen with the naked eye—a test in which two persons would be very apt to disagree.

THE enlarged issue of the *Journal of Botany* still continues to be occupied almost entirely with papers on descriptive botany, and chiefly relating to the flora of the British Isles. In the numbers for May and June, Prof. R. Chodat describes some new species of *Polygala* from South Africa; and Mr. W. H. Pearson a new liverwort, *Plagiochila Stableri*, from Rydal.

THE papers in the *Nuovo Giornale Botanico Italiano* for April, and in the *Bulletino della Società Botanica Italiana*, Nos. 2–4, relate almost entirely to the flora of Italy. In the former, Signor S. Sommier describes and figures an interesting hybrid between *Ophrys bombyliflora* and *O. tenthredinifolia*. In the latter is an abstract of an article by Signor B. Longo, on the mucilage of the Cactaceæ.

Bulletin de la Société des Naturalistes de Moscou, 1895, No. 3.—On considerable perturbations of atmospheric pressure in the year 1887, by B. Sresnewskij. A research into the relations between the said perturbations, the movements of cyclones, and the local weather predictions based on the study of the same; as also their relations, both to the groups of areas of minimal pressure and to the distribution of temperature (in German).—Materials for the Amphibia and Reptile fauna of the Orenburg region, by N. Zarudnyi. List of eleven species of the former, and fifteen species of the latter (Russian).—*Aquila Glitchii*, Severtsoff, a biological sketch, by P. Suschkin, in German, with two plates.—Note on *Posidonomya buchi* of the Balaclava schists in Crimea, by M. D. Stremoouchow, with a plate.—On Russian Zoocecidiæ and their makers, by. Ew. H. Rübsaamen, based on a collection made by Madame Olga Fedchenko and her son Boris Fedchenko. No less than 120 galls and their occupants from various parts of Russia and Caucasia are described.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 11.—"On the Relations between the Viscosity (Internal Friction) of Liquids and their Chemical Nature. Part II." By Dr. T. E. Thorpe, F.R.S., and J. W. Rodger.

In the Bakerian Lecture for 1894 the authors gave an account of their work on the viscosity of some seventy liquids, and they discussed the interdependence of viscosity and chemical composition. In order to render their investigation more complete, they have now made measurements of the viscosity of (1) a number of esters or ethereal salts, and (2) of ethers, simple and compound—groups of liquids, which with the exception of a single member, ethyl ether, have not hitherto been studied by them. The physicochemical relationships previously established made such determinations of special interest, for it was shown that one of the most striking of the various connections traced between chemical constitution and viscosity was the influence exerted by oxygen according to the different modes in which it was assumed to be associated with other atoms in the molecule. The influence which could be ascribed to hydroxyl-oxygen differs to a most marked extent from that of carbonyl-oxygen, and it appeared that ether-oxygen, or oxygen linked to two carbon atoms, had also a value which differed considerably from oxygen in other conditions.

The details of the observations are given in precisely the same manner as in the first paper, and formulæ of the Slotte type showing the relation between viscosity in absolute measure and temperature are calculated for each liquid. The general results of the observations are then discussed in the same manner as in the previous memoir.

The conclusions relating to the graphical representation of the results may be thus summarised. Both ethers and esters give no evidence of molecular aggregation, and conform to the rules that:—

(1) In homologous series, the viscosity is greater the greater the molecular weight.

(2) An iso-compound has a smaller viscosity than a normal isomer.

(3) The more symmetrical the molecule of an isomeric compound the lower is the viscosity.

As regards the esters themselves, it is noteworthy, where the comparison is possible, that:—

(4) Of isomeric esters, the formate has the larger viscosity.

As regards the algebraical representation of the results, it is shown that in the expression $\eta = C/(1 + \beta t + \gamma t^2)$, derived from Slotte's formula:—

(1) In any homologous series, β and γ increase as the molecular weight increases.

(2) Of isomeric compounds, the iso-compound has the smallest coefficient.

(3) Ethyl ether, the symmetrical isomer, has smaller coefficients than methyl propyl ether.

(4) As regards normal isomeric esters, the formate has the largest, and the propionate the smallest coefficients, and the values of the acetate are larger than of the butyrate.

The authors then deal with the relationships existing between the various viscosity magnitudes—the viscosity coefficient, the molecular viscosity, and the molecular viscosity work—(1) at the boiling point, and (2) at temperatures of equal slope, the slope adopted being that employed in their previous paper, namely, 0·04323, and values for the oxygen in three different conditions are given for each system of comparison in the same manner as in their first communication.

Physical Society, June 26.—Captain Abney, President, in the chair.—Mr. F. Bedell read a paper on admittance and impedence. The author discusses the application of the method of "vector diagrams" to the solution of questions connected with alternating currents. He shows how, by a consideration of the loci of the different lines on such a diagram, many problems which require for an analytical solution a lengthy investigation, may be simply and expeditiously solved. Mr. Blakesley asked the author what was his test of resonance? Was it that the primary current and E.M.F. were exactly in the same or in opposite phase? The term resonance was an acoustical one, and he did not see why it should be applied to one particular case in the electrical problem. Mr. Inwards asked what degree of accuracy the author had obtained. The author in reply said that if the applied E.M.F. and the current were brought into phase by means of a condenser in the secondary, then he called that a case of resonance. The agreement between the experimental and theoretical results was generally within from 1 to 3 per cent.—Prof. S. P. Thompson read a paper on the properties of a body having a negative resistance. The author, after showing the consequences which would follow according to the laws of Joule and Ohm if we postulate the existence of a body having a negative resistance, goes on to show how the observations described by Messrs. Frith and Rodgers, in a paper read at a recent meeting of the Society, only prove that that part of the resistance of an arc, which is not constant, is a positive resistance that varies inversely as the current. Since it varies inversely as the current the term dR/dC will be negative, and so will the quantity $C(dC)/dR$, which is what they have tabulated as a negative resistance. That the resistance of the arc itself should vary inversely as the current is natural, for it may be regarded as a column of vapour, the cross-section of which is proportional to the current, and therefore increasing in its conductance in direct proportion to the current. There is no need even to suppose any (distributive) adjuvant E.M.F., which would be the other alternative to the suggestion they have made Mr. Swinburne asked if the numbers on which Messrs. Frith and Rodgers based their arguments were obtained by taking successive readings of a voltmeter. Prof. Ayrton said that what they maintained was, that if the arc acts as if it had a back E.M.F. and a resistance, then the resistance is a negative quantity. In ordinary cases we do not know what really constitutes a resistance, but simply say that a circuit, in which electrical energy is being dissipated at a rate proportional to the square of the current, has resistance. If the loss is proportional to the first power of the current, then we say there exists a back E.M.F. Is it impossible to imagine a circuit in which a loss of electrical energy occurs proportional to the current, and a return of energy to the circuit proportional to C^2? If in a curve showing the relation between V and C you draw a tangent at any point, it is not the tangent of the inclination of this tangent which Messrs. Frith and Rodgers have called the resistance; it is another quantity, which they call the electrical dV/dC. In conclusion the author seems to have based his paper on three misconceptions: (1) That it had been claimed that a negative resistance could exist alone. (2) That the curves given by Messrs. Frith and Rodgers showed that the ordinates were inversely proportional to the current. (3) That what was measured was the geometrical dV/dC. Mr. Frith said that in a paper by Mr. Rodgers and himself, they had defined the resistance of the arc as the ratio dV/dA, where by dV/dA they meant, not what was ordinarily understood by this expression, but the value of the ratio obtained by superposing an alternating current for a direct current arc. In order to show that, in cases analogous with that of the arc, but in which the true resistance can be verified, the electrical dV/dC obtained by superimposing an alternating current gives correct results for the resistance, some experiments have been carried out. In one case a glow-lamp was placed in series with some fifty ampere secondary cells, and a current sent through against the E.M.F. of the cells. The value obtained for the electrical dV/dC agrees very well with the value of the resistance obtained by dividing the P.D. between the terminals of the lamp by the current. At very low frequencies for the superimposed alternating current it is evident that the electrical oscillations would travel along the steady value curve, and this is clearly the meaning of the critical frequency observed with cored carbons, namely, that under the critical frequency the superimposed alternating current travels on the steady value curve, and over that frequency along the line joining the point on the curve and the instantaneous origin.—Mr. Frith exhibited a mechanical model of the arc which he has devised. This model consists of two rods of carbon dipping in two mercury cups which are traversed by the current. The current also passes through a solenoid which attracts an iron core attached to the carbon rods and draws them down into the mercury, thus reducing the resistance of the instrument. Hence it can be arranged so that the P.D. between the terminals decreases as the current increases. With this model it is found that, for superimposed oscillatory currents of such a frequency that the moving parts are not able to follow the changes in the current, the oscillations of the current and of P.D. are in phase, and the electrical dV/dC gives the resistance of the apparatus for various currents. Mr. Carter asked the author how on his vapour column theory he explained the difference in the behaviour of solid and cored carbons. Mr. Enright asked why it was absurd to suppose that a negative resistance could exist. Prof. Ayrton and Mr. Frith had made in their definitions certain restrictions; it ought, however, not to be necessary to make any such restrictions. Mr. Blakesley asked if, since the title of the paper by Messrs. Frith and Rodgers was entitled the "*true* resistance of the arc," it was to be inferred, as the results given were negative, that a negative ohmic resistance existed in the arc. Prof. Thompson's paper appeared to him (Mr. Blakesley) to be rather a mathematical than a physical paper. Prof. Rücker said that the discussion showed that considerable confusion existed, and that the introduction of the term negative resistance only tended to fog matters. It was entirely wrong to argue that because you have a quantity with a positive value, therefore a negative value must also be possible. As an example, take the case of mass. If you defined as a positive mass that which is attracted to the earth, and then found that cork when immersed in water was repelled from the earth, would you therefore say that cork had a negative mass? Is not "negative resistance" a term for which some equivalent could be found which would not lead to confusion? Mr. Hovendon made some remarks on his experiments. The author in his reply said that he did not dispute the accuracy of the results obtained by Messrs. Frith and Rodgers, but it was the interpretation which they had given of their results to which he objected. Mr. Frith now makes a new reservation, namely, that the results depend on the particular way in which the increment of C and the decrement of V are made. He supposes that if the experiment is made in a particular way a new slope is obtained which is proportional to what we call the true resistance, and hence gets a new definition of the quantity *d*V/*d*C. He (the speaker) endorsed all Prof. Ayrton had said as to the interest of the model exhibited. The question is, Is there anything in the arc which acts as a source of energy to the circuit, either as a negative resistance or as an adjuvant E.M.F.? Mr. Frith's experiments do not give us any hint as to the point where the negative resistance occurs, and the absence of any such energy-giving portion of the arc is rendered probable by the fact that the arc itself is hotter than the crater. In reply to Mr. Carter, the anomalies which occur with cored carbons are so great as to prevent any argument being based on their behaviour. The Chairman (Captain Abney) said that the mere fact that the quantity *d*V/*d*C had been defined in two distinct ways, showed that the definitions would have to be modified in some way.

Zoological Society, June 16.—Sir William H. Flower, K.C.B., F.R.S., President, in the chair.—Mr. E. E. Austen gave an account of a journey undertaken by Mr. F. O. Pickard-Cambridge and the author up the Lower Amazons, on board Messrs. Siemens Bros. cable s.s. *Faraday*, for the purpose of making zoological collections on behalf of the British Museum. No terrestrial mammals were met with, but observations were made on the two species of freshwater dolphins (*Inia geoffroyensis* and *Sotalia tucuxi*, or *S. fluviatilis*), which are extremely abundant in the Lower Amazons. Among the birds, the only species of special interest collected were a little goatsucker from Manaos, referred provisionally to *Nyctiprogne leucopygia*, and a woodpecker (*Celeus ochraceus*), of which the British Museum previously possessed but two specimens. The reptiles and amphibians met with all belonged to well-known and widely distributed forms, and the chief interest of the collections centred in the invertebrates. Among these Mr. Pickard-Cambridge made a large collection of spiders, including an extensive series of the large hairy Therephosidæ, eleven species of which were pronounced to be new. An interesting collection of the nests of some of these forms was also obtained. Mr. Cambridge likewise secured several specimens of *Peripatus*. Mr. Austen, who devoted himself chiefly to insects, obtained some 2500 specimens of different orders, of which it was expected that a fair proportion would prove to be new. Attention was drawn to some interesting examples of mimicry.—Mr. P. Chalmers Mitchell read a "Contribution to the Anatomy of the Hoatzin (*Opisthocomus cristatus*)." He stated that from the characters of the alimentary canal, the hoatzin might be placed either between the sand-grouse and the pigeons, or between the Gallinæ and the Cuculidæ. He described some interesting individual variations in the condition of the ambiens muscle, and referred to other points in the muscular anatomy.—Mr. G. A. Boulenger, F.R.S., gave an account of the occurrence of *Tomistoma schlegeli* in the Malay Peninsula, and added some remarks on the atlas and axis of the Crocodilians.—A communication was read from Mr. W. Schaus containing notes on Walker's American types of Lepidoptera in the University Museum, Oxford.—Mr. Hamilton H. Druce read a paper entitled "Further Contributions to our knowledge of the Bornean Lycænidæ," in which he referred to about forty species of this family not hitherto recorded from Borneo. A number of these were new, and were now described by Mr. G. T. Bethune Baker and the author.—Mr. F. G. Parsons read a paper on the anatomy of *Petrogale xanthopus* as compared with that of other kangaroos.—Dr. J. Anderson, F.R.S., communicated on behalf of Miss M. E. Durham some notes on the mode of swallowing eggs adopted by a South African snake, *Dasypeltis scabra*, as observed in the specimens now living in the Society's Gardens, and illustrated by a series of drawings.—Mr. F. O. Pickard-Cambridge read a paper on the spiders of the family Aviculariidæ taken during the expedition up the Amazons previously described by Mr. Austen.—Mr. G. A. Boulenger, F.R.S., read the description of a gecko which he proposed to refer to a new genus and species as *Mimetozoon floweri*, in honour of Mr. Stanley Flower, who had obtained the specimen at Penang.

Royal Meteorological Society, June 17.—Mr. E. Mawley, President, in the chair.—Mr. H. Harries read a paper on Arctic hail- and thunder-storms, in which he showed that the commonly accepted opinion that hail- and thunder-storms are almost, if not quite, unknown in the Arctic regions is incorrect. He had examined 100 logs of vessels which had visited the Arctic regions, and found that out of that number no fewer than 73 showed that hail was experienced at some time or other. Thunder-storms were not so frequent as hail, but they have been observed in seven months out of the twelve, the month of greatest frequency being August. Mr. Harries is of opinion that the breeding-place of thunder-storms in these high latitudes is in the neighbourhood of Barent's Sea.—A paper, by Mr. J. E. Cullum, on the climatology of Valencia Island, was also read. The observatory at Valencia, which is under the control of the Meteorological Office, is situated on the extreme south-west coast of Ireland, and is almost the most westerly point of Europe. Continuous records from self-recording instruments were carried on from 1869 until 1891, when the observatory was removed to Caherciveen, and the author gives the results of the observations for these twenty three years.

Royal Microscopical Society, May 20.—Mr. A. D. Michael, President, in the chair.—Mr. E. M. Nelson exhibited and described a small portable microscope, which had been designed by Dr. Ross for the investigation of cases of malarial fever. The President said that the instrument seemed to be very compact, and in this respect would no doubt be found of great value. Mr. J. E. Ingpen wished something could be done in designing microscopes of this kind to get them to fold up a little flatter.—Mr. J. Rheinberg's paper, on an addition to the methods of microscopical research by a new way of optically producing colour contrast between an object and its background, or between definite parts of the object itself, was read by Mr. Nelson.

June 17.—The Rev. Canon Carr, Vice-President, in the chair.—Surgeon V. Gunson Thorpe, R.N., exhibited and described some Rotifera, preserved after Rousselet's method, which he had collected whilst on the China station.—Lieut.-Colonel Siddons, R.A., exhibited and described a portable microscope which he considered met the suggestion offered by Mr. Ingpen at the previous meeting.—Mr. Conrad Beck read the report of the sub-Committee of the Council on screw-tools.

PARIS.

Academy of Sciences, June 22.—M. A. Cornu in the chair. An expression for the skin friction in the irregular flow of a fluid, by M. J. Boussinesq.—Some properties of the primitive roots of prime numbers, by M. de Jonquières.—On the caustic of an arc of a curve reflecting rays emitted by a luminous point, by M. A. Cornu.—On the formation of gaseous and liquid hydrocarbons by the action of water upon metallic carbides. Classification of the carbides, by M. H. Moissan. A *résumé* of the work done by M. Moissan and his pupils upon metallic carbides, together with some remarks on the geological bearing of the results.—Remarks on a work entitled "Microbial and animal toxins," by M. A. Gautier.—Observations on Swift's comet (April 13, 1896) made with the large equatorial at the Observatory of Bordeaux, by MM. G. Rayet, L. Picart and F. Courty.—Dr. Gill was elected a Corresponding Member in the Section of Astronomy in the place of the late Prof. Cayley.—On the zero of Riemann's function $\zeta(s)$, by M. Hadamard.—On the X-rays, by M. C. Maltézos. Some theoretical considerations as to the possible nature of the rays.—An electrolytic method of desilverising argentiferous lead, by M. D. Tommasi.—Magnetic anomaly observed in Russia, from a letter by M. Moureaux to M. Mascart. In the village of Kotchetovka (lat. 51°, long. 6° 8′ east of Poulkowa) determinations of the magnetic elements at fifteen points within an area of one square kilometre gave values for declination varying between $+58°$ and $-43°$; for inclination, from 79° to 48°, and for the horizontal component, 0·166 to 0·589. The latter figure, which is the highest value of the horizontal component hitherto observed, was carefully controlled by six measurements at neighbouring points, from the results of which figures between 0·48 to 0·58 were obtained.—On the dark blue nitrosodisulphonic acid, by M. Paul Sabatier. By the action of cuprous oxide upon strong sulphuric acid containing a little nitrite, a deep blue colour is produced, the absorption spectrum of which is closely analogous to that produced by Fremy's potassium oxysulphazotinate (nitrosodisulphonate). The same coloration can be produced by passing a current of nitric oxide mixed with air into sulphuric acid saturated at 60° with sulphurous anhydride.—On the preparation of aluminium alloys by a chemical reaction, by M. C. Combes. A mixture of aluminium with a sulphide or chloride is heated till the reaction commences. The heat evolved during the chemical action is sufficient to melt the alloy formed provided that there is a sufficient difference between the heat of formation of the metallic sulphide employed and that of aluminium sulphide. Alloys of aluminium with nickel, manganese, and chromium were prepared by this method.—On the action of phosphorus on some metallic chlorides, by M. A. Granger.—Measurement of heat of etherification by the action of the acid chloride upon the sodium alkylate, by M. J. Cavalier. A thermochemical study of the reaction between phosphoryl chloride and sodium ethylate.—On the heat of combustion of acetal and monochloracetal, by M. Paul Rivals.—On the thermochemistry of the chloracetic ethers, by M. Paul Rivals.—Action of hydrazine upon the glyoxylic acids of the aromatic series, by M. L. Bouveault. The hydrazones obtained lose CO_2 at 180°-200°, giving nearly quantitative yields of the hydrazones derived from the corresponding aldehydes.

$$R(CO_2H).C=N-N=CR(CO_2H)=2CO_2+R.CH:N-N:CH.R$$

The yield of aldehyde, however, obtained by the hydrolysis of these hydrazones is not good.—On the constitution of inactive campholenic acid, by MM. Guerbet and A. Béhal.—On the nutritive value of flour and on the economic consequences of excessive sifting, by M. Balland.—On the chemical mechanism of the reduction of nitrates in plants, by M. A. Bach.—On the rational denaturation of alcohol, by M. G. Jacquemin. The addition of crude mercaptan to rectified spirit is suggested as a means of rendering alcohol unfit to drink, without interfering with its industrial applications.—On the deep borings at Charmoy (Creusot) and Macholles (Limagne), by M. A. M. Lévy. The first of these borings showed a rise of 1° C. for every 26 metres, the second (Charmoy) giving a rise of 1° C. for every 14·16 metres.—On the region of Diego Suarez (Madagascar), by M. R. Bourgeois.—On the relations which exist between the first segmentation groove and the embryonic axis in Amphibia and Teleostia, by M. E. Bataillon.—Tuberculosis experimentally shown to be attenuated by the Röntgen radiation, by MM. L. Lortet and Genoud.

PHILADELPHIA.

Academy of Natural Sciences, May 19.—The collections made by Dr. A. Donaldson Smith in Western Somaliland and the Galla country, North-eastern Africa, in 1894, were presented to the Academy. Dr. Smith spoke of the physical features of the regions from which the specimens had been collected, and gave briefly some facts regarding the habits of the animals observed by him. The several sections of the collection were commented on by the specialists of the Academy. The mammals are of unusual interest because these alone have not been studied by authorities elsewhere. They embrace fifty genera and about seventy species represented by over two hundred specimens. Seven genera and twelve species are new to American museums. The collection, except the bats, which are being studied by Dr. Harrison Allen, is in the hands of Mr. Samuel N. Rhoads, who will furnish a detailed report on the material submitted to him. The birds have been studied by Mr. Bowdler Sharpe. One hundred and fifty specimens of about one hundred species have been given to the Acadamy. The insects embrace 871 specimens. The Hymenoptera are being studied by Mr. Wm. J. Fox, who has determined eight species heretofore undescribed.—Mr. Henry A. Pilsbry made a communication on the fish-house deposits of New Jersey.—A paper entitled "The Plantstonokrit, a centrifugal apparatus for the volumetric estimation of the food supply of oysters and other aquatic animals," by Dr Chas. S. Dolby, was presented for publication.

May 26.—A paper entitled "Catalogue of the species of Cerion, with descriptions of new forms," by Henry A. Pilsbry and E. G. Vanatta, was presented for publication.—Mr. Edw. Goldsmith reported that a specimen of supposed Guperite from Hawaii had proved on examination to be an amorphous, soluble sulphate of lime. It is deposited in association with sulphur on the margin of the Kilauea crater, and is either ejected from the volcano or formed by the action of the oxygenated sulphur water on associated minerals.—Prof. Edw. D. Cope described a new genus and species of whalebone whale from the Miocene of the Yorktown epoch, under the name *Cephalotropis coronatus.* It was characterised by an elongation of the parietal and frontal bones, and establishes the relation of the group to the Zenglodonts.—Dr. M. F. Ball described a human exancephalic monster born about the seventh month, in which the brain, although extruded, was well developed.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Fourteenth Annual Report of the Fishery Board for Scotland, 1895, Part 1 (Edinburgh, Neill).—19th Annual Report of the Connecticut Agricultural Experiment Station, 1895 (New Haven).—Rheumatism, its Nature, its Pathology, and its successful Treatment: Dr. T. J. Maclagan (Black).—La Vie d'un Homme. Carl Vogt; W. Vogt (Paris, Schleicher).—Nitro-Explosives: P. G. Sanford (Lockwood).—Wayside and Woodland Blossoms: E. Step, 2nd series (Warne).—Geographical Journal, Vol. 7 (Stanford).—Plants of Manitoba (M. Ward).—Coloured Vade-Mecum to the Alpine Flora for the use of Tourists in Switzerland: L. and C. Schröter, 5th edition (Zürich, Raustein).—Sport in the Alps: W. A. Baillie-Grohman (Black).—Micro-Organisms and Disease: Dr. E. Klein, new edition (Macmillan).—Macmillan's Geography Readers, Book v. (Macmillan).—A Concise Handbook of British Birds: H. K. Swann (Wheldon). Der Lichtsinn augenloser Tiere: Dr. W. A. Nagel (Jena, Fischer).—La Spectrométrie: Prof. J. Lefèvre (Paris, Gauthier-Villars).—Le Nickel: H. Moissan and L. Ouvrard (Paris, Gauthier-Villars).—University Tutorial Series. Matriculation Directory (32, Red Lion Square).—Ros Rosarum, 2nd edition (E. Stock).—The Scenery of Switzerland: Sir J. Lubbock (Macmillan).

PAMPHLETS.—U.S. Department of Agriculture:—Some Mexican and Japanese Injurious Insects liable to be introduced into the United States (Washington).—On the Interpretation of Greek Music: C. Torr (Frowde).

SERIALS.—English Illustrated Magazine, July (Strand).—Revue Générale Internationale, No. 1 (Paris, Ollendorff).—Longman's Magazine, July (Longmans).—Good Words, July (Isbister).—Sunday Magazine, July (Isbister).—Lloyd's Natural History. Butterflies: W. F. Kirby, Part 1 (Lloyd).—Chambers's Journal, July (Chambers).—Natural Science, July (Page).—Journal of the Chemical Society, June (Gurney).—J. C. Poggendorff's Biographisch-Literarisches Handwörterbuch, 3 Band, Liefg. 1 (Leipzig, Barth).—Ergebnisse der Meteorologischen Beobachtungen in Jahre 1895, Jahrg. vi. (Bremen).—Memoirs of the Geological Survey of India, vol. xxvii. Part 1 (Calcutta).—Ditto, Palæontologia Indica, Ser. xiii. Vol. 2: Ser. xv. Vol. 2, Part 2 (Calcutta).—Bulletins de la Société d'Anthropologie de Paris, tome septième, (ive. série), 1896, fasc. 1er (Paris).—Mémoires de la Société d'Anthropologie de Paris, tome 2, (3e sér.) 1er fasc. (Paris).—National Review July (Arnold).—Century Magazine, July (Macmillan).—Notes from the Leyden Museum, October 1895 (Leyden, Brill).—Contemporary Review, July (Isbister).—Morphologisches Jahrbuch, 24 Band, 1 Heft (Leipzig, Engelmann).—Reliquary and Illustrated Archæologist, July (Bemrose).

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