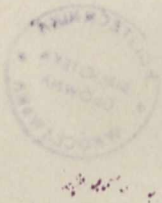
Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE



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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, MAY 2, 1907.

THE ENIGMA OF LIFE.

(1) *The Evolution of Life.* By Dr. H. Charlton Bastian, F.R.S. Pp. xviii+319; with diagrams and many photomicrographs. (London: Methuen and Co., n.d.) Price 7*s.* 6*d.* net.

(2) *The Nature and Origin of Life in the Light of New Knowledge.* By Prof. Felix Le Dantec. An introductory preface by Robert K. Duncan, author of "The New Knowledge." Pp. xvi+250; 21 figures. (London: Hodder and Stoughton, 1907.) Price 6*s.* net.

(1) DR. H. CHARLTON BASTIAN re-affirms his conviction that living organisms continue to arise from not-living material. It is a long time since, in his "Beginnings of Life" (1872), Bastian sought to establish the reality of this "archebiosis" and also of heterogenesis—that strange process by which organisms or parts of organisms of definite kind give rise to organisms of a quite different kind, as when the ovum of the rotifer Hydatina produces the infusorian Otostoma. In 1876–7 there was a notable and useful controversy between Bastian, on the one side, Tyndall and Pasteur on the other, the issue of which seemed to most experts to be that Bastian failed to make good his case for the present-day occurrence of spontaneous generation. The claims of professional work forced the heretic to renounce his investigations for about twenty years, but he has recently been able to return with unabated vigour to the study of both heterogenesis and abiogenesis. His "Studies in Heterogenesis" and his work on "The Nature and Origin of Living Matter" have been already reviewed in NATURE, and we have now before us an account of his recent researches on "archebiosis" and a clear exposition of his views as to "The Evolution of Life." It is impossible not to admire the author's strong desire to get at the truth, the courage of his convictions, and his incomparable good humour.

Dr. Bastian begins by indicating some of the objections to the term "spontaneous generation," which is almost as bad as "generatio equivoca"; he advocates the use of the word "archebiosis"—the past or present origination of living things from not-living material—and he contrasts it with "heterogenetic reproduction," which presupposes pre-existing organisms. In the first part of his book he points out that inorganic evolution (recently studied in ways not a little upsetting) has not stopped, and argues against the dogmatism of those who, while admitting that archebiosis probably occurred very long ago, refuse to discuss the possibility of its occurrence now. Because it has been shown that maggots are not really produced by the flesh in which they crawl, it does not follow that minute specks of living matter may not arise *de novo* in suitable not-living fluids, and to base the formula *omne vivum ex vivo* on the "past experience of mankind" is ridiculously naïve. It has become the fashion to call "spontaneous generation" a "chimera," and the study of it a search for a mare's nest. But "neither Darwin, Huxley, nor Spencer ever undertook any experimental work on this subject themselves," and as for Tyndall and Pasteur, both were convinced beforehand. The whole story is gone over again (pp. 95–228), and it is (psychologically, at least) very instructive. Since 1878, Dr. Bastian had not, before the present work, published anything on the subject of archebiosis, save one chapter in his 1905 volume, and it is interesting to read his retrospect of a famous controversy and his undismayed conclusions in spite of all.

"Mere observation," the author points out, "can never settle the question whether Archebiosis does or does not take place at the present day." In a fluid believed to be quite not-living, minute living creatures appear, but observation cannot decide whether they arise from invisible germs of pre-existing organisms, or "whether they have come into being in the mother liquid as a result of life-giving synthetic processes." Therefore we must resort to experiment, and the fallacies to be guarded against are two. The heat employed in the sterilising process must be adequate to kill all pre-existing living things

within the experimental vessels, and there must be no subsequent contamination with atmospheric germs. Therefore Bastian heated his fluids to 115° C. or 130° C., and hermetically sealed the tubes. But these precautions involve disadvantages; the degrading effect of the initial purifying heat process may render the medium unfit for the occurrence of future processes that may lead to life-origination, and the glass of the hermetically sealed vessel in which the fluid is contained partially excludes actinic rays which might be potential, or at least helpful, in bringing about the combinations in question. In spite of these disadvantages, Dr. Bastian found living creatures—"Bacilli, Vibriones, Cocci, Streptococci, Torulæ, and other germs of Fungi"—in saline solutions within tubes that had been heated at 115° C. to 130° C. for from ten to twenty minutes, and the present subdirector of the Pasteur Institute has declared, in regard to spores of bacilli in all such fluids, that "a temperature of 115° C. sterilises them completely and most rapidly." Some of the photomicrographic figures of "organisms" are not very like organisms at all, but others are. The alternative interpretations are (1) that Dr. Bastian's methods were not rigorous enough; (2) that the fatal temperature has been estimated at too low a figure; (3) that contamination occurred during the preparation of the photographed slides, or (*d*) that archebiosis actually takes place. Personally, we are not disposed to accept the last interpretation until every possibility of error has been excluded, and we are not convinced by Dr. Bastian's "final decisive experiments." We suspect that the sterilisation was imperfect; we suspect that there were "germs"—where we have often seen them—on the slides and cover-slips; we suspect everything to a degree that Dr. Bastian—with a tolerant smile—would say outrages common sense. For we belong to the prejudiced, illogical, conservative sect of St. Thomas who doubt and doubt. The whole business is so analogous to belief in "spooks" that no amount of argument is of any use until we have seen for ourselves. Why, then, Dr. Bastian says, will you not experiment? And why will you not, in the name of St. Thomas, point out precisely where my experiments are fallacious? As to the first question, we think the answer is that we regard archebiosis as so great a miracle that we do not expect to see it repeated. As to the second question, we do not know what to answer, unless it be that the sterilisation was inadequate, or that the preparations were contaminated before the photographs were taken. At the same time, recent physicochemical discoveries centred around the fact of radio-activity warn us that dogmatism as to possibilities is far from being consistent with the truly scientific mood.

Harking back to heterogenesis, perhaps it may be useful to say that Dr. Bastian was good enough to show us the mummy of an Otostoma reposing within the egg-case of Hydatina. There can be no doubt about it. But what remains unproved is that the organisation of a Hydatina ovum gives rise by heterogenesis to the organisation of the infusorian Otostoma. We suspected parasitism, and we watched many ova of Hydatina. But neither the expected nor the unexpected happened. On one occasion, however, Dr. John Rennie, lecturer on parasitology in the University of Aberdeen, an expert investigator who was good enough to assist in watching for the advent of Otostoma, observed two (not identified) infusorians moving inside the rotifer's egg, but he did not regard the phenomenon as a proof of heterogenesis. As a matter of fact, the egg-envelope showed a small split, through which the infusorians soon passed out, doubtless following the path by which they formerly entered.

(2) Prof. Felix Le Dantec has entitled his book "The Nature and Origin of Life," but with a humour which we appreciate he has entirely shirked the question of *origin*, only referring to it in a casual, half-hearted sort of way on the last page, where he tells us that "the time will come when methodic analysis will allow of a reasoned synthesis" of protoplasm. It is probable that the solution will be found in the study of diastases.

"When the effective synthesis is obtained, it will have no surprises in it—and it will be utterly useless. With the new knowledge acquired by science, the enlightened mind no longer needs to see the fabrication of protoplasm in order to be convinced of the absence of all essential difference and all absolute discontinuity between living and not-living matter."

Prof. Le Dantec's book—which discusses the nature of life—ranges over the whole field of biology from bacteria to the nervous system, from karyokinesis to mutations, from tropisms to natural selection, and he leaves one with the general impression that even "in the light of new knowledge" the riddle of "life" remains very obscure. In a popular elusive manner, with abundant concrete illustrations, the author seeks to show that the living creature is a mechanism and nothing more, and that "the study of life belongs to chemical physics." "A higher animal such as man is *a mechanism of mechanisms of mechanisms.*" This rather cryptic conclusion is expanded into the statement that man is an anatomical mechanism of colloid mechanisms of chemical mechanisms. The wonder is that they all hold together. "More and more the living being appears to us a superposition of dead things." But it is a fell superposition. "A rat trap would be alive if, while exercising its normal function of loosing its spring, it should impress on its constituent substances a chemical activity whose result would be a tension of the spring tighter than before." This seems to us rather a clap-trap theory of life. We mean that the author gives the problem a false simplicity; he conveys the impression that we can really give a mechanical re-description of the development, the growth, the reproduction, the behaviour, the evolution—the life of living creatures. But he does not go thoroughly enough into any single instance to win conviction, and he is continually retreating into the mystery of colloids. Some of his utterances strike us as rather intemperate, as when he tells us that "life is an aquatic phenomenon," or that "Life is only a surface accident in the history

of the thermic evolution of the globe," or that "*The fact of being conscious* does not intervene in the slightest degree in directing vital movements." Yet when we were conscious of this sentence we turned back several pages and re-read the preface, where the editor takes an optimistic view of mechanistic theories.

The author has full faith in the theory of *epiphenomenal* consciousness; it is a negligible shadow. He prefers to keep to the purely objective, *e.g.* the mechanism of colloids and the polarities of the cell. He is very strong on bipolarity. "The living cell is a bipolar apparatus, since it needs a cytoplasm and a nucleus." "In each bipolar element of protoplasm there is a male pole and a female pole." "Maturation is explained by the disappearance in cytoplasm and nucleus of all elements of the *sex opposed* to that of the mature element finally obtained." "Fecundation is the operation in which the spermatozooid, introduced by sexual attraction into the ovule, completes by means of its male poles the female poles of the ovule's elements, which are incomplete." "Assimilation is a bipolar phenomenon," and "alternating generation is also related with the bipolarity of the living elements." All this is "in the light of new knowledge," as is also the conclusion that "strictly speaking there is never any hereditary transmission except of acquired characters." The author corrects some of the errors of Claude Bernard, Darwin, and Weismann.

The book has been translated by Stoddard Dewey, and it is just possible that the original may have suffered a little. "If the hen fabricates the egg, the egg in its turn will fabricate the hen. We shall not therefore be astonished when we come to verify the marvellous phenomenon which governs the entire evolution of living beings: the heredity of acquired characters." "Lichens result from the association of seaweed and mushrooms." This lacks precision. "The embryology of an animal reproduces its genealogy." This lacks elegance. Speaking of crabs and lobsters, he says, "All variation, all modification is limited in such animals to this phenomenon of moulting." This lacks clearness.

J. A. T.

ZOOLOGY OF THE INDIAN OCEAN.

(1) *The Fauna and Geography of the Maldive and Laccadive Archipelagoes.* By J. Stanley Gardiner. Vol. ii. Part iv. and Supplements i. and ii., with index. Pp. 807–1079; 34 plates and figures in the text. (Cambridge: University Press, 1905 and 1906.)

(2) *An Account of the Alcyonarians collected by the Royal Indian Marine Survey Ship "Investigator" in the Indian Ocean.* I. *The Alcyonarians of the Deep Sea.* By J. Arthur Thomson and W. D. Henderson. Pp. xvi+132; 10 plates, with colours. (Calcutta: The Indian Museum, 1906.)

THE memoirs contained in the above-named publications belong, if taken alone, to that large class of scientific papers which are commonly said to be "of interest only to specialists," but in reality they betoken much more than this, since they denote a great activity in the investigation of the biological problems presented by the Indian Ocean. Far from overlapping, they are complementary to each other and to a third piece of contemporary work which does not fall within the scope of this notice—the Ceylon pearl-oyster report.

The research conducted by Mr. Stanley Gardiner upon the bionomical conditions or "biocœnosis" of the Maldive and Laccadive Archipelagoes, the earlier parts of which have been already reviewed in NATURE, is now brought to a close with the completion of the second volume, and, as Mr. Gardiner points out in his concluding remarks, the whole report contains fifty-four separate papers by thirty-two different authors. It is not easy to estimate the value of this unique work, which will remain indispensable to all who are interested in Indian marine zoology and in coral reefs. Perhaps the best tribute that can be paid to it, as a whole, is conveyed in that accorded to one portion of it by Prof. H. Coutière, the author of a report in vol. ii., part iv., upon the Alpheidæ, a family of Crustacea frequenting coral reefs and other suitable localities in the tropics:—

"La collection comprend 76 espèces et variétés, soit près de la moitié des formes actuellement connues d'Alpheidæ, et, parmi ces formes, 48 sont nouvelles. Aucune expédition n'a jamais atteint, même de loin, un semblable résultat. Si la localité choisie s'est montrée exceptionnellement riche, il faut aussi que son exploration ait été conduite avec une méthode et une science de la recherche des espèces marines qu'on ne saurait trop mettre en relief."

Every naturalist who has worked along shores where corals grow is familiar with some members of the family Alpheidæ, for which a satisfactory English equivalent seems not to have been invented. These crustacea are so remarkable that a common expression calculated to convey some idea of their properties is to be desired, and the name of trigger shrimps may be suggested. Upon placing them in a glass jar, one is likely to be startled by a sudden report, often so loud as apparently to threaten the fracture of the vessel. The noise is made by the snapping of one of their pincers of peculiar construction.

Although mainly systematic, Prof. Coutière's memoir will be welcomed by those who take an interest in the forms of animal life, not only because of his method of treatment, but especially on account of the admirably clear illustrations, which are reproduced from the author's drawings on eighteen plates, besides text-figures. These are models of what such illustrations should be, and one shudders to think of the paper without them. There is something wrong with Figs. 127 and 128 on pp. 855–6, the letters of the former not corresponding with the description, and the number of joints in the shaft of the outer antennular flagellum of male and female respectively not coinciding with the statement in the text—small blemishes of no account to the specialist, who can endure much. This work does not include a bibliography, and such references as are given are

not always to the point, *e.g. Ann. des Sc.* (6), 1899; the series should be (8) and the volume ix.

The same number (vol. ii., part iv.) contains the third instalment of Prof. Hickson's report on the Alcyonaria of the Maldives, with descriptions of fifteen (including two Briareidæ described previously) species of Gorgonacea and one Pennatulid. The depths at which the material was obtained ranged from 0–43 fathoms, generally between 20 and 30 fathoms; two specimens of the Pennatulid (*Pennatula murrayi*) were taken at 43 fathoms in the Suvadiva Lagoon. A general feature of many of the sublittoral Alcyonaria is their extreme variability.

Other papers to which space does not permit us to do justice beyond mentioning them are by Major Alcock on Paguridæ (hermit-crabs), recording twenty-six species, of which nine are new to the Indian Ocean, five new to science; Mr. L. A. Borradaile on Hydroids, twenty-three species; Mr. A. E. Shipley on two parasites; and Mr. W. L. Distant enumerates twenty species of Rhynchota.

The first supplement contains reports by Messrs. A. O. Walker (Amphipoda), J. Stanley Gardiner (Madreporaria), E. T. Browne (Scyphomedusæ), D. Sharp (Coleoptera), W. E. Hoyle (Cephalopoda), and R. Norris Wolfenden (Copepoda). Dr. Hoyle describes a rare squid, *Ancistrochirus lesueuri*, which has luminous organs; one specimen only, the second on record, was found floating dead off one of the atolls. Dr. Wolfenden, whose paper is illustrated by folding plates, compares the oceanic copepods of the Indian Ocean with those of the Atlantic, an intermixture of species between these two great oceans being hindered by the water barrier formed by the Agulhas Current; the author also points to an extraordinary difference between the Copepod fauna of the Maldive Group and that of the Gulf of Manaar, owing to the paucity of littoral forms in the former area.

The second supplement contains an article by Mr. R. I. Pocock (Myriopoda), an excellent systematic index, a subject-index, and Mr. Stanley Gardiner's concluding remarks. From his notes on the habits and distribution of the land animals, we learn that the mammals of the Maldives are three, the fruit bat or flying fox, *Pteropus medius* (not found in Minikoi), the musk shrew, *Crocidura murina*, and the rat, *Mus rattus*; the absence of insectivorous bats is noted as a singular deficiency. The study of the land fauna has confirmed his conclusion, previously based on geological grounds, "that the Maldives and Laccadives are recent lands."

As is known, Mr. Gardiner has crowned his labours in the Maldives by another expedition to the western part of the Indian Ocean, and when these results are made known the importance of his individual contribution to Indian oceanography will doubtless be fully appreciated.

The sumptuous monograph of the Indian Alcyonarians of the deep sea, by Prof. J. A. Thomson and Mr. W. D. Henderson, is a revelation of a wealth of new forms depicted in a manner which, for this class of illustration, is beyond praise. The authors are alive to the æsthetic possibilities of their subjects, and although these are to some extent prejudiced by inevitable *post-mortem* changes, enough remains to delight the eye and attest the beauty that is hidden in the depths of the sea. Of the eighty-six species included in the collection, sixty-one are new; only nine belong to the Alcyonacea (leathery corals, chiefly shallow-water forms); eight of these are new, and two of them are made the types of new genera. There are forty-one species of Gorgonacea ("sea-fans") and twenty-eight species of Pennatulacea ("sea-pens" or "sea-feathers"), thus displaying a very great contrast with the shallow-water fauna of the Maldives. Two genera, Sympodium of the Stolonifera and Umbellula of the Pennatulacea, contain a multiplicity of specific forms which the authors admit may be only mutations. In view of this possibility, it is hard to accept so many names on an equal footing with those of undoubted and striking types.

Several comparative tables of the species of various genera are introduced in the course of the work, and these should prove of great service to future investigators. This method of tabulation is the right one, and is capable of improvement until a degree of perfection is attained. In written descriptions it happens frequently that the most obvious distinction between allied species is a difference of verbiage. Such banalities can be eliminated from tables; thus it is not much to learn that whereas the axis of *Umbellula durissima* is "nearly cylindrical," that of *Umbellula dura* is "almost cylindrical." The quotation of an isolated example of this kind is not meant to detract in any way from the total value of the tables.

A special property of many deep-sea Alcyonarians is their viviparity. The authors have found embryos in eight different species belonging to the three principal sections, Alcyonacea, Gorgonacea, and Pennatulacea. A full bibliography completes the present monograph, and one dealing with the littoral forms is promised later.

MEDICAL MEDITATIONS.

Principia Therapeutica. By Dr. Harrington Sainsbury. Pp. xi+244. (London: Methuen and Co., n.d.) Price 7*s.* 6*d.* net.

IN the biological sphere, to attain by means of scientific analysis to generalisations of such a breadth as to justify the term of "Principia" is an arduous task, even for generations of men, and is one which is far beyond us at present. The attainment of principles can only be by the long and fallible ways of observation, verified by the experimental method; and—in medicine at any rate—we can claim to have surveyed and mapped out no very wide areas as yet. Now if this be true of pathology, of therapeutics it is grievously truer, although on the lines of pharmacology much "triangulation" is now going forward. It is almost needless to guard these remarks by adding that no one probably is more aware of these limits of our knowledge than the

thoughtful writer of the book before us; he no doubt would be among the first to admit that his "Principia" are for the most part rather of the nature of ripe reflections on medicine—well-balanced cogitations by a wise, experienced, and instructed physician, regarding his art, as it were, from a height. Such thoughts obtain their generality rather by selection and proportion than by the slow accumulations of "induction." For our own part, we should have been disposed to prefer for this book some such a title as "Contemplations on Medicine."

Yet if we are indisposed to accept Dr. Sainsbury's mature reflections as "principia" in the sense of scientific theory, we are far from saying that it is useless to step thus backwards, or upwards, occasionally, so as to take more comprehensive glances of our science and art, and to delineate its larger features, so far as a slight sketch may go. By standing clear for a moment of the multiplicity of detail we gain a better sense of the proportions of the parts. The danger of this method is, of course, lest we mistake mere generalities for laws, dialectic for analysis of origins, and axioms of provisional service for verified and permanent conceptions. And it would be too much to say that Dr. Sainsbury has wholly escaped this danger; in some chapters his broad and detached way of looking at things is significant and illuminating, in others the attenuation of detail tends to vapidity, and thought is diluted until it becomes somewhat artificial and prosy. On the other hand, it may be just to say that no one could perhaps have penetrated farther in his way than Dr. Sainsbury does, and we have admitted that the change of attitude is needed occasionally to guide us and to give us wider bearings.

It would not be appropriate, then, to enter upon controversies with the author on matters of detail. It would not be difficult or unjust to do so, in many details, if the point of view were in itself more particular; but the author would be justified in answering that his reflections must be judged, not by items, but by the truth of the general point of view, and his answer would have weight. We forbear, then, from picking out from the joints of his edifice mortar which in not a few places seems to us to be unsound. Many a queried paragraph we may pass over in silence, as we must refrain from quoting many a happy one.

To turn to the larger aspects of the subjects, those general thoughts which the author had in view are often very well put; such as his conception of "compensation" as but part of the adaptation of stable moving equilibriums to their environments, so that cardiac "compensation," for instance, too often conceived with more than a spice of teleology, is a re-adaptation of the same general kind as immunity to bacterial and other poisons, and so forth. The whole of chapter vi. is interesting, perhaps the best in the book; the relative incidence of remedies in time is dwelt upon, and the potentialities of combinations of drugs—a practice in recent years much neglected—are fully discussed, their mutual enhancements or cross-purposes considered, and an explanation given of the chemical room left in the body for additional drugs as these may be in a solution saturated by one or more previously dissolved. Pp. 126–9, which deal with this part of the subject, are felicitous, and also the few pages following. Many sentences, too, are happily put, as, for instance, on p. 40:—"It may here be noted how it is that the organism as a whole secures its excretory stability, namely, by not carrying to the extreme the process of differentiation through which the higher types of tissue have arisen," &c. In another paragraph Dr. Sainsbury estimates in general terms the relative vigour of the communal and individual life of several parts. The chapter on diet, again, is good, especially the discussion on alcohol.

We must be forgiven if, in conclusion, we express the opinion that, in one respect at any rate, the author has not been watchful, namely, to counteract that tendency to flatness or dilution of thought which we have said is almost inseparable from speculative contemplations, and to endeavour to prevent prosiness and vagueness, by apt and penetrating phrases and instances. The quotations, which are made with some profusion, many of them bits of Latin, should have been fresh and "inevitable," but Dr. Sainsbury has not gone out of his way to seek for telling quotations. Almost all of them are well-worn "tags"; some are stale indeed. A common sentiment gains nothing by reiteration in Latin; *modus operandi* is no better than "mode of operation," and *non pane solo vivit homo* sounds to us better in our mother tongue. These points may receive attention in the new edition which the book deserves. The volume is well printed, and light in the hand. T. C. A.

OPTICAL INSTRUMENTS.

Leitfaden der praktischen Optik. By Dr. Alexander Gleichen. Pp. viii+221. (Leipzig: S. Hirzel, 1906.) Price 5.60 marks.

OF the making of German optical text-books there is no end, and there are perhaps few which do not constitute valuable additions to optical literature. The present volume, however, does not pretend to furnish new material, and it is improbable that it will be found of any special interest to opticians in this country. It is, indeed, not easy to gather for what class of reader the work has been designed. The preface suggests that the mathematical knowledge assumed in the ordinary treatises on optical instruments is usually lacking to the practical optician, and that it seemed a not altogether useless task to explain the principles of the theory of optical instruments, their construction and design, on the basis of an acquaintance with mathematics not extending beyond the first elements of algebra. Thus should the practical optician be provided with matter he could digest and the student with a stepping-stone to the treatises aforesaid, not the least useful among which are the author's own "Lehrbuch der geometrischen Optik" and his text-books on special departments of optics.

It would seem to us, accepting the writer's own account of his intention, that the requirements neither of the student nor of the practical optician have been kept sufficiently clearly in view. It is probably rather to the amateur who wishes to acquire an intelligent appreciation of the main principles of construction of the more important optical instruments that the book will appeal. The practical optician is daily confronted with problems towards the solution of which he will here find little help, while the student who looks for an introduction to the subject will scarcely do well to acquire the elements of optics from a work in which the necessary mathematics are so entirely kept out of sight. For the general reader the volume presents many excellent features, yet even to him we would prefer to recommend Moritz von Rohr's admirable little book, "Die optischen Instrumente," which provides for the non-mathematician a very considerable amount of information in the smallest compass.

For the rest, the matter is carefully arranged and the explanations of technical points clearly and simply given. The usual portions of the subject are included—the elementary theory of mirrors, prisms and lenses, the optics of the eye, the microscope, telescope, and the photographic lens. There is a chapter also on stereoscopy, in which some of the modern developments are shortly treated. The variable power telescope receives rather more attention than is usual. Tables are given for the calculation of achromatic lenses and of prism combinations, and throughout the book attention has been paid to the furnishing of numerical data. These, however, might easily be rendered more complete—*e.g.* particulars as to the field of view obtainable at various powers in telescopes of different pattern would be of value. Complete data are provided for the construction of certain well-known combinations, direct-vision prisms, eyepieces, microscope objectives, photographic lenses, &c. The provision of numerical information is, indeed, the most characteristic feature of the book, and will render it of value for occasional reference to some who are already familiar with the author's presentment of the optical theory.

OUR BOOK SHELF.

Die Eisenindustrie. By Oskar Simmersbach. Pp. x+322. (Leipzig and Berlin: B. G. Teubner, 1906.) Price 7.20 marks.

In German technical literature there are excellent exhaustive treatises on the metallurgy of iron, and students' manuals exist in abundance, but Mr. Simmersbach's work on the economics of the iron trade opens up an entirely new field. The leading principles and practices of the German iron trade are made clear, and a careful study of the information set forth cannot fail to prevent much waste of time and misapplication of energy in the conduct of business. The various chapters are well worthy of attentive study, and the book should find a place in the library of all who have any connection with the iron industry.

The first eight chapters give a concise introduction to the technology of iron and steel. They deal respectively with iron and its alloys, raw materials, blast-furnace practice, steelworks practice, rolling mills, testing of iron and steel, foundry practice, and the testing of cast iron and cast steel. The remaining seven chapters, dealing with the economics of iron and steel, are of greater interest. A general sketch of the importance of the world's iron trade is followed by chapters on the world's ore trade, the world's coal and coke trade, the world's pig-iron trade, the world's trade in castings, and the world's trade in malleable iron and steel. The final chapter deals with labour conditions and customs tariffs. The author takes an exceedingly optimistic view of the German coal and iron-ore resources. Germany is, he thinks, richer in iron ores than the rest of the Continental countries put together, and he explains the annual importation of more than six million tons of foreign ores as being the outcome of high railway charges. At the present rate of coal consumption there is, he believes, enough coal in Germany still unworked to last for 3520 years. These figures contrast strongly with his pessimistic views of the available resources of other countries. Prophecies as to the future of the world's iron trade are, however, of little moment.

The chief value of the author's work is in the abundance of admirably arranged statistical material regarding the present condition of the iron and steel industries, and in the evidence amply afforded of the manner in which science has superseded the old rule-of-thumb methods of carrying on operations at iron and steel works. A chapter on trusts, cartels, and syndicates would have been a useful addition to the work, and the absence of an index is to be deplored.

A Text-book of Fungi. By G. Massee. Pp. xi+427. (London: Duckworth and Co., 1906.) Price 6*s.* net.

The fungi constitute numerically the most extensive group of plants, and at the same time they present the largest number of unsolved problems; this, too, despite the fact that, as the author says, our knowledge has increased by leaps and bounds.

Mr. Massee plunges at once *in medias res*, and proceeds to describe modern cytological developments, their legitimate and strained applications, and certain lines of inquiry pursued by Marshall Ward. Recent work has widened our knowledge of conidia, spores of various kinds, and other methods of reproduction. The author has introduced the salient facts both of sexual and asexual reproduction, but fails to offer a logical definition or a practical limitation of the terms spore, sporophore, &c. The chapter on sexual reproduction contains useful summaries of Blakeslee's account of the Mucorineæ, Thaxter's investigations of the Laboulbeniaceæ, as well as Dangeard's and Blackman's researches. The author's views on parasitism in fungi are set forth, and reference is made to experiments on similar lines by Miss Gibson and Mr. E. S. Salmon, the latter of whom has contributed the chapter on "biologic forms." Closely allied with the spread of disease, which provides the opportunity for noting the insidious danger of hibernating mycelium, is the subject of legislation. Mr. Massee enunciates his arguments, which are mainly to show that, unless it is exceedingly drastic, legislation to prevent the introduction of plant diseases through imported plants and seeds would be useless.

On the subject of classification, the opinion of the author as an acknowledged exponent is especially valuable, and the reader will find clear, and we think convincing, reasoning in favour of the acceptation of Brefeld's main groupings. The personal views on phylogeny appearing earlier in the book should be

consulted in this connection. The treatment of the families is necessarily brief, but a good working basis for amplification is provided, and the last four sections, dealing with the anomalous order of Deuteromycetes, will be particularly useful to economic botanists.

The author claims to have provided an introduction to new lines of research. This is modestly expressed, for it will be found that, besides furnishing such an introduction, he has performed the additional service of discussing in a broad spirit their significance and interpretation; further, he has touched on most aspects of fungology, although not on the association of fungi in lichens, and has outlined the taxonomy of the group with a view to practical utility. In fact, Mr. Massee has supplied a serviceable and much required text-book on the present state of fungology which is embellished with numerous artistic and practical illustrations.

Douglas English Nature Books. No. 1, *One Hundred Photographs from Life of the Shrew-mouse, the Dormouse, the House-mouse, the Field-mouse, the Meadow-mouse, and the Harvest-mouse.* By Douglas English. Pp. 93. No. 2, *One Hundred Photographs of Bird Life.* By R. B. Lodge. Pp. 95. Illustrated (London: S. H. Bousfield and Co., Ltd., 1907.) Price 1*s.* each.

SINCE no less than sixty-four out of the ninety odd pages which go to form each of these volumes are devoted to reproductions of photographs of mammals and birds in their native haunts, the lover of animal life has a rich entertainment at a very small cost. As we learn from the introduction to the first, this series of books is intended for the pocket of the field-naturalist, and it is hoped that while the illustrations (which are almost beyond praise) will aid in the recognition of species, the letterpress will be of service alike in confirming previous observations and in suggesting new lines of inquiry. The series is intended to be comprehensive in scope. In the first part, which is devoted to some of the smaller British mammals, it is satisfactory to find a reversion to the use of popular names like water-rat, field-mouse, and shrew-mouse, in place of the spurious terms water-vole, field-vole, and shrew. In the second number Mr. R. B. Lodge gives one hundred photographs of bird-life, with appropriate notes. Since, however, the illustrations include species like the glossy ibis, little egret, and spoon-bill, it is rather difficult to see what they have to do with the ordinary field-naturalist. R. L.

Gold Mining Machinery: its Selection, Arrangement, and Installation. By W. H. Tinney. Pp. xii+308. (London: Crosby Lockwood and Son, 1906.)

THIS book professes to be "a practical handbook for the use of mine-managers and engineers" to assist them in the "selection, arrangement and installation" of gold-mining machinery. Such a work properly executed would doubtless perform a useful function; but Mr. Tinney's production fails in its purpose, for it is out of date and superficial. For example, winding machinery, which should surely be one of the most important sections of a work such as this purports to be, is dealt with in seven pages of letterpress, and, as may well be imagined, the modern high-class winding engine finds no place in it. Deep winding, the greatest problem at present engaging the attention of the mechanical engineers of the Witwatersrand goldfields, is passed over in silence. Again, the electrical transmission of power, a subject of vast and ever-growing importance to the miner, is dismissed in four pages of letterpress.

It may well be asked, of what are the 300 pages of this book made up? The work appears to consist of a jumble of extracts from the note-book of the author (whose experience of the gold mines of the world would seem to have been somewhat limited), together with specifications of machinery makers, illustrated by a selection of photographs from their catalogues. To this *olla podrida* has been added a number of workshop receipts and various elementary tables, such as "the sizes of drawing paper," and formulæ for calculating the areas of a circle, a triangle, a square, &c., and the volume of a cube, a sphere, a cylinder, &c. One of the tables gives the "names, common and chemical," of a list of substances, beginning with "aqua fortis" and ending with oil of vitriol, and including such rare materials as chalk, iron pyrites, rust, slaked lime, salt, and soda.

Memories of the Months. Fourth Series. By the Right Hon. Sir Herbert Maxwell, Bart., F.R.S. Pp. x+319. (London: Edward Arnold, 1907.) Price 7*s.* 6*d.*

SIR HERBERT MAXWELL'S new volume will be welcomed by the many readers of his previous series of "memories." The ability to combine literary grace with scientific accuracy, and the power to interest and at the same time to impart useful information, is unfortunately rare, and we are grateful to Sir Herbert Maxwell for placing his gifts at the disposal of a large audience by means of these pages. Readers will be able to share with the author of the memories his "delight in the open field, the woodland, and the riverside," and if they prove willing disciples they may in time experience the joy of original observation for themselves—at least they will learn to study and appreciate the boundless beauties of nature.

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.*]

On the Relationship of Lemurs and Apes.

ACCORDING to the report published in NATURE (April 11, p. 574), Mr. H. F. Standing recently presented a memoir to the Zoological Society in which he described certain extinct lemuroids from Madagascar as being, "in many respects, intermediate between existing lemurs and monkeys," and, as the result of this interpretation of the anatomy of these animals, he expressed the view "that it was not possible to separate the Primates, as hitherto, into the two suborders Lemuroidea and Anthropoidea."

At the suggestion of Dr. A. Smith Woodward, Mr. Standing kindly sent me casts of the cranial cavities of three of the Prosimiæ found by him, and in January last I sent him a report in which their outstanding features and the inferences to be drawn from them were set forth. My conclusions not only lent no support to the above-quoted summary of Mr. Standing's opinions, but are in direct conflict with them. But I would not have deemed it necessary to repeat these statements, already made in my report (which I presume will be published along with Mr. Standing's memoir), had it not been for the fact that, since my report was written, further investigations (chiefly histological studies in the structure of the neopallium of Tarsius, Loris, Nycticebus, Perodicticus, Lemur, Propithecus, Hapale, Cebus, and Cercopithecus) have revealed important facts that enable me to speak more emphatically on the old problem once more raised

for discussion by Mr. Standing, and also incline me to suggest a modification of my previously expressed views.

The evidence afforded by the cranial casts is very precise and unmistakable. One of them does not differ in any essential feature, excepting size, from the form exhibited by the brain in the living species of the genus Lemur; a second is an almost exact replica of the cranial cast of Indris; and the third, so far from affording any evidence of affinity to monkeys, presents highly specialised features, which enable us to place the animal (and also Nesopithecus, Megaladapis, and possibly Chiromys) within the fringe of the Indrisinæ. As these lemuroids are the most diversely modified members of the most highly specialised family of the Prosimiæ—which means that they are furthest removed from (and presumably have retained least resemblance to) the very early and remote ancestor from which both lemurs and apes could have sprung—it follows that these, the most aberrant and outlying branches of the prosimian phylum, are the least likely to supply us with any evidence bearing on the relationship of lemurs to apes; and the facts elucidated by the actual examination of these specimens quite bear out this *a priori* supposition.

I am the more anxious to make my position absolutely clear in regard to this matter for the reason that, some four years ago (Linn. Soc. Journal—Zool., vol. xxix., p. 83), in protesting against Hubrecht's suggested exclusion of all Prosimiæ (except Tarsius) from the Primates, I may have unduly minimised the differences in structure that indicate the wide separation of the Lemuroidea and the Anthropoidea.

The organisation of every part of the body proclaims the kinship of lemurs and monkeys, distant though it be; this has been so often summarised (see Earle, "On the Affinities of Tarsius," the *American Naturalist*, 1897, pp. 569 and 680) that it does not need repetition. I might direct attention to the fact that the lemurs are the only mammals that exhibit the true Sylvian fissure such as we find in the Anthropoidea or Simiæ; that the true central (Rolando's) sulcus is present in Perodicticus and in no non-Primate mammal, although there are distinct evidences in many prosimian families of the tendency toward the development of this caudal-limiting sulcus of the motor area; that the motor area presents histological features like those of the lowlier monkeys, and has a similar topographical distribution; that the calcarine sulcus and the distribution of the visual cortex (area striata) conform essentially to the Primate type, although in certain respects the structure of this cortex and its relation to sulci more nearly resembles the condition found in certain primitive Carnivora; and that the organisation of the other parts of the cerebral hemisphere and of the brain-stem and cerebellum resembles that of the corresponding parts of the brain in monkeys much more nearly than that of the Carnivora and Edentata, in which there are some analogies to the Prosimiæ.

But if the facts of cerebral anatomy establish the claim of the Prosimiæ to be included in the Primates, they afford equally emphatic evidence of the sharp line of demarcation between the diversely specialised suborders Lemuroidea (Lemures) and Anthropoidea (Simiæ) and the degraded rank of the former. In attempting to formulate the contrasts between these two suborders, Tarsius comes to occupy such an enigmatical position that it must be put into a category by itself, the suborder Tarsii (Gadow), the other Lemuroidea then forming the suborder Lemures (Hubrecht).

The Lemures are macrosmatic, and (excluding Megaladapis) have a sessile olfactory bulb, whereas the Simiæ are microsmatic, and have an elongated olfactory peduncle. Tarsius has a sessile olfactory bulb like the Lemures, and in form exactly like that of the Galaginæ and Lorisinæ, but it is much smaller than that of any lemur, and at the same time is bigger than that of a monkey.

The cerebral hemisphere in the Simiæ is prolonged backward to cover the cerebellum, carrying with it a diverticulum of the lateral ventricle to form a posterior cornu, the walls of which are composed to a large extent of very highly specialised striate cortex differing markedly in structure from the homologous area of other mammalian orders. In Lemures the occipital prolongation is not so extensive; there is no posterior cornu, and the cortex of the area striata approximates in structure to that of the Carnivora more nearly than to that of the apes. In Tarsius the extent of the occipital pole and its form most nearly resemble the condition found in the brain of the Galaginæ, but there is an extensive posterior cornu as in the apes, and the structure of the area striata presents a marked contrast to that of the lemurs, and resembles that found in Hapale and Cebus.

In the lemurs the frontal, temporal, and parietal association areas are much smaller than in monkeys.

The lateral hemispheres of the cerebellum exhibit a much greater expansion in the Simiæ than in the Lemures, although there is a very close resemblance between the patterns exposed in mesial section in the two suborders.

In many respects the structure of the brain in Tarsius departs widely from that of all the other Primates, both Lemures and Simiæ. Most of these features, such as the form and proportions of the corpus callosum and the architecture of the cerebellum, are indicative of a very primitive generalised condition, such as we find in the insectivore Gymnura.

All these considerations, and the mass of facts elucidated by Burmeister, Turner, Hubrecht, Mivart, Leche, Eugen Fischer, and the writer among many others, can, I think, find a rational explanation only by admitting that the Primates consist of three divergent phyla, which have all departed in varying degrees and in different ways from their original common ancestor, which must have been a creature in many respects like Tarsius, but more macrosmatic, and possessed of a smaller and less highly specialised visual cortex.

G. ELLIOT SMITH.

The School of Medicine, Cairo, April 22.

Radium and Geology.

Two points of special interest have come to light in recent investigations which I have made in connection with this subject.

(1) Typical rocks from the Simplon Tunnel contain quantities of radium considerably in excess of the average of igneous rocks. The Simplon rocks are altered sediments, for the most part, from Archæan to Jura-Lias age. There appears to be sufficient radium to account for the excessive temperatures met with in boring the tunnel, and the practical suggestion is allowable that engineers will do well to estimate the distribution of this substance before embarking on similar projects in the future.

The investigation suggests that radium, accumulating in great thicknesses of sedimentary deposits, may enter as a factor in mountain building by raising the temperature at the base of the accumulated mass. This would lead to a lessened resistance to compressive stress and pressure from beneath. In short, it will be for future investigation to explore how far radium (and uranium) in the surface materials has proved a source of *instability* in geological history, its transport by denudation being, in fact, not a transport of matter only, but a convection of energy.

(2) A sample of red clay from a depth of 2740 fathoms in the North Atlantic contained sixteen times as much radium as the average of igneous rocks as determined by the Hon. R. J. Strutt, and a specimen of globigerina ooze from a depth of 1990 fathoms in the South Atlantic about six times this average. These materials I owe to the kindness of Sir John Murray.

Here the question will arise, Whence all this radium? Sir John Murray's cosmic dust, of course, at once comes to mind, and, taking all the facts into account, I venture to regard these results as further evidence in favour of the extra-terrestrial origin of some portion of the radium we find upon the earth.

The above results are obtained by measurement of the emanation, with every precaution against error.

The point as to what constituent of the oceanic deposits is responsible for the radium is under investigation.

J. JOLY.

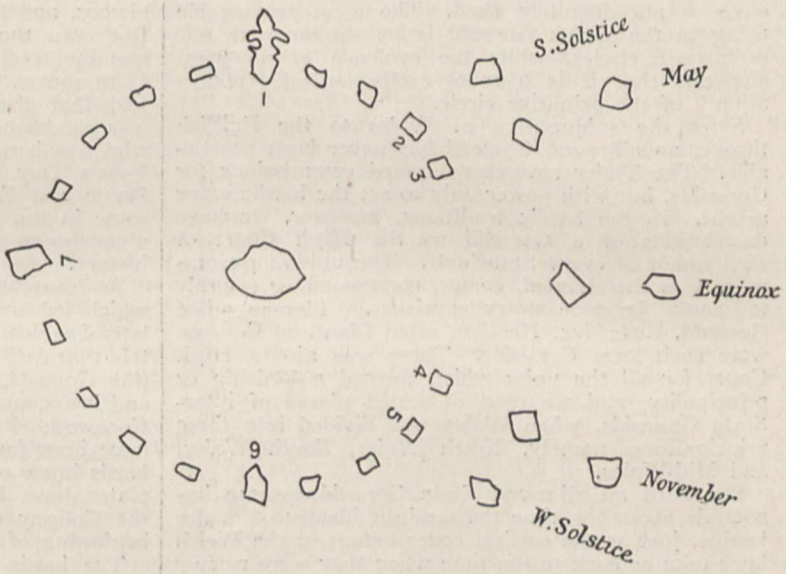
Geological Laboratory, Trinity College, Dublin, April 29.

THE ASTRONOMICAL AND ARCHÆOLOGICAL VALUE OF THE WELSH GORSEDD.

AS a common term *Gorsedd* is used for "throne"; as a specific term it means (1) the stone circle, and (2) the bardic assembly at the circle. The proper Welsh for "throne" is *gorsedd-vaingc*, "*gorsedd*—seat or bench"; so the Welsh idea of a throne is the place of honour in a stone circle. That was once literally the case. Though the chief bard has always been the master of the Gorsedd ceremonies, the assemblies were held by the authority of the chieftain, lord, or king, and the business and festal features of the assembly were personally controlled by the lord of the land.

Perhaps the most satisfactory translation is "High Court." From the twelfth century to the present the Gorsedd has been the High Court of the Bards. We never hear of any other business transacted except matters that affected the bardic fraternity. But even such a circumscribed Gorsedd was never legal without the lord's authority.

There are many lines along which it would be easy to show the genuine antiquity of the Gorsedd traditions, and had I nothing more than this to say, I could with confidence invite archæologists to study them. When, however, Sir Norman Lockyer's "Stonehenge" came to my hand, some very obvious facts about the Gorsedd appeared at once to the point, and it has been my delight for the last six months to gather such facts together and apply to them the useful instructions given in the work mentioned. The present Gorsedd circle consists of twelve stones, 30° apart, with a larger stone in the centre. Outside, on the east, three stones are placed to indicate the solstices and equinoxes to an observer at the centre stone. A reader of "Stonehenge" would at once see that such an arrangement does not look very ancient. The silence of the bards about the February-May-August-November year suggested that something had been omitted in the instructions. All the old plans of a Gorsedd I have seen give 30° or so between the sunrise stones, and invariably the plans are contradicted by the verbal instructions accompanying them, in which a solstitial arrangement is insisted upon. Mr. T. H. Thomas, of Cardiff, to whom all Welshmen are grateful for what he has done towards setting the Gorsedd aright, kindly sent me a tracing of a Gorsedd plan preserved among the Iolo MSS. at Llanover, Mon.



PLAN OF A GORSEDD.

The plan was evidently prepared for the engraver, and the draughtsman signs his name as "T. Jones, Merthyr Tydvil, Sculpsit." The numbers given in the plan are not properly explained. A portion of the page is torn, and we have the fragmentary explanations:—"1 Alba—, 2 Alba (also underneath) Alb—, 3 Alban—, 4 y mai(n)—Cadlas neu Cylch C—.' Nos. 5, 6, and 7 are not explained. What Alban No. 1 represents is difficult to make out. In the above tracing I affixed No. 1 to the north stone, by way of directing attention to the fact that for a stone there we have an elaborated north sign. No. 1 was probably intended to mark the Alban Eilir and Elfed (the equinox stones). No. 2 fronts the Alban Hevin (summer solstice stones), but that name is written across the head of the May stones. No. 3 fronts the May stones, though on the margin it is "3 Alba—." No. 4 fronts the November stones, but across the head of that alignment is written "Alban Elfed," the bardic name for the autumnal equinox, while on the margin No. 4 is explained by words which seem to be names for the whole group of sunrise stones. The easternmost stone is described as "Alban Arthan," the name of the winter solstice. Between the May and November alignments we have two names, one, "y meini gwynion neu'r Cylch Cyngrair," "the Holy Stones or the Stones of Testimony," the name, in fact, of the circle; the other name is "y Cyntedd," "the Court," the name of the space or gap formed on the east of the circle by the "sun stones." Accompanying another plan, in which names and measurements are also misplaced, we have the following explanatory remarks, which are perfectly correct:—

"The stones forming the circle are termed *White Stones* or *Stones of Testimony*—the circle itself is sometimes called the *white circle*.

"The middle stone, or altar, is termed *Maen Gorsedd*, i.e. *Presidial stone*.

"The stones pointing at the Equinoxes and Solstices are called *Stones of the Sun*. The Bards stand unshod and uncovered within the circle, the Presiding Bard, who must be of the *Primitive Order*, stands by the *presidial stone*. All the other Bards attend around, standing near the *white stones* or periphery of the circle."

This is the bard's English, in which language he used to hold his own in the presence of the great Pitt, Dr. Johnson, and the notabilities of his time. My references to the sources of these Gorsedd plans are "Llanover Iolo MSS., vol. x., p. 267, and vol. xix., p 160." "Holy," not "white," is the meaning of *gwyn* as applied to the Gorsedd circle.—J. G.

It was the perfect plan that I had been searching for. It was accompanied by another, less perfect. As usual, the verbal explanations contradict the plans. In the perfect plan, which gives both the solstitial and the May years, the directions 30° or so north and south of east are stated to be the solstices, while no verbal explanation is given of the solstice stones. In the other plan the distance between the east stone and the winter solstice stone is stated to be "30 degrees south." Delightful blunders both! The writer, Edward Williams (Iolo Morgannwg), who died in 1826, did not quite understand the plans, but to his honesty as a copyist we are indebted for a very valuable document.

In what I venture to call the perfect plan, the place of honour is given to the May year, the solstitial stones taking a second place. This is the case still in Wales. The chief dates still in our rural life are May Day and All Hallows. The gap in the direction of the sunrise stones suggests a comparison with other circles which show a gap in that direction.

It is evident that our bards give us plans which they seem not to understand. They have not invented them. So far as I know, there is no megalithic monument in Britain exactly like a proper Welsh Gorsedd, that is, it is no copy of any existing monument. On the other hand, the similarity between it and existing circles is most striking. There is a circle of nineteen stones, with one stone much larger inside, at Boscawen-un, and nineteen is rather a common figure in such circles in Cornwall. A circle of twelve stones roughly divided the year into months, and one of twenty-four

into "fifteen-nights," as the Welsh for "fortnight" signifies, with a gap left in the east to welcome the sun on the chief days of the year, for the nineteen stones are separated, except on the east, by 15°. I have noted that when the stones of a circle are separated, in the plans, by 30°, the circle is complete, as space is provided for a May-November alignment. But providing a splayed avenue for a solstitial arrangement necessitated a reduction in a circle of twenty-four stones to nineteen, and in the two plans I have referred to, where the circle consists of nineteen stones, there is no inner circle of twelve stones described. It is significant that in the conventional instructions the number of stones forming a Gorsedd circle is not definitely fixed. The most remarkable thing in the Welsh Gorsedd is its similarity to our prehistoric circles, while the evidence at no point suggests that it is a mere archæological "restoration" of the primitive circle.

Since the subjugation of Wales to the English throne, an all-round Gorsedd has never been practicable. The Tudor sovereigns issued commissions for Gorsedds, but with power only to set the bardic order aright. In the bardic traditions, however, we have descriptions of a Gorsedd as the High Court of Parliament of every State unit. The unit of government was the *cwmwd*, comot, corresponding roughly to some large country parishes. Places called Gorsedd, Eisteddva, Henllan, often Llan and Eglwys, were such local Gorsedds. There was also a High Court for all the units which formed a lordship or principality, and we read of stated places of inter-State Gorsedds, when Wales was divided into three principalities, namely, North Wales, South Wales, and Mid-Wales.

But such an all-round State Gorsedd became impossible about the time the straight history of Wales begins, just as the earliest codes extant of the Welsh laws take us back to the time when they were rapidly becoming obsolete. The bardic traditions, however, describe such impossible things, even to minute details. So the laws give us much of the history of Wales that is otherwise nebulous.

Even more than the ancient codes of Welsh laws, the bardic traditions of the Gorsedd are the most formally authenticated of any Welsh literature. Since the tenth century the former have had to take care of themselves, apparently, but the bardic traditions were always recited at every proper Gorsedd. From the twelfth century to the first quarter of the nineteenth we have accounts of a series of great Gorsedds (or Eisteddvod, the same thing), every one of which was convened for the chief purpose of re-codifying or otherwise dealing with the bardic traditions. The voluminous body of traditions in question grew out of such assemblies. There was usually one bard head and shoulders above the others, who, of his own accord or by request, would prepare a statement which would be approved at a Gorsedd convened by the lord, as at Caerwys by Queen Elizabeth, and become afterwards the law of the fraternity. After long intervals, and especially after great disturbances in civil government, such revising Gorsedds became necessary, and that they were held for such a purpose, in very adverse circumstances, witness the conservatism, persistence, and vitality which are still much in evidence in the Welsh bardic order. We have nothing so well and faithfully guarded in Welsh literature as our bardic traditions.

The very latest instructions which our present bards observe in erecting a Gorsedd circle were recorded at a time when some said the winter solstice was on December 9 and some on December 10. I mention this because some would have it that these instructions were invented by a Glamorgan bard about the beginning of the last century, who knew the solstice to occur on December 21!

True or false, there is no question of the formal authentication of these traditions, and that is a great step gained. But could these traditions be deliberate inventions after all, guarded and handed down by the bards as such? There is nothing to warrant such a remark. To invent such things the bards would have to be expert historians and archæologists. They were neither the one nor the other, and in their time scientific history and archæology were hardly in existence. Sometimes the bard-redactor indulges in history, and he always blunders in names and dates. But even the poor bits of history are found to be genuine traditions, and may be true enough except as to names, places, and dates. For instance, we are told that the bardic order, and every other order, was established by a man named Prydain (Britain), who was born on the vernal equinox, and every New Year's Day was Prydain's birthday. Students of Rome and Egypt will note this, though, I believe, some in the past have looked upon this tradition as a conclusive proof of the utter worthlessness of bardic history.

As to archæology, it is some study of that science which led me to look into these traditions for collateral evidence. The following are instances. We are told that Arthur caused the system of the Round Table (the Gorsedd, in fact) to be written on plates of tin and brass, and deposited at Gelliwig (Pendennis?) in Cornwall. I am not aware that such bronze tablets have been found there, and it is a mystery how the bards knew of such a medium of writing. But such plates have been found in ancient Gaul on which the Coligny Calendar is inscribed, dating about the beginning of the Christian era.

The bards tell us of an important festival which has wholly disappeared, except possibly in the form of "house-warming," the Hob Feast, *Gwyl Bentan*, "the feast of a fire back, which takes place when five fire back stones have been raised, so as to constitute a dwelling station."

There is one feature of the bardic lore that invites confidence apart from historical and archæological allusions. It is a fine unconsciousness, such as is never found, I believe, in faked, forged, or invented histories. It betrays itself in two ways. On the one hand, the necessity of proving or defending whatever history or tradition he records never occurs to the bardic scribe. From period to period we have simply a record, stamped by a Gorsedd authority, of accepted truth or sound lore. On the other hand, he never troubles himself about Druidism as such. He tells us, in passing, that there was something of the kind in the time of Julius Cæsar. Very seldom the term Druidism is used, and then not for what Cæsar knew as such, but for the actual teaching of the bards. He never troubles himself over the question of a Druidical succession from Cæsar's time to the present. It is over-consciousness in handling the bardic traditions that has worked havoc with them within the last century. Fortunately, however, our materials have a downward limit of date to the sixteenth century, before hardly anybody thought of arguing the matter.

Within the last fifty years a special effort has been made to "restore" the Gorsedd. Until lately its preservation was very much a local matter, in which the bards of Glamorgan have been most faithful. Now, however, it is a distinctly national institution.

JOHN GRIFFITH.

CLIMATOLOGY OF THE UNITED STATES.

PREPARED by Prof. A. J. Henry, under the direction of Prof. Willis L. Moore, chief of the United States Weather Bureau, a volume[1] of 1012 pages has recently been published dealing with the climate of the United States. This most valuable contribution to meteorological science will be welcomed by all who wish for the advancement of this subject, and the Department of Agriculture is to be congratulated on publishing in this form the climatic statistics for the different portions of the United States.

Americans are nothing if not practical, and the issue of the volume before us is an excellent example of this. Thus, in the introduction, we are told first that the "need of such a volume has been felt for some time, particularly within the Department." Further, and this is where Great Britain might take a hint with regard to furthering the agricultural needs of her colonies, "During the last few years the Bureau of Plant Industry has introduced a number of seeds and plants new to this country, as well as new varieties of plants and grains already well established. In order that the best results may be obtained, it is essential that the new plant or seed be placed in a climate closely resembling that of its original habitat. The Pomologist has likewise felt the need of more generalised climatic data than is afforded by the scattered publications of the Weather Service, and this is true in other lines of research that are being prosecuted by the Department."

The above quotation is another instance, if one is required, that the American Government carefully fosters the study of meteorology, and thereby increases its revenue.

The data on which the statistics here given are based may be said to be taken from three sets of observations. Thus the first is due to the Medical Department of the Army, the observations being made at military posts during the period 1820–1890. The second is the result of observations made by the cooperating observers of the Smithsonian Institution, and extends from 1849–1874. The third and last set is due to the Signal Service and the Weather Bureau, and commenced in 1870 and is continued up to date.

In spite, however, of the fact that several records cover a great number of years, only a few records exceeding fifteen years in length are inserted in this volume. The reason for this, as stated, is that it is only within the last ten or twelve years that uniformity, both in observing and recording climatological data, has been attained.

The book before us may be considered as divided into three sections. The first portion consists of an admirable summary of the main features of the United States climate (pp. 7–84), supplemented with numerous maps and charts. The second part (pp. 85–118) consists of general tables of temperature, humidity, and wind, followed by a list and map of the climatological stations which appear in the report. The remaining but greater portion of the volume (pp. 119–1012) is composed of the contributions of the district forecaster or section director of each State. This, as a rule, takes the form of a general description in words of the climate of the State as a whole, then a State summary in tabular form regarding temperature, frost, and precipitation, and, lastly, the monthly, seasonal, and annual means for temperature and precipitation for each station, together with such data as description of locality, instrumental equipment, and positions of instruments. When it be mentioned that no less than 690 stations are referred to, and the data for each station occupy a page, some idea of the amount of material dealt with can be obtained.

Reference has been made above to Prof. Henry's admirable summary of the broader features of American climate. This portion of the work should be read with great interest, because it brings together in clear and concise language an account of the general conditions of atmospheric circulation which occur over this large stretch of country. Justice to this essay could only be done by occupying considerable space, so remarks will be limited simply to one or two points which seem to be of more special interest. The first of these describes the conditions which accompany "cold waves," which occasionally pass over the country and envelop it in Arctic weather. The fall of temperature to justify one of these waves must, as is stated, be at least 20° F. in twenty-four hours, except along the Gulf Coast, where a drop of 16° F. or more constitutes a cold wave. Cold waves follow in the wake of cyclones under the influence of which the temperature has risen. The lowest isotherms are nearly coincident with the highest reading isobars in the anticyclonic system which follows the cyclone. The isotherms, other than the lowest, only very generally follow the trend of the isobars, and spread much further south over the United States than the isobars would suggest. The cause of these cold waves is due, not merely to the prevalence of the cold north-west winds which follow the passage of the low-pressure area, but more particularly to the radiation from the ground in the clear dry air in the rear of the cyclone. The cold of radiation is communicated to a greater stratum of air, and the effect of solar radiation is reduced, since the surface layers are being constantly renewed by colder air from higher latitudes. With little horizontal air movement in the anticyclone, the night temperatures are low, and there is a tendency for this cold air to collect in valleys and basins. January, February, and March are the months in which the waves chiefly occur, and in the eastern part of the United States the average number a year is three or four.

Prof. Henry gives some very instructive maps illustrating the barometric and thermometric conditions during some of the more intense waves that have been recorded.

Hot waves, or "heated terms" as he calls them, are more briefly dealt with, and some idea of their effect on humanity may be gathered from the statement that "during the three weeks that ended August 22, 1896, there were 2036 known deaths in the United States directly attributable to sunstroke. Large as this number is, it doubtless falls far short of the actual number of cases."

In the same thorough way in which the above waves of heat and cold have been discussed, Prof. Henry deals with precipitation, sunshine, wind (including thunderstorms and tornadoes), &c. The concluding section is devoted to seasonal variations from year to year. It will be remembered that at the beginning of the present year, when Europe was enveloped in a cold wave, Iceland, with a much more northern latitude, was revelling in warm weather. Similar inversions occur in the United States. Thus we read that, during the severe weather of March, 1906, when temperatures 10° F. to 20° F. below zero prevailed in the northern Rocky Mountain region, including the southern portions of Alberta, Assiniboia, and Winnipeg, the weather in Alaska, far away to the north, was warm and pleasant, with temperatures above freezing in the

[1] "Climatology of the United States." By A. J. Henry. U.S. Department of Agriculture. Weather Bureau, Bulletin Q. (Washington, 1906.)

lower Yukon Valley, and about freezing in the vicinity of Eagle (longitude 141° W.).

The primary object of the present work was to present in a form for easy reference comparative statistics for the different parts of the United States. This object has been very successfully attained in this volume so far as existing homogeneous observations allow, but the data for many stations will have to be revised when means can be formed for a greater number of years. Nevertheless, the volume is a valuable contribution to the meteorology of the portion of the world with which it deals, and will serve probably to stimulate the directors of some other meteorological services to bring together masses of existing material which are for the most part lying dormant.

DEDICATION OF THE CARNEGIE INSTITUTE.

THE trustees of the Carnegie Institute had permitted their European guests to select the steamers that suited them, and had taken quarters for them in the new and luxurious Hotel Belmont, 42nd Street, New York. On Wednesday morning, April 10, two special pulmans and a luncheon car were provided to take the party to Pittsburg, and one or two of the trustees were on board to welcome the guests and to make them known to one another. Amongst the party were Baron d'Estournelles de Constant and M. Paul Doumer, representing the Institut and various French universities; M. Leonce Benedite, director of the Luxembourg; and M. Camille Enlart, director of the Trocadéro Museum, Paris; their Excellencies T. von Moeller, Minister of State, and Lieut.-General von Loewenfeld, Adjutant-General, represented the German Emperor; Privy Councillor Dr. Koser, chief director of the Prussian State Archives and member of the Academy of Sciences, and F. S. Archenhold, director of the Treptow Observatory, represented scientific Germany; Sir Robert Ball, F.R.S., and Dr. Roberts, the Vice-Chancellor, represented the University of Cambridge; Dr. John Rhys represented Oxford University; whilst there were also present Sir Edward Elgar, Sir William Preece, F.R.S., and Dr. Chalmers Mitchell, F.R.S.

Continued snowstorms made it impossible to see much of the wild scenery of the Alleghenies, and the famous horse-shoe curve of the Pennsylvania Railroad was traversed in a regular blizzard. The party reached Pittsburg about 8 p.m., and at the Hotel Schenley, situated in the Schenley Park, a few yards from the Carnegie Institute, found assembled a very large number of Americans representing nearly all the scientific institutions and universities of the United States and from Canada, Principal Peterson and Dr. Bovey from the McGill University, Montreal, and Dr. Galbraith from Toronto.

The proceedings began on Thursday morning, April 11, with a reception of the guests in the founder's room by Mr. Frew, president of the board of trustees, who above all others has been responsible for the translation of Mr. Carnegie's generosity into the actual buildings. This was followed by a reception in the grand foyer of the institute, at which the guests were presented to Mr. and Mrs. Carnegie. After luncheon there was a procession of the guests in uniform or academic costume through lines of cheering students, from the hotel to the institute. At 2 o'clock nominally, actually about 3.30 p.m., the dedication took place. The Cambridge Vice-Chancellor delivered an "invocation," modelled on the university "bidding prayer"; Principal Rhys read a scripture lesson (Proverbs, iii., 9–27), Mr. Carnegie delivered a long address, and M. d'Estournelles de Constant and Theodor von Moeller presented official congratulations from France and Germany.

It was notable, and somewhat humiliating to the English visitors, how elaborately Germany had made official arrangements for showing the sympathy of its Government. At each function Germany was to the fore; there was a personal cable from the Emperor, the Emperor's high representatives appeared with their staff in brilliant uniform, and a special gift of German State records and Blue-books, and the formal return gift from Mr. Carnegie of a cast of Diplodocus, were only characteristic examples of the German activity. The high position and exquisite tact of Baron d'Estournelles de Constant, together with the public announcement made by him a few days later at New York, that the French Government had commissioned him to bestow the Grand Cross of the Legion of Honour on Mr. Carnegie, supported the prestige of France, but although the British subjects who were present ably upheld the position of England in their individual capacities, there was no one formally commissioned to represent the English Government.

On Friday, April 12, there was an informal reception at the technical institute, and a presentation of addresses in the large hall from the various universities and learned bodies throughout the world. There were in addition a number of addresses delivered in whole or in part by the European guests; Sir Robert Ball took as his subject "The Solution of a Great Scientific Difficulty," stating the difficulty in the old supposition that the contraction of its sphere could be the source of the energy radiated out by the sun, and suggesting that the presence of radium offered a solution. Sir W. H. Preece spoke on the connection between science and engineering, tracing the extent to which the art of the engineer had been indebted to the researches of pure science. Dr. Chalmers Mitchell discussed international co-operation in zoology, dealing specially with the necessity for unity in nomenclature and with progress in the international recording of zoological literature. In the evening there was a large banquet, and the proceedings ended on Saturday morning with the ceremony of the conferring of honorary degrees by the Western University of Pennsylvania. The English recipients were as follows:—LL.D., Sir Robert Ball, Sir Robert Cranston, Sir Edward Elgar, Dr. P. Chalmers Mitchell, Sir W. H. Preece, Dr. John Rhys, the Rev. Dr. E. S. Roberts, Dr. John Ross; Litt.D., Mr. C. Moberly Bell and Mr. W. T. Stead.

The Carnegie Institute, the area of which is nearly four acres, and the adjacent technical schools, which when completed will cover with their workshops and yards nearly thirty-two acres, are the "gifts of Andrew Carnegie to the people of Pittsburg," and are dedicated to "literature, science, and art." The total cost, together with a recent endowment for maintenance of more than a million pounds, has been about four million pounds. The management is vested in a board of trustees consisting of local representative men, under whom Dr. W. J. Holland is director of the museum, Mr. John W. Beatty director of the fine arts department, Mr. A. A. Hamerschlag director of the technical schools, whilst Mr. A. H. Hopkins is chief librarian. The exterior of the institute proper is unpretentious, the structure being of steel faced with grey sandstone in a simplified Corinthian style. The interior is a series of gorgeous halls and corridors in marble and gilding, decorated with a striking series of mural paintings by Mr. J. W. Alexander, a

young American artist. The library contains special rooms for the reference collection, for the lending library, and for children, and at present consists of nearly 1,500,000 volumes, 800,000 of which find place in an eleven-story book-stack. There is a very large music-hall with a fine organ and a magnificent foyer. The fine arts department contains nine galleries, with a floor space of more than 44,000 square feet, and in addition a hall of sculpture and a hall of architecture. The galleries contain a good permanent collection, specially rich in the works of modern artists, with a special section for an annual international exhibition.

The museum, to which there is attached a fine lecture hall, an excellent special library, and a well-equipped series of research rooms, has a floor space of more than 100,000 square feet, arranged in three tiers, of open courts and galleries. On the ground floor there are special collections of gems and coins, particularly rich in specimens from China, India, and Korea, the gifts of John J. Lewis, William Thaw, and Mr. Carnegie. The main hall of the museum is devoted to mineralogy and geology. There is an almost complete collection of local minerals, and a fine series of huge relief maps of the district. The palæontological department is dominated by Diplodocus, but contains many other interesting specimens, in particular a very fine series of Oreodont mammals. The second floor contains galleries devoted to economic botany and to general zoology. There is a large and well-mounted showcase of Steller's sea-lions, and a capital group of Rocky Mountain goats. The bird series is as yet disappointing, but the arrangement of the galleries has only begun. The third floor is devoted to entomology, and Dr. Holland's fine collection of Coleoptera and Lepidoptera has now found a home worthy of its zoological importance. The chief assistants of Dr. Holland are Mr. Douglas Stewart, in the department of mineralogy; Dr. A. E. Ortmann, with P. E. Raymond, Earl Douglass, and O. A. Peterson, in palæontology; Prof. C. V. Hartman, in ethnology; Mr. O. Jennings, in botany; Mr. W. E. C. Todd, in ornithology; and Mr. H. Kahl, in entomology. The chief assistant in the setting up of fossils is Mr. A. S. Coggshall, whilst Mr. F. S. Webster is the taxidermist and Mr. Th. A. Mills the modeller. With such a staff and the ample endowments at his disposal, Dr. Holland has a magnificent opportunity of which he may be expected to take full advantage.

A full description of the technical schools would require many pages. In equipment and staff they are magnificent, and are adapted for the teaching of almost every form of the mechanical arts.

ARCHÆOLOGY AND THE ASSOUAN DAM.

A DESPATCH from the Earl of Cromer, just issued as a White Paper (Cd. 3397), deals with the question of increasing the water supply of Egypt by constructing a new dam or raising the present dam at Assouan. Notes are included by Sir William Garstin, Sir Benjamin Baker, Mr. A. L. Webb, and Captain Lyons, in which the various plans are considered. After examining all possible sites, the opinion expressed is that no alternative exists but that of raising the Assouan dam. Unfortunately, this means the almost complete submersion, during a portion of the year, of the temples at Philæ; and it is therefore important to know what the Egyptian Government intends to do with regard to the Nubian monuments affected by the proposed works.

Captain Lyons points out in his note that since in an arid climate the flood plains are almost the only region where civilisation has been able to develop, a thorough investigation of the monuments in the district to be affected should be made before the water-level is raised. His principal suggestions are summarised as follows:—

> An archæological survey of Nubia should be carried out, at the expense of the Government, and every effort should be made to render it as complete as possible. The different archæological societies in Europe should be invited to cooperate with the Egyptian authorities in this work, by sending representatives to assist in these researches. Wherever possible, the foundations of the monuments submerged should be reconstructed and consolidated, as was done in the case of the Philæ temples. Such repairs as may be considered necessary to insure the stability of their superstructure should also be undertaken. A thorough and complete examination of all the ancient sites, settlements, and cemeteries which will fall within the limits of the raised water-levels should be carried out, and drawings or photographs sufficient to preserve a complete record must be made by competent artists. Lastly, the results of these investigations must be published to the world.

Sir William Garstin does not hesitate to say that this programme will be adopted, and that "the funds necessary for such an object will not be grudged by the Government." If the raising of the dam is preceded by an exact scientific survey, archæology will benefit by an increase of knowledge, while Egypt will gain by an increase of water supply. There ought, however, to be a definite undertaking that the work will be carried out by the Egyptian Government in a reasonable time. We should be glad to know what has been done with regard to the complete archæological survey of the region already submerged. When the proposal was made in 1894 to build a dam at Assouan with its crest 114 metres above mean sea-level, the archæological societies of Europe protested against it in the strongest terms, and the result was the adoption of a modified scheme in which the crest of the dam is eight metres (26 feet) lower than that of the original project. This was of the nature of a compromise, and the Egyptian Government on its part undertook "to carry out an archæological and scientific investigation of the whole of Nubia."

From Captain Lyons's note in the present White Paper we understand that a topographical basis for such a survey has been prepared, but the systematic study of the submerged portion of the Nile valley, from an archæological point of view, has still to be made. As this is a matter for the Egyptian Government, the responsibility for the survey must not be thrown upon archæologists (who not only are not paid, but have to pay for their exploration), but should be borne by the Government.

By the scheme now proposed, the future maximum water-level will stand seven metres (very nearly 23 feet) higher than is the case at present, so that the dam now contemplated will have practically the same height as that of the original project against which archæological societies strongly protested. It is therefore desirable to insist that the promised investigations should be undertaken seriously by the Egyptian Government without delay, and that adequate provision be made for the systematic survey of the region. Unless all records of the earlier civilisation of the region are carefully and accurately collected and studied, as suggested by Captain Lyons, the claims of archæology are likely to be forgotten when the engineering scheme has been approved and the works are in progress.

MAY METEORS.

IN Spring months meteoric observers can hardly expect very productive results. The weather is often fine and pleasant, it is true, but meteors are usually scarce, and an average night will not present more than about four or five per hour. In 1886, during the month of May, I counted 127 meteors in twenty-five hours of observation. In 1903, May, I saw seventy-two meteors in 18¼ hours, and, if allowance is made for time engaged in recording paths, the deduced horary number was about five.

I have noticed that at this season of the year there are comparatively few meteors leaving definite streaks. In July (last half) and August there are, however, a large proportion of streak-producing meteors, but the majority of these are obviously Perseids belonging to the great July-August shower. Some years ago I counted out the number of meteors with streaks seen by me in June and July (1873–1901), and the relative figures were :—

June, of 252 meteors, thirty-one had streaks, proportion 8 to 1.

July, of 641 meteors, 141 had streaks, proportion 4½ to 1.

It cannot be held that May offers any special inducement to meteoric observers, but some very interesting showers are visible. In the early part of the month there are the Aquarids, supposed to be connected with Halley's comet. At about the middle of May the Coronids are often active from radiants at about 231°+27° (near α Coronæ) and 246°+31° (ζ Herculis), and at the close there are the η Pegasids from 330°+26°, maximum on May 30.

There are many other showers from Hercules, Draco, Libra, Serpens, Scorpio, &c. Fireballs are tolerably numerous during the month, and they are apparently directed from a number of different radiants.

This epoch is likely well to repay investigation, as it has never been amply studied in past years. More observations should therefore be obtained, so that the leading showers of the present day may be ascertained.

Though the majority of streams are probably of annual occurrence, a few of them are undoubtedly periodical, giving perhaps only one pretty rich exhibition once in a long series of years. The latter class of shower would escape notice unless observations were maintained with great assiduity and regularity. As an instance of a rich periodical shower of this kind, I may mention that on 1879 August 21–25 I witnessed the flight of fifty-six bright meteors from a radiant at 291°+60°, near the star o Draconis, but though I frequently endeavoured to re-observe this display, it never returned except under a very feeble aspect. W. F. DENNING.

NOTES.

THE annual conversazione of the Royal Society will be held at Burlington House on Wednesday next, May 8.

SIR JAMES DEWAR, F.R.S., has been elected a foreign member of the National Academy of Sciences, Washington.

THE Société chemique de France will celebrate its fifty years' jubilee by special meetings on May 16–18.

REUTER messages from Messina report that a violent eruption of Stromboli occurred at 10 p.m. on April 27. It was accompanied by a strong shock of earthquake, which shattered windows and caused other damage in the vicinity. The cable between the Lipari and Stromboli islands has been broken.

THE Meteorological Committee has appointed Mr. Ernest Gold, fellow of St. John's College, Cambridge, superintendent of instruments in the Meteorological Office, to the readership in dynamical meteorology established for three years from October 1. The readership is constituted from funds contributed by Dr. Arthur Schuster, F.R.S., and is tenable, under certain conditions, at any university in the United Kingdom.

THE exposition which is to be held at Berlin in connection with the fourteenth International Congress for Hygiene and Demography, on September 23–29, promises to be an interesting one. The fight against infectious diseases, principally colonial and tropical diseases, hygiene work of the State and municipality, especially the care of infants, provision of good drinking water, removal of waste, and the hygiene in schools, will be represented by many exhibits. In consideration of the importance of hygiene to private and public life, it has been resolved to keep open the exposition, which is to be held in the "Reichstag," to the end of September.

THE Destructive Insects and Pests Bill was read a second time in the House of Lords on Monday. The Bill is intended to grapple with several matters of importance to the agricultural world, and in particular with the disease called the gooseberry mildew. It provides that the Board of Agriculture may make such orders as are thought fit to prevent the introduction or spread of any particular insect, fungus, or other pest destructive to agricultural or horticultural crops, or to trees or bushes. The Bill gives the Board power to regulate the landing of plants and to authorise the removal or destruction of any diseased plant. Local authorities are empowered to pay compensation for any crops or trees so destroyed.

AT a special general meeting of the Geological Society, to be held on Wednesday, May 15, a new section of the bye-laws, providing for the election of women as associates, will be considered and voted upon. The first clause of the proposed new section reads as follows :—"Any woman who has distinguished herself as a geological investigator, or who has shown herself able and willing to communicate to the Society original and important geological information, or who has exercised signal liberality towards the Society, and is desirous of being elected, provided she be a British subject, or be domiciled in the British dominions or their dependencies, may, subject to the provisions hereinafter contained, be elected an Associate, the number elected being limited to forty."

AT the second National Poultry Conference, to be held at Reading on July 8–11, the discussions have been arranged under six sections, dealing respectively with poultry farming and production, breeding, hygiene and disease, women and the poultry industry, education and research, and commercial subjects. Among papers to be read at the conference we notice the following :—the Mendelian laws and their application to poultry breeding, by Mr. C. C. Hurst; hybridisation experiments with Ceylon jungle fowl (*Gallus stanleyii*), by Dr. J. Llewellyn Thomas; the economic values of external characters, by M. Louis van der Snickt; parasitic liver disease in poultry, by Prof. F. V. Theobald; the influence of heredity upon the diseases and deformities of poultry, by Dr. H. B. Greene; methods of instruction in poultry-keeping, (*a*) in the United Kingdom, by Mr. F. W. Parton, (*b*) in Australia, by Mr. W. H. Clarke; results of experimental work, (*a*) in the United Kingdom—(*b*) in America, by

Prof. J. E. Rice. Full particulars of the conference can be obtained from the honorary secretary, Mr. Edward Brown, 12 Hanover Square, W.

THE annual conversazione of the Selborne Society was held in the theatre and halls of the Civil Service Commission, Burlington Gardens, on Friday, April 26, and between five hundred and six hundred guests were present. Lord Avebury presided, and was supported by the Earl of Stamford and the Hon. Walter Rothschild. During the course of his presidential address, which dealt with the study and appreciation of nature, Lord Avebury said:—"To the wise and good, indeed, Nature is divine, but to understand her we must love her, we must feel that we are one with her. People often talk of the supernatural. This is, no doubt, mainly a matter of definition. To me, Nature is all-sufficient and all-covering. What they regard as supernatural seems to me either natural or non-existent. Whatever exists is part of Nature. It is not that those who hold these views wish to lower the so-called supernatural, but that those who hold the opposite opinion seem to us to limit and lower Nature. Nature is infinite. Every fresh discovery reveals new sources of wonder; every problem that is solved opens others. The telescope and microscope create for us new worlds; the spectroscope has answered questions which Comte thought were obviously beyond the range of human ken." During the evening Mr. E. J. Bedford, one of the first to apply photography to the study of birds, gave an illustrated lecture on "Bird Architecture." Among the exhibits were the original manuscript of Gilbert White's "Natural History of Selborne," and the original letters of Mulso to Gilbert White.

To vol. lxxxvi., part ii., of the *Zeitschrift für wissenschaftliche Zoologie*, Mr. W. S. Marshall, of Madison, Wisconsin, contributes an elaborate account of the development and structure of the cellular elements of the ovary in two species of insects, based on investigations recently conducted by himself in Berlin. The wasp known as *Polistes pallipes* forms the subject of the first paper, in which, after reviewing previous work, the author discusses the developmental history of the three types of cells—oöcytes, nurse-cells, and epithelial cells—throughout the whole or the greater part of their existence. In the second paper, where *Platyphylax designatus* is the species discussed, the author opens up newer ground, since very little is known as to the details of the developmental history of the Phryganeidæ.

WE have received three publications from the Bergen Museum, the *Aarsberetning* for 1906, together with the third part of the *Aarbog* for 1906 and the first part for 1907. From the first of these we learn that attention continues to be directed to extending the educational value of the museum, especially as regards the fauna of the country, several new groups of Norwegian animals having been added to the exhibited series. In the third part of the *Aarbog* for 1906 Mr. J. A. Grieg continues his description of the echinoderms collected in the late cruise of the *Michael Sars*, dealing in this instance with the starfishes, while the bryozoans obtained on the same expedition form the subject of an article by Mr. O. Nordgaard in the issue for the current year. The stone-implements of western Norway are discussed by Dr. A. W. Brögger in the last-named part.

PROF. A. J. EWART contributes to the Proceedings of the Royal Society of Victoria, vol. xix., part ii., a list of identifications of Australian plants, several of them being corrections of previously recorded names. A new genus of the Compositæ, Bellida, founded on a West Australian species, is described and figured. Two new species, *Daviesia mesophylla* and *Eriostemon intermedius*, are recorded, and the characters of *Romulea cruciata*, a native Irid known as onion grass, allied to *Romulea bulbocodium*, are noted.

IN Florida the growers of citrus fruits are troubled with the whitefly, *Aleyrodes citri*. A Bulletin, No. 88, of the Florida Agricultural Station, prepared by Dr. E. W. Berger, deals with the methods of combating the pest. Special value is attached to the efficacy of fungi parasitic on the whitefly, of which a red fungus, *Aschersonia Aleyrodes*, a yellow species of Aschersonia, and a brown fungus are known. It is recommended to scatter spores of the fungi by spraying, or to introduce cultures on leaves or trees.

As a consequence of the shortage in the Indian jute supply, the Government of India delegated Mr. R. S. Finlow, attached to the Agricultural Department as a jute specialist, to ascertain whether new localities suitable as to soil and climate could be discovered outside the ordinary area of jute cultivation that lies along the lower courses of the Ganges and Brahmaputra rivers. In Mr. Finlow's report, issued as Bulletin No. 3 of the Agricultural Research Institute, Pusa, it is stated that jute growing promises to be successful in Bihar, where it will take to some degree the place of indigo. With regard to districts inspected in Madras, Bombay, and Central Provinces, the prospects are less certain, and it will be necessary to await the results of experimental cultivation.

No branch of botany received more attention from Prof. Errera and his pupils than the examination of organic compounds in plants. The late professor was therefore essentially qualified to prepare a practical course on the microscopical identification of such compounds in plant tissues. A small brochure, consisting of the notes on this subject drafted by him for the benefit of students taking botany for a doctorate in science at the University of Brussels, has been published by Dr. J. Massart. Some of the reactions are based on researches made in Brussels, others are taken from the writings of Macallum, Gilson, and Moll.

A GENERAL review of the evolution of scientific methods for improving the sugar-cane by hybridisation is presented in the paper published in the *West Indian Bulletin*, vol. vii., No. 4, under the joint authorship of Sir Daniel Morris and Mr. F. A. Stockdale. The possibility of raising seedling canes was authenticated by Harrison and Bovell in 1888; this was shortly followed by the production of numerous seedlings, some of which have proved greatly superior to previously existing strains. Success was thus obtained, but the results were quite fortuitous, and the parentage of the seedlings could not be determined. Finally, the somewhat difficult task of removing the anthers from young flowers and pollinating with pollen from a known type was performed by Lewton-Brain in 1904. The paper also furnishes an indication of future lines of work and a summary of results already obtained. Coloured illustrations of six of the best known West Indian varieties are given.

UP to the present time no deposit of coal has been discovered in the Sahara and in the whole of North Africa. An attempt to ascertain whether coal really exists to the south of Algeria has been made by Mr. E. F. Gautier,

and the results of his explorations have been communicated to the Société d'Encouragement (Bulletin, vol. cix., No. 3) by Mr. A. Carnot. No trace of coal was found, but an extensive Carboniferous area was traversed between Figuig and In Salah, and it is possible that coal exists concealed beneath the vast Cretaceous plateaux.

AT the meeting of the Institution of Civil Engineers on April 16, papers were read on the Pyrmont bridge, Sydney, New South Wales, by Mr. P. Allen, and on the swing bridge over the river Avon at Bristol, by Mr. W. H. B. Savile. The Pyrmont bridge across Darling Harbour is 1210 feet long. There are three 30-feet openings in the Sydney approach for vehicular traffic to wharves, while on the Pyrmont side the Darling Island railway passes under a steel bridge of 25-feet span. Electric motive power is used for working the swing span and for roadway gates and for lighting, the whole being operated by one man from a conning tower in the centre of the swing span. The Bristol bridge, which is 600 feet long, carries a carriage road and a double line of the Great Western Railway. The main feature is the swing span, which is 202 feet 6 inches long, pivoted on a pier in the river.

THE current issue of the Transactions of the English Ceramic Society (vol. vi., part i.) shows that much useful work in the discussion of subjects relating to the clay-working industries is being done by the society, which meets at Tunstall, Staffordshire. The contents comprise seven original memoirs, four of which are written by Dr. J. W. Mellor, the hon. secretary of the society, and deal respectively with the determination of the amount of soluble salts in clays, excess air in firing kilns, the sulphuring and feathering of glazes, and the influence of high temperatures on porcelain pyrometer tubes. In the other papers, Mr. W. Burton reviews the different methods of recording high temperatures, Mr. W. F. Murray discusses the pottery oven of the future, predicting that gas firing, at present unknown in the earthenware trade, will fifty years hence be universal, and Dr. F. Shufflebotham deals with the hygienic aspect of the pottery industry.

THE Bureau of Science of the Government of the Philippine Islands publishes the *Philippine Journal of Science* in three sections, dealing with:—A, general science; B, medical science; and C, botany. The numbers in each section appear as rapidly as material is available, and the latest number to hand (A, vol. ii., No. 1) shows that the papers attain a high standard of excellence. There are four original memoirs, on the terpene oils of *Manila elemi*, by Mr. A. M. Clover; on the action of sodium on acetone, by Mr. R. F. Bacon and Dr. P. C. Freer; on a new subspecies of Philippine Cicindelidæ, by Mr. W. Horn; and on the proximate analysis of Philippine coals, by Mr. A. J. Cox. In the last-mentioned paper the author shows that the directions for coal analyses recommended by the American Chemical Society are inapplicable to certain Philippine coals. These coals are easily detected by the shower of incandescent carbon particles which are driven off when the sample is subjected to rapid heating. This mechanical loss can be overcome by expelling the volatile matter very slowly so that the escaping gases do not ignite. This smoking-off method approaches the conditions existing in a coke-oven.

AN interesting account of the Blue Grotto at Capri has been published by Mr. F. Furchheim, of Vienna, 2 Seilerstätte, District I., for private circulation. It is reprinted from the *Deutsche Rundschau für Geographie und Statistik* (January), and deals with the changes which have taken place in the grotto, considered particularly in reference to variations of sea-level, from the times of the ancients down to the present day, as revealed by historic documents and references.

THE *Revue scientifique* (April 13) publishes an interesting account of graphic methods of calculation in the form of an inaugural address by Prof. Maurice d'Ocagne. As is well known, Prof. d'Ocagne introduced the method of "nomography," in which calculations are performed by drawing lines across a diagram with a ruler. His use of the method for solving algebraic equations is well known. That a piece of squared paper forms an excellent substitute for a slide rule when used in this way is so simple and obvious that it is surprising how often the fact is overlooked.

THE relations of science to questions of national interest forms the subject of a number of the papers in the current issue of *Science Progress*. Mr. James Johnstone discusses the international fishery investigations, and directs attention to the unsatisfactory position of fishery statistics, particularly in connection with Great Britain. The relationship of mining to science, in the hands of Mr. W. E. Lishman, forms the basis for further reflections on England's neglect of science. Dr. John Wade replies to Prof. H. E. Armstrong's attacks on our present medical curriculum; and Prof. Armstrong contributes an address on "The Opportunity of the Agriculturist," and draws a timely moral from the efficiency of the United States Agricultural Bureau. Mr. R. H. Biffen also shows the need of agricultural research in his paper on modern plant-breeding methods. Mr. Shipley, in his paper on the danger of flies, puts in one good word for the motor-car, which, with all its faults, affords no nidus for flies.

IN a paper contributed to the *Physical Review* for March, Mr. W. R. Turnbull discusses the forms and stability of aëroplanes. The author describes laboratory experiments made with planes and singly and doubly curved surfaces, and draws curves showing the lift, drift, and coordinate of the centre of pressure expressed graphically in terms of the angle of inclination. He rightly directs attention to the supreme importance of longitudinal stability. This is a factor which is apt to be neglected by practical aëronauts whose main thought is to build flying machines in the hope of winning prizes. The data in question will afford useful material so far as they go, for studying the stability of various types. This stability depends, however, on other factors also, such as the moment of inertia and the position of the centre of gravity of the proposed apparatus. Another interesting note was recently contributed to the *Comptes rendus* by Captain Ferber, dealing with the forms of propellers calculated to give the maximum efficiency.

MR. F. W. ASTON writes in reply to Mr. A. A. Campbell Swinton's letter, which appeared in NATURE of April 18 (p. 583), to say that when Mr. Swinton has the opportunity of comparing the full text of the Royal Society paper with his own results of 1898 he will recognise the wide dissimilarity of conditions, effect, and explanation between them. The mica mill referred to in the abstract is designed to show that inside the dark space, under conditions of moderate pressure and continuous current, the mechanical energy flowing towards the kathode in the path of the kathode rays is far in excess of that flowing

in the opposite direction, a phenomenon which, under the conditions of Mr. Swinton's experiments—very low pressure and discontinuous current—is actually reversed.

REFERENCE was made in NATURE of April 4 (p. 543) to a paper by Mr. C. E. Moss on the "Geographical Distribution of Vegetation in Somerset." The paper is published by the Royal Geographical Society, but did not appear in the *Geographical Journal*.

A CORRESPONDENT asks for a reference to the latest discussion of the stadium of Eratosthenes and the official or Royal Egyptian stadium mentioned in a recent review in NATURE (April 11, p. 553). The information required will be found in "Griechische und römische Metrologie," by F. Hultsch (Berlin, 1882), and in Dr. Dreyer's "History of the Planetary System" (Cambridge, 1906).

A SECOND edition of "The Textile Fibres: their Physical, Microscopical, and Chemical Properties," by Dr. J. Merritt Matthews, of the Philadelphia Textile School, has been published by Messrs. John Wiley and Sons, of New York, and Messrs. Chapman and Hall, Ltd., in this country. The book has been re-written, and is intended to bring together all the material available for the study of the textile fibres. The price of the volume is 17*s*. net.

MESSRS. WITHERBY AND CO. announce the forthcoming publication of a limited edition of a work on "The Vertebrate Fauna of North Wales," by Mr. H. E. Forrest. The work will be a history of the mammals, birds, reptiles, amphibians, and fishes to be found in that part of Wales lying north of the Dovey Estuary, illustrated with plates depicting notable haunts of typical species, portraits of Pennant and other former recorders, and a coloured map of the district.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN MAY:—

May 1. 11h. Mars in conjunction with Uranus, Mars 0° 46′ S.
,, Mars. Apparent diameter = 12″·54.
1–6. Epoch of Aquarid meteors. Radiant 337° − 2°.
6. 10h. 31m. Minimum of Algol (*β* Persei).
16. 7h. 13m. to 10h. 27m. Transit of Jupiter's Sat. III. (Ganymede).
21. 12h. Jupiter in conjunction with Neptune. Jupiter 1° N.
26. 12h. 14m. Minimum of Algol (*β* Persei).
,, 16h. 6m. to 16h. 52m. Moon occults *θ* Libræ (mag. 4·3).

COMET 1907*b* (MELLISH).—An extension of the ephemeris given by Miss Lamson and Frederick, computed by Dr. Strömgren, appears in No. 4172 (April 20) of the *Astronomische Nachrichten*, and gives the calculated daily positions of the comet up to May 10. This object is now barely one-tenth as bright as when discovered, and, according to the elements, was nearest to the earth on April 10·98.

THE RING OF MINOR PLANETS.—Some very interesting facts are educed in a discussion, by Dr. P. Stroobant, which appears as an extract from the *Annales d'Observatoire Royal de Belgique*, vol. ix., part iii.; Dr. Stroobant's subject is the constitution of the ring of minor planets, and he considers the relative distribution, the masses, and the classification of the first 512 of these bodies. After giving a very abbreviated history of the discovery and study of asteroids, the paper discusses the *lacunae* in the grouping of the minor planets, and also the grouping in regard to their mean distances from the sun. A decided maximum occurs between the limits marked out by rings respectively 2·55 and 2·85 astronomical units from the sun, 199 of the asteroids considered revolving in this annulus.

From a discussion of the available data concerning the magnitudes and probable diameters of asteroids, it is found that nearly all the asteroidal matter is concentrated near to the middle of the ring in the neighbourhood of the mean solar distance of 2·7, whilst further analysis shows that, as a general law, the smaller asteroids are relatively less numerous in the richest zones. At the end of the paper Dr. Stroobant tabulates the 512 asteroids in order of their mean distances from the sun, and gives the mean movement, the mean distance, and other data for each.

POSITIONS OF PHŒBE, 1898–1904.—No. 3, vol. lx. (pp. 45–85), of the Harvard College Observatory Annals contains the measured positions of Phœbe, the ninth satellite of Saturn, during the period 1898–1904.

The places of the standard stars employed were taken from the C.P.D. for the epoch 1875·0, and, should greater accuracy be required, all the material for a second reduction is included in the present memoir; it will only be necessary for such a reduction to determine the places of the standard stars with greater accuracy.

OBSERVATIONS OF THIRTY-THREE VARIABLE STARS.—In Bulletin No. 110 of the Laws Observatory, University of Missouri, are published the preliminary results obtained from the observations of thirty-three variable stars, the light-curves and periods of which are as yet imperfectly known. The bulletin gives a list of the stars considered, with their places for 1855·0, followed by a brief discussion of the results yet obtained for each star. These results are compared with previously published elements, and in some cases the light-curves are reproduced.

THE ITALIAN PROMINENCE OBSERVATIONS, 1877–1883.—No. 5, vol. xxxvi. (p. 54, 1907), of the *Memorie della Società degli Spettroscopisti Italiani* contains a series of notes on the prominence observations made at Palermo and Rome from 1877 to 1883. These notes give the atmospheric conditions for each observing day, and brief remarks on any observation of especial interest, and should prove useful in any discussion of these valuable observations.

THE SPECTRUM OF MIRA.—A brief discussion of the spectrum of Mira, photographed at the Lowell Observatory on January 11, is published by Mr. V. M. Slipher in No. 3, vol. xxv. (p. 235, April), of the *Astrophysical Journal*. The region shown on the plate includes H*α*, H*β*, H*γ*, and H*δ*, all of which are bright and increase in intensity in the order given. The series of absorption bands commences at λ 4584, possibly at λ 4463, and appears to extend beyond the region photographed, *i.e.* beyond λ 7000. Vanadium absorption is strongly represented. A comparison of this spectrum with that obtained by Stebbins, at Lick, in 1902, shows that H*β* (and probably H*α*) was more intense during the more recent maximum. On the other hand, the series of dark bands appears to have been more intense, and to have extended further into the ultra-violet, in 1902.

THE HARVARD COLLEGE OBSERVATORY.—Prof. E. C. Pickering's report of the work done at the Harvard College Observatory during the year ending September 30, 1906, sounds a note of disappointment at the lack of financial support given to the schemes for astronomical work on well organised lines which he has formulated. The amount of meridian and photometric work accomplished was on the usual immense scale, and it is hoped that when the 60-inch Common telescope is completed the visual work will be greatly extended to the faintest stars.

On the Henry Draper memorial photographs Miss Cannon studied 691 stellar spectra and classified them. Three stars, H.P. 934, H.P. 3030 and +44°.3639, were found to show the second series of hydrogen lines. Mrs. Fleming also found numerous variable stars and stars having peculiar spectra on plates taken with the 8-inch Draper, the 8-inch Bache, and the 24-inch Bruce telescopes respectively. A great amount of work was also performed at the Arequipa station and at the Blue Hill Meteorological Observatory.

NORTH POLAR PROBLEMS.[1]

THE deep North Polar Basin forms the northern termination of a series of depressions of the earth's crust extending north through the Norwegian Sea from the eastern side of the Atlantic, and dividing between the continental masses of the old and the new world. The eruption of the Jurassic basalts of Franz Josef Land and Spitsbergen may have had some connection with the sinking in of the North Polar Sea bottom, but the basin was probably to a great extent formed before that time. Newer volcanic rocks are not known hitherto from the edges of the North Polar Basin. On Bennett Island, De Long reports lava (or basalt), but we do not know its age.

It is most improbable that any block of land (horst) should have remained isolated in the middle of such a basin, surrounded by deep water on all sides, and without having any connection with the surrounding lands or continental shelves. It is, therefore, of essential importance to determine the edge of the continental shelf off the known coasts. But the edge of the North Polar continental shelf is only known exactly in two places—north-west of the New Siberian Islands and north of Spitsbergen—whilst in the region between these two places we know the deep sea to the north. In the remaining part of the North Polar Sea we know as yet very little about the edge of the continental shelf.

The rule that the continental shelves are generally much narrower outside high and mountainous coast than off flat and low lands holds good only where the mountain formations of the coast are in near relation to the trend of the coast and to the continental slope outside, and also where the mountainous coast is built up by primary rocks. This seems hardly to be the case on the northern coast of the American Arctic Archipelago and Greenland, although there are rather high promontories in some places. It is, therefore, difficult to say much about the extent of the continental shelf there. It is perhaps more the case along the north coast of Alaska, and therefore the continental shelf may possibly be narrower in that region; but even this is uncertain. The deeper soundings taken near the supposed edge of the shelf may simply indicate depths of submarine valleys, which may be numerous in this region, and many more and deeper soundings are required before we can say anything with certainty.

Dr. J. W. Spencer's conclusions as to the width of the continental shelf (*American Journal of Science*, vol. xix., No. 113, May, 1905), drawn from the great depths of the submarine fjords of the American Arctic Archipelago, are hardly well founded. Considerable depths of the submarine valleys and channels (fjords) do not point to a comparatively narrow shelf in regions where there has been glacial erosion. It ought also to be considered that, on the whole, the region of the American Arctic Archipelago exhibits geomorphological features which are exceptional. This region was probably near the heart of the great North American Ice age, and the land has been split up into islands and peninsulas, whatever the original cause of this dissection might have been.

It cannot, therefore, be said that the geomorphologic features of the known part of the Arctic regions exclude the possibility of a wide extension of the continental shelf, possibly with lands on it, into some parts of the Unknown North.

The Sea Currents and *the Drift of the Ice* seem to indicate that there is an extensive area of sea to the north of the *Fram's* track. Peary's experiences during his latest expedition also indicate that there is much sea to the north of Greenland. The ice-drift converges towards the opening between Greenland and Spitsbergen. Peary's observations of a rapid eastward ice-drift also indicate that there cannot have been much land to the east of his northward track; but as we do not know the depths over which Peary travelled, we cannot say much with regard to the possibility of land or continental shelf further north and east.

The drift of the *Jeanette* can hardly be said to indicate land to the north, as this drift was chiefly influenced by the winds.

My conclusions with regard to an actual current in the surface-layers of the North Polar Basin, pointing towards Franz Josef Land and Spitsbergen ("The Scientific *Fram* Report," vol. iii.), might seem to indicate that there was land to the north, and that the North Polar Basin is a long and narrow depression. For, owing to the earth's rotation, we might expect a surface-current of this kind to be deflected towards the coast on its right-hand side, *i.e.* towards the Greenland and American side. It is, however, probable that the winds and ice-drift in the unknown parts of the sea might have influenced the direction of our drift, and that therefore the results arrived at as to the direction of the current are not quite correct.

R. A. Harris's contention that the difference in the magnitude of the *tides* on Bennett Island and the coast of Alaska proves the existence of extensive land to the north is based on a much too scanty material of observations. On the northern coasts of Franz Josef Land I found a smaller tide than the *Jeanette* people on Bennett Island.

The possible differences shown by the *ice* in the Beaufort Sea, on the coast of Prince Patrick Island, north of Ellesmere Land and Greenland, and in the sea crossed by the *Fram*, cannot be said to point to the existence of land in the Unknown North.

The occurrence of *driftwood* on the northern coasts, and even on the floe-ice itself (north-west of Greenland), proves that this ice must have drifted across the unknown sea from Siberia or America. The great quantity of "*post-Glacial*" *driftwood*, found even at high elevations on the now ice-bound coasts in the north, points to a milder period in post-Glacial times with a more open North Polar Sea.

Methods of Exploration.—The drawback with sledge journeys across the Polar ice is that they do not give much opportunity of soundings and oceanographical work; but something could be done by a practical equipment. Determination of the edge of the continental shelf would be most important, but also some observations of the temperature and salinity of the deep-water strata of the deep sea beyond this edge would be of value.

A drift with a ship across the Unknown North from the sea north of Behring Straits or Western Alaska, and towards Greenland, would give important results, and could be done probably in five years, although the drift-cask of Bryant and Melville took nearly six years from Alaska to Iceland (from September 13, 1899, to June 7, 1905).

[1] Abridged from a paper by H.E. Dr. Fridtjof Nansen, G.C.V.O., read before the Royal Geographical Society on April 29.

SEISMOTECTONIC LINES.[1]

IN studying the distribution of the towns and villages damaged by Calabrian earthquakes, Prof. Hobbs finds that they show a noteworthy tendency to grouping along series of essentially parallel straight lines (seismotectonic lines), which he believes are related to coast-lines, borders of mountain-masses, boundaries of geological formations, &c. The places most seriously damaged are generally situated at or near the intersections of indicated seismotectonic lines, while these lines often intersect lines of volcanoes (volcanotectonic lines) at volcanic vents. In the direction perpendicular to seismotectonic lines, he states that the destructive intensity of the waves falls off rapidly, having but little effect upon well-built houses more than a mile distant, except in the case of earthquakes of the first order of intensity. He therefore concludes that "the destructive violence of an earthquake is localised on vertical planes of fracture within the earth's crust; along which cracks the seismic waves are transmitted with the least loss of intensity."

The district chiefly affected by the Calabrian earthquakes is one in which the peculiar earth-sounds, known as brontidi, mistpoeffers, &c., frequently occur. Recent investigations by Cancani, Alippi, and others have shown

[1] (1) "On some Principles of Seismic Geology"; (2) "The Geotectonic and Geodynamic Aspects of Calabria and North-Eastern Sicily, a Study in Orientation." By William Herbert Hobbs. (*Beiträge zur Geophysik*, Bd. viii., pp. 219–362, and plates.)

that these sounds are closely connected with ordinary earthquake-sounds, and Prof. Hobbs finds that the Calabrian villages from which brontidi are reported are also those which have suffered most from disastrous earthquakes, and that they are ranged along the more prominent seismotectonic lines of the district.

In great detail Prof. Hobbs studies, not only the places damaged by the important earthquakes of 1638, 1659, 1783, 1894, and 1905, but also those at which numerous slight shocks were observed, for the latter, owing to their small disturbed areas, seem to be the most useful indices of the course of seismotectonic lines. The positions of more than 300 such lines in Calabria and north-eastern Sicily are estimated and drawn upon a series of maps, as well as the bearings of joint-planes, the trend of the volcanotectonic lines, and the distribution of brontidi.

It will be seen from this brief abstract that Prof. Hobbs's memoirs possess considerable interest. They are the result of extensive reading, and contain many useful references. But his wide generalisations seem to me to be based on insecure principles and insufficient data. Isoseismal lines, it is well known, are elongated in the direction of the originating faults, but the positions of a few places at which shocks are felt cannot determine a line of fracture. For instance, one of the British seismotectonic lines is located by the positions of four places, two of which are more than 200 miles apart. The seismotectonic lines revealed by the New England earthquake of 1870 are based on the positions of about a score of places distributed over an area reaching from Quebec to New-haven, and on about a dozen apparent directions of the shock. When observed in houses, such directions are almost invariably perpendicular to the principal walls, but Prof. Hobbs assumes that they indicate that the shocks were transmitted along parallel seismotectonic lines. In Calabria, on the other hand, the damaged villages are so numerous that it would be strange if many of them were not collinear. Several of the seismotectonic lines plotted by Prof. Hobbs no doubt correspond with lines of fracture, but the existence of a very large number of his lines must, I think, be regarded as doubtful. Industrious as he has been in the collection of materials, he has tried within little more than a year to achieve results which the long-continued labours of many men might fail to establish.

C. DAVISON.

HYDRATES IN AQUEOUS SOLUTION.

A RECORD of researches which have been carried out by Prof. H. C. Jones with his students and confrères has recently been published by the Carnegie Institution.[1] The investigations which have been undertaken were to elucidate an observation made by Jones and Ota when studying the freezing points of solutions of double salts in order to ascertain whether in solution they remained as constituent molecules or were broken down. They found that concentrated solutions gave abnormally low freezing points, the molecular lowering of freezing point passing through a well-defined minimum as the concentration changed. Now according to the ionic theory as then expressed, the molecular lowering should decrease continuously as the concentration of the solution increased.

A very large number of solutions of salts, acids, and bases, and neutral organic substances have now been studied, and as a result it has been found that this excessive depression as the concentration increases is a general property of solutions. In order to explain this digression from the generally accepted rendering of the ionic theory, Jones postulates that "in solution a part of the solvent is combined with the dissolved substance and no longer plays the *rôle* of solvent, at least so far as the freezing point method is concerned."

By a determination of the freezing point, conductivity, and specific gravity of the solutions, it has been found possible to calculate approximately the total amount of water held in combination by the dissolved substance, and consequently the approximate amount combined with one molecule of the compound or of the ions resulting from it.

[1] "Hydrates in Aqueous Solution." By Harry C. Jones. Pp. viii+264. (Washington: Carnegie Institution, 1907.)

The theory proposed here differs from that suggested by Mendeléeff, who considered that such substances as sulphuric acid and calcium chloride form a few definite compounds with the water in which they are dissolved. But the present theory supposes that combination between the dissolved substance and water to be a general phenomenon. The compound forms, say, for example, calcium chloride, a complete series of hydrates extending from a few molecules of water to at least thirty, all the intermediate stages being represented.

The memoir commences with an introduction, in which the earlier work is reviewed and the freezing-point and conductivity apparatus used by the author are described. Then follows part i., dealing with the evidence for the existence of hydrates in aqueous solution and the approximate composition of the hydrates formed by a large number of electrolytes. The work here described was carried out by Getman and Bassett. Attention is directed to the effect of temperature on water of crystallisation, as bearing on the theory of hydrates in solution. It is shown that salts which on crystallisation contain water of crystallisation are able to combine when in solution at ordinary temperatures with a much larger quantity of water than they are able to bring with them out of solution on crystallisation. The results obtained are illustrated in many cases graphically by curves and in other cases by tables.

Part ii. is chiefly the work of Uhler, and deals with spectroscopic investigations. The spectrographic photographs which are given have been magnificently reproduced, and form quite a feature of the book. The colour changes produced, for example, by the addition of different salts to cobalt salts have been investigated quantitatively. That is to say, the absorption spectra of the substances, separately and when mixed in known quantities, have been observed with a direct-reading spectroscope, and thus the wave-lengths and absorption bands obtained. The special spectrograph which has been used to obtain the photographic record of the absorption bands is also described. The final section deals with non-aqueous solutions, the solution of substances in methyl and ethyl alcohol having been studied. The results seem to indicate that some substances at least, such as lithium chloride, bromide, and nitrate, combine to some extent with the solvent. However, this portion of the work is yet in its initial stage, and much yet remains to be done. We understand that the author is extending the work in this direction.

Altogether, the memoir is an extremely valuable contribution to the study of the subject, more especially in connection with concentrated solutions. It has often been urged, and with a considerable amount of truth, that the ionic theory is simply a specialised hypothesis, which is true only of dilute solutions. Prof. Jones has gone far to remove this reproach by broadening the basis of the theory and enlarging its scope. The publishers, the Carnegie Institution, must also be congratulated upon the splendid way in which the letterpress and diagrams have been got up.

F. M. P.

PRODUCTION AND DECAY OF MEDIÆVAL STAINED GLASS.[1]

THE earliest direct evidence as to the methods of mediæval glass-painting is contained in the treatise of Theophilus ("Diversarum Artium Schedula"), which dates back in all probability to the latter half of the twelfth century; here one finds detailed instructions for the making of the glass as well as for its formation into the flat sheets or "tables" in which it is required by the glass-painter.

This treatise makes it clear that at that time such window glass was for the most part made by what is generally known as the "muff" process. The process referred to is one of the three known methods of making window glass, namely:—

(1) Cast or plate glass, made by pouring molten glass on to a flat stone or metal slab.

(2) Muff or cylinder glass, in which the glass is worked

[1] Abstract of a paper read before the Society of Arts on March 13 by Mr. Noel Heaton.

into the form of a hollow cylinder by means of the blow-pipe, which cylinder is subsequently opened out into a flat sheet.

(3) Spun or crown glass, in which a bulb-shaped mass of blown glass is converted into a disc by rotating it rapidly whilst in a plastic state.

The earliest known window glass, that of the Romans, was produced by the first of these methods; in fact, it has hitherto been supposed that the Romans knew no other way of making glass into sheets. A careful examination of the glass brought to light by the excavations at Silchester, however, leaves no room for doubt that the Romans were acquainted with the art of making blown window glass according to the "muff" process.

There are reasons for thinking that the making of window glass was not handed down from the Romans, but was re-discovered in the Middle Ages, and the author thinks it most probable (although evidence is too scanty to justify this as a statement of fact) that the glass of the earliest stained-glass windows, that is, those of the ninth and tenth centuries, was made in the same way as the cast window glass most generally employed by the Romans, this being the method that would most naturally suggest itself in the first place.

The composition of the glass described by Theophilus was quite different from that of the Romans, being produced, according to the treatise referred to, by heating a mixture of sand and the ashes of beechwood. It is probable, however, that the glass varied very considerably in composition at different times and in different places, owing to the impurity of the sand used and the varying nature of the wood ashes, which would in all probability be obtained by burning whatever species of timber came nearest to hand.

Considering these facts, mediæval glass would be expected to reveal on analysis a fairly complicated composition, and, whilst varying considerably, to show in general a richness in alkali (usually potash) and poorness in lime.

In order to obtain further information on this point, the author, in conjunction with Mr. Percy Williams, determined accurately the composition of some typical specimens of mediæval stained glass, of which a description is given in the paper. The following table is a summary of the results obtained:—

Composition of Mediaeval Glass.

Material	Sandiacre	Dale Abbey	Modern window glass
Silica	54·01	46·94	70
Phosphoric acid	4·18	4·11	—
Potash	13·20	16·96	15
Soda	1·70	0·12	
Lime	17·37	19·01	13
Magnesia	5·33	5·00	
Alumina	2·41	3·02	2
Iron	0·81	1·46	
Manganese	1·03	1·37	
Moisture due to decay ...	0·21	2·16	—

These results are of interest in several directions, chiefly, however, as revealing the presence of a considerable amount of phosphorus in the glass. The evidence this affords as to the making of the glass, and its effect on the nature of the glass, are discussed in the paper, and attention is directed to the disturbing influence this unlooked-for ingredient has on the process of analysis.

The importance of this point lies in the fact that if a partial analysis of the glass is made—with the view of determining the amount of alumina, for example—or if an analysis is attempted without the possibility of the presence of phosphorus being recognised, the results are liable to be seriously inaccurate. A summary of the method adopted by Mr. Williams for obtaining the analyses quoted follows, this being based on the removal of the phosphorus by silver carbonate.

The paper then passes on to discuss the phenomena of the decay of old stained glass in the light of the peculiar composition revealed by these analyses.

Mediæval glass decays in a very characteristic manner. Very commonly the glass becomes covered with little pits, for all the world like the worm-holes one often sees in an old oak cabinet.

The process of decay in glass is undoubtedly a parallel on a small scale to the change produced on a large scale by the action of time and weather on geological formations, such as chalk and sandstone—a combination of corrosion and internal change.

Corrosion of the surface of glass is produced by the long-continued action of moisture, which gradually extracts the

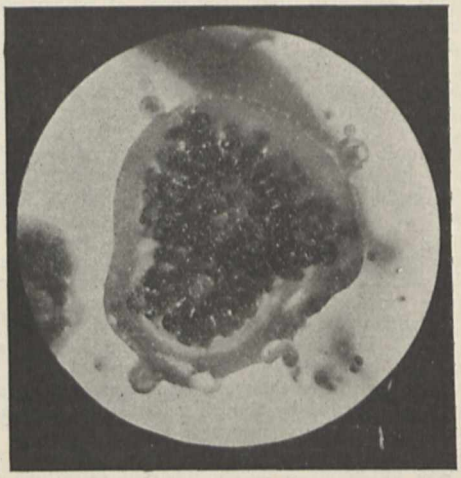


FIG. 1.—Photomicrograph of an area of decomposition in mediæval glass.

soluble silicates, leaving the insoluble silica in a thin film, the glass thereby becoming iridescent. Owing to the large proportion of lime it contains, however, mediæval glass does not become iridescent as the result of corrosion. On the extraction of the alkali by water this lime is left behind with the silica, and forms with it a hard, insoluble silicate of lime, which adheres to the corroded surface of the glass, forming an opaque scum or patina. In some cases this is so marked that the glass appears to be covered with a coat of cement.

The peculiar pitting of old stained glass is not, however,

FIG. 2.—Photomicrograph of similar structures produced experimentally in modern window glass.

in the author's opinion, due to corrosion at all, but to a change in the constitution of the glass. As is well known, glass changes its constitution and becomes crystalline if kept at a red heat for a length of time. What happens in a few hours when the glass is hot tends to take place on prolonged exposure to the atmosphere, with this difference, that when the glass is molten its molecules can

freely move about, whereas when it is cold and rigid such freedom of movement is impossible; in consequence the definite formation of crystals cannot take place, and the result of the change is different. What happens is this. In the first place, molecules of the same kind tend to separate out from the homogeneous mixture and collect round a point, forming a centre of decomposition. Proceeding from this centre the glass is found decomposing into definite compounds in an ever-enlarging circle until it reaches a point at which the strain set up in the glass by this molecular movement results in a crack forming round the area of decomposition, and then the whole mass comes away, leaving behind it a little hole or pit in the surface of the glass.

Such are the two forces at work on the decay of glass—corrosion without and decomposition within—and, of course, they act simultaneously. As the pits are formed they are extended by corrosion, forming a resting place, in fact, for the water, until eventually the whole fabric of the glass is destroyed.

According to varying circumstances—the position of the window as affecting its degree of exposure, the climate in which it is placed, differences in composition and mechanical state of the glass—we get all sorts of variations in the precise effect of decay in particular instances.

It is a well recognised fact that glass containing a large proportion of earths, that is, lime, magnesia, and alumina, is especially liable to become crystalline. If, then, one is correct in thinking that the peculiar pitting of Gothic glass is due to a similar change of constitution, one would expect to find it excessively rich in these constituents, and we have already seen that this is, in fact, the case.

On the other hand, glass containing excess of alkali has an equally recognised tendency to go "blind," that is, to become covered with a film, due to corrosion. Finally, glass with a high content of silica, with earth and alkali equally balanced, may be looked upon as highly resistant in both directions. It is such glasses which decay slowly and with little tendency to devitrification, the surface being merely etched by corrosion, leaving the large proportion of silica in a coherent thin film, producing gorgeous effects of iridescence.

Besides the glass itself, a study of the materials used for producing the enamel with which the glass was painted to represent figures and subjects is a matter of some importance, which is fully discussed in the paper. After going thoroughly into the evidence afforded by those mediæval pay-rolls which have been preserved, dealing with the execution of stained-glass windows, the author comes to the conclusion that the enamel in question was prepared by making a fusible opaque black glass, technically known as "geet," probably because it resembled jet in appearance (the word jet being in writings of the period variously spelt jeat, ieat, geat, geet); this material would be used as a flux, and mixed with the oxides of iron and copper to make the paint. Experiment shows that an enamel prepared in this way is in every respect similar to that used in the finest examples of mediæval stained glass.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AN exhibition illustrating a course of lectures on Japanese education given under the auspices of the University of London by Baron Kikuchi, will be opened on Tuesday next at the Victoria and Albert Museum (Indian Section), South Kensington. The exhibition will remain open until the end of June.

RECENT statistics published by the French Minister of Public Instruction give the number of students attending courses of instruction in French universities and higher educational institutions. The total reaches 38,197, of whom 3434 are foreigners—a number much larger than usual owing to the temporary closing of certain Russian universities. Of the native students, 1364 are women. The number of students at some of the larger universities are as follows:—Paris, 15,789; Lyons, 2783; Toulouse, 2675; Bordeaux, 2496; Nancy, 1841; Montpellier, 1752; Lille, 1560; Rennes, 1498; and Aix-Marseilles, 1269. The Paris students are distributed among the different faculties and schools as follows:—law, 7032; medicine, 3369; letters, 2413; science, 2022; and pharmacy, 953. The total number of French university men students include in the various departments of learning:—law, 15,427; medicine, 7501; letters, 4605; science, 5881; and pharmacy, 2224.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 15, 1906.—"On the Effect of High Temperatures on Radium Emanation and its Products." By Walter **Makower** and Sidney **Russ**. Communicated by Prof. A. Schuster, F.R.S.

In a previous paper it was shown that the activity of radium emanation sealed in a quartz tube is temporarily changed by subjecting it for a short time to temperatures between 1000° C. and 1200° C. From the results obtained it seemed probable that this change was not due to any alteration of the emanation itself, but rather to a change of activity of one of the more quickly decaying products of the emanation with which it is in equilibrium. To settle this point measurements were made of the rate of decay of the emanation when kept at 1100° C. Subsequently experiments were made on the effect of high temperatures on the active deposit collected on a platinum wire by exposure to the emanation.

The results obtained were:—

(1) The change in activity noticed when radium emanation is subjected to a high temperature is not due to any alteration in the emanation itself, since its time period is unaltered when it is maintained at a temperature of 1100° C.

(2) The change is due *either* to a change in radium B *or* C, since the activity of a mixture of these two substances can be changed by heating.

(3) The change is *probably* due to some influence of temperature on radium C. This conclusion is in agreement with the statement made by Curie and Danne.

In a note the authors discuss some recent observations made by Dr. Bronson which appear at first sight difficult to reconcile with the above conclusions. As a result of his experiments, Dr. Bronson concludes that there is no change of activity in radium even when exposed to temperatures of 1600° C.

It is, however, pointed out by the authors that there are several important differences between Dr. Bronson's experiments and their own, the most important of which is that Dr. Bronson measured the activity of the radium while hot, whereas they always allowed the active deposit to cool before making measurements. It is on this account that the authors consider that the results of Dr. Bronson and their own are not necessarily contradictory.

Zoological Society, April 9.—Dr Henry Woodward, F.R.S., vice-president, in the chair.—A collection of fishes made in the eastern watershed of the Transvaal by Captain G. E. Bruce, and presented to the British Museum: G. A. **Boulenger**. The collection contained specimens of eighteen species, of which several had not been previously recorded from the Transvaal, and five were new.—The osteology of the oligomyodian and diacromyodian Passeres: W. P. **Pycraft**. After referring to his previous contribution (published in the Proceedings) on the osteology of the eurylæmid and tracheophone Passeres, the author remarked that there seemed little room for doubt but that the diacromyodian and oligomyodian Passeres must be regarded as divergent branches of a common stem. The latter suborder included the Tyranniformes, Phytotomidæ, and Pittidæ, while the former embraced the remaining Passeres. In the present communication some fourteen families were described, and these were divided into four groups, Hirundines, Muscicapæ, Laniinæ, and Gymnorhinæ. This arrangement was based, not on osteological characters alone, but also on the evidence of pterylosis and certain wing-muscles. The author proposed to include the Vireonidæ with the Muscicapæ, and the Vireolaniidæ with the Gymnorhinæ. With this last group he proposed, tentatively at any rate, to include the Paradiseidæ,

inasmuch as there seemed good reason for continuing to regard these birds as near allies of the Corvidæ.—Anatomy of a Bornean frog of the genus Megalophrys, with references to other genera of Batrachia: F. E. **Beddard.**—The winter habits of the greater horseshoe and other cave-haunting bats: T. A. **Coward.** This paper contained the results of observations made in the Somersetshire caverns, where at the end of December and beginning of January the author found that the bats were not in profound sleep, but moved in the caves and went into the open for food. This food, the author showed, was not all taken when the bats were in flight, but was usually devoured when the bats were at rest. The manner of feeding was described, and information supplied about the food of the greater horseshoe and the parasites which infested this species and the lesser horseshoe.

Anthropological Institute, April 16.—Mr. A. L. Lewis, vice-president, in the chair.—*Exhibit.*—A selection of specimens of flint from Cornwall: Mr. **Lewis,** Mr. **Warren,** Mr. **Kendall,** and Mr. **Chandler.**—Note on some Palæolithic and Neolithic implements from East Lincolnshire: S. Hazzledine **Warren.** The Neolithic implements described were found by the author *in situ* in an undisturbed section of the fen deposit of the East Lincolnshire coast near Skegness. The lowest bed seen in the district was Boulder-clay; overlying this there are patches of fluviatile gravel; above this, again, comes the old surface soil of the buried forest; then the peat by which the forest was destroyed, and above this, again, a succession of warp clays with some subordinate peat beds. The exact horizon at which the Neolithic implements occurred was in the old surface soil beneath the lowest peat bed. Besides the neoliths, the author also found a palæolith *in situ* in one of the patches of fluviatile drift gravel between the submerged forest above and the Boulder-clay below. One or two other palæoliths were also found which had evidently been derived from one of these patches of post-Glacial drift. Apart from discoveries in caves, this is the most northerly point at which Palæolithic implements have yet been found in this country in any river drift gravel.

Geological Society, April 17.—Sir Archibald Geikie, Sec.R.S., president, in the chair.—The toadstones of Derbyshire, their field-relations and petrography: H. H. **Arnold-Bemrose.** The district over which the toadstones are seen may be divided into three main areas of volcanic activity, between which there are no exposures of igneous rock:—(1) the north-western or Miller's Dale area; (2) the south-eastern or Matlock area; (3) the south-western or Tissington area. In each of these areas there are lava-flows, bedded tuffs, and volcanic vents, and in the Miller's Dale and Matlock areas several intrusive sills. In the Miller's Dale and Matlock areas the igneous rocks are, with the exception of the Hopton vent, entirely in the Mountain Limestone, but in the third area they are mostly in the Yoredale Shales, and lava plays only a subordinate part. In the Miller's-Dale area the upper lava is the thicker, and extends over a greater district than the lower, while in the Matlock area the converse is true. In the former area the lavas are separated by about 150 feet of limestone, in the latter by about 80 feet to 100 feet. The upper lava of Miller's Dale is on a lower horizon than the lower lava of Matlock, and the limestone above it contains at least two bands of interbedded tuff. The lavas are vesicular and amygdaloidal in structure, and often very much decomposed. They contain olivine, augite, and felspars, magnetite, and iron-oxide; the felspars are often present in two generations. The sills are, for the most part, ophitic olivine-dolerites, and pass from a very coarse-grained dolerite through the intervening stages into a fine-grained dolerite or basalt; they are similar in structure to certain Tertiary dolerites. The toadstones have all been mapped on the 6-inch scale, and petrological accounts of the different rocks are furnished.—Data bearing on the age of Niagara Falls: Prof. J. W. W. **Spencer.** The author has been engaged in investigations for a monograph on Niagara Falls, to be published by the Geological Survey of Canada. Soundings at all the points of great changes in the gorge have been successfully undertaken; borings were put down for the exploration of buried valleys, and instrumental surveys made of the original river-banks and the physics of the stream. The mean recession of the crest-line of the falls is found to be 4·2 feet a year under existing conditions, and this rate has approximately obtained for 227 years. But this rate will not give the age of the falls, on account of former great variations in the volume of the river and in the height of the falls themselves. The chief change in volume of water depends on the fact that originally Lake Erie alone was discharged over the falls, when the supply of water was only 15 per cent. of the present discharge. Lake Ontario, too, stood at a higher level, and thus the cutting-back from Queenstown to Foster's Flats was effected with a small water discharge and, at first, a low head. After an uplift, which raised the crest of the fall considerably above Lake Ontario, a slight depression followed which "drowned" part of the lower gorge. This cutting is calculated to have taken 35,500 years for a distance of 14,400 feet. Above Foster's Flats the sudden widening indicates the inflow of the other lakes into Erie, greater water discharge, and greatly increased rapidity of recession. The changes in height of the falls and resistance of the rocks are examined in detail, and the small influence of pre-Glacial filled channels estimated. The whirlpool is on the site where the recession broke down the partition separating the head of the Whirlpool-St. David's buried gorge, and began to empty out the contents of this valley. The cutting with the full power of the water of the four lakes varied at times according to the height of the fall, and is calculated to have occupied only 3500 years for the cutting-back of about four miles above the head of Foster's Flats. Thus the entire age of the falls is given as 39,000 years.

Royal Meteorological Society, April 17.—Dr. H. R. Mill, president, in the chair.—Phenomenal rainfall in Suva, Fiji, August 8, 1906: R. L. **Holmes.** This is an account of a very remarkable fall of rain which occurred during a thunderstorm at Suva, the capital of Fiji, on the night of August 8. Unfortunately, the exact amount had to be, in part, estimated, owing to the observer failing to measure the fall at intervals during the night. Very little rain fell before sunset, but from 6 p.m. it continued a ceaseless downpour until sunrise the next day. At 10 p.m. the assistant found the gauge overflowing with 12·50 inches of rain in it. Four hours later, at 2 a.m. on August 9, the gauge was again overflowing, and at 6 a.m. it was overflowing once more, that is, three times in twelve hours. Very little rain fell after 6 a.m. These measurements show more than 37 inches, without taking into account the overflowings, which are an unknown quantity. As the gauge was 25 feet above the ground, Mr. Holmes is of opinion that the rainfall should be increased by about 11 per cent., so that the total fall must have been fully 41 inches in about thirteen hours, which he thinks surpasses anything that has been recorded in any other part of the world in so short a space of time.—Temperature around the British Islands in relation to the Gulf Stream: R. **Strachan.** This paper was based on observations made in the year 1906 which have been published by the Meteorological Office. Around the British coasts the temperature of the air was lowest in February and highest in August; the temperature of the sea corresponded to these epochs with slight interruptions, having been lowest in January for the west and central, in March for the south, and highest in September for the north and in July for the east, positions. The water in the Strait of Florida was about 30° warmer than the sea at the north of Scotland.—Weather regarded as a function of climate: L. C. W. **Bonacina.**

MANCHESTER.

Literary and Philosophical Society, March 12.—Prof. W. Boyd Dawkins, F.R.S., in the chair.—The occurrence and significance of symbiotic corpuscles in the lower animals: Dr. F. W. **Gamble** and Dr. F. **Keeble.** The paper described the occurrence of symbiotic coloured corpuscles in the bodies of lower animals. It dealt in detail with a single case, that of the simple turbellarian worm

Convoluta roscoffensis, and discussed the evidence for describing the green cells of the animals as an "infection" by a flagellated vegetal organism. The nature and life-history of this organism were described, and the significance of the association of the organism and of the animal Convoluta was discussed.—Bones of the great auk from Funk Island, Newfoundland: F. **Nicholson.** The bones exhibited were those of the now probably extinct species of bird, the great auk, or gare-fowl, *Alca impennis* of Linnæus. There were seven bones in this collection, consisting of:—one base of skull, one clavicle, one sacral vertebra, two right humeri, two right tibiæ. The bones have been presented to the Manchester Museum at the Victoria University.

March 26.—Mr. Francis Nicholson in the chair.—An apparent case of gaseous absorption caused by the action of a few milligrams of radium bromide on the sides of a glass tube containing the radium: T. **Thorp.** At first there was an expansion, but later on, as the glass turned purple, a contraction took place to less than the original volume. Further investigations are being made, the results of which will be communicated to the society.—A collection of fishes, batrachians, and reptiles made by Mr. S. A. Neave in Rhodesia, north of the Zambezi, with field notes by the collector: G. A. **Boulenger.** Thirteen species of fish, one of which (*Barilius neavii*) was described as new, seven batrachians, and forty-four reptiles were obtained. The localities, dates of capture, and native names of the various forms were given in the paper.—A new class of organo-metallic compounds. Trimethylplatinimethyl hydroxide and its salts: W. J. **Pope** and S. J. **Peachey.** No alkyl compounds of metals belonging to groups 1 and 8 of the periodic table have hitherto been described. The authors find that the chlorides, or in some cases the oxides, of iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, and platinum, belonging to group 8, and of gold, belonging to group 1, react vigorously with magnesium methyl iodide. Trimethylplatinimethyl iodide, $(CH_3)_3Pt.I$, is formed by the action of platinic chloride dissolved in ether upon magnesium methyl iodide in ethereal benzene solution; after treating with water and extracting with benzene, the benzene solution yields the new compound on evaporation. On boiling for several hours with silver hydroxide in a moist mixture of benzene and acetone, it is converted into trimethylplatinimethyl hydroxide, $(CH_3)_3Pt.OH$. Trimethylplatinimethyl nitrate, $(CH_3)_3Pt.NO_3$, obtained by dissolving the hydroxide in nitric acid, crystallises in colourless plates, and is freely soluble in water. On adding an alkali chloride to its aqueous solution, trimethylplatinimethyl chloride,

$$(CH_3)_3Pt.Cl,$$

is precipitated. This salt crystallises from chloroform in colourless rhombic dodecahedra belonging to the cubic system. In a similar manner a number of other salts have been prepared, including the bromide and the cyanide; the latter is hydrolysed on heating with caustic potash with evolution of ammonia.

April 9.—Mr. Arthur McDougall in the chair.—Further notes on the adventitious flora of the sandhills of St. Annes-on-the-Sea: C. **Bailey.** The author summarised his observations on the alien plants which had appeared during his five years' residence at St. Annes-on-the-Sea. The number of these aliens was quite worthy of a large ballast-discharging port; altogether between forty and fifty species have occurred, as represented by herbarium examples exhibited at the meeting.

PARIS.

Academy of Sciences, April 22.—M. A. Chauveau in the chair.—Primitive tuberculosis of the lungs and bronchial and mediastinal ganglia communicated to young cattle by the ingestion of tuberculous virus of human origin: A. **Chauveau.** Tubercle of the lungs can arise directly from the ingestion of human tubercle virus by the digestive organs, and this is not necessarily accompanied by tuberculous lesions of the intestines, although such may sometimes be the case.—The earthquakes of April 15, 18, and 19, 1907, recorded at Paris: G. **Bigourdan.** The records of April 15 indicate that the epicentre was at a distance of 8500 kilometres to 9000 kilometres, about the distance from Paris to Mexico. It is known that there was a disastrous earthquake in Mexico on this day.—The direct hydrogenation of the isocyanic esters: Paul **Sabatier** and A. **Mailhe.** The vapours of ethyl isocyanate, carried off in a current of hydrogen in excess, were passed over a column of reduced nickel maintained at 180° C. to 190° C. The gases issuing from the apparatus contained a little ammonia and carbonic acid, but neither methane nor carbon monoxide. The chief product of the reduction was methylethylamine, small quantities of ethylamine, diethylamine, and triethylamine being also present. With phenyl isocyanate a little aniline was obtained, but the main product was diphenylurea.—Concerning the spectroheliograph: G. **Millochau.** On a question of priority as to the use of a second slit by M. Deslandres.—Differential equations of the second order and first degree the general integral of which has fixed critical points: B. **Gambier.**—Equations with reciprocal integrals: C. **Popovici.**—The theorem of Nernst and liquid chains with identical extremities: J. **Guyot.** An extension of the work of Negbauer and Nernst on solutions of binary electrolytes formed of univalent ions to solutions of electrolytes of polyvalent ions. The experimental results are compared with the figures calculated by Planck's method.—Positive light and Melde's experiment: P. **Villard.**—The phosphorescence of the rare earths: J. **de Kowalski** and C. **Garnier.** To the nitrate of calcium or strontium is added a weak solution of the nitrate of the rare earth (praseodymium, neodymium, erbium, or samarium), the whole precipitated as carbonate, and the latter heated to a red heat with sulphur. The proportions of rare earth giving a maximum phosphorescence were determined in each case.—The phosphorescence of manganiferous calcium compounds: L. **Bruninghaus.**—The triboluminescence of substances containing zinc: Adrien **Karl.**—Some complementary observations concerning a property of platinum amalgam discovered by M. Henri Moissan: Paul **Lebeau.** The property of platinum amalgam of forming a stable emulsion seems to be peculiar to that metal. Instead of shaking the amalgam with water, the author used a 5 per cent. solution of gelatin, capable of solidifying on cooling. Sections were taken of the solidified mass with the view of studying its microscopical structure.—Remarks on the constitution of the copper alloys: Léon **Guillet.**—A new silicide of tungsten, Si_2W: Ed. **Defacqz.** The new silicide is formed by the action of amorphous tungsten upon copper silicide (containing 50 per cent. of silicon) at the temperature of the electric furnace; the same compound is obtained by reducing a mixture of tungstic anhydride and silica with aluminium in the presence of sulphur.—The condensation of sodium derivatives of acyloines of the fatty series with acetic esters: L. **Bouveault** and René **Locquin.** The authors have given the name acyloines to compounds of the type

$$R.CH(OH).CO.R.$$

—Ethylidene-imine (aldehyde ammonia) and hexaethylidene-tetra-amine: Marcel **Delépine.** The author has previously given reasons for supposing that aldehyde-ammonia is not $CH_3.CH(OH).NH_2$, as usually supposed, but the hydrate of $(CH_3.CH:NH)_3$. In confirmation of this view the present paper describes the preparation and properties of the trinitroso-derivative.—The detection and estimation of ammonia in monomethylamine and the more volatile fatty amines: Maurice **François.** By the usual method of a Nessler's reagent of defined composition, two parts of ammonium chloride in 1000 of methylamine hydrochloride can be detected with certainty. A quantitative method is developed on this basis.—The composition and analysis of wolfram and hübnerite: Paul **Nicolardot.** A scheme for the rapid analysis of tungsten minerals, permitting of the determination of all the constituents.—The differentiation of the tissues of the stem and frond of Equisetum: C. **Queva.**—The experimental genesis of vital processes: J. **Kunstler.**—Some remarks on the food of the sardine: Casimir **Cépède.**—The functions of the hypophysis and the pineal gland: M. **de Cyon.**

CALCUTTA.

Asiatic Society of Bengal, April 3.—Specimens illustrating the fauna of certain brackish pools in the delta of the Ganges: Dr. N. **Annandale.** This fauna has become isolated recently, probably within the last half-century, and presents many features of interest. It includes typical fresh-water Entomostraca, as well as two cirripedes (*Balanus amphitrite* and *B. patellaris*), the larvæ of a mosquito (*Anopheles rossii*), numerous fresh-water fish and molluscs, a hydrozoon (*Irene ceylonensis*), and an actinian (*Metridium schillerianum*). The last is probably the most interesting form now occurring in the pools, as it appears to have undergone a very distinct change, both in structure and in habits, since it was described by the late Dr. F. Stoliczka thirty-nine years ago.—Note on the absorption of gases, vapours, and substances from solution by solids and amorphous substances: Dr. M. W. **Travers.** In this note attention is directed to the physical character of such phenomena as the absorption of moisture by organic materials. It has usually been considered that such absorption must be attributed either to surface condensation or to solid solution. It appears, however, that substances which absorb gases or vapours are invariably amorphous, and as amorphous substances must be referred to the liquid rather than to the solid phase, the use of the term solid solution is not permissible. It is the author's opinion that such phenomena as the absorption of water vapour by cotton or jute involve the formation of a simple solution, the supposed solid phase consisting really of a substance in the liquid phase, but possessing a high viscosity. The law of distribution in this particular case is exponential instead of linear, but it tends to become linear as the temperature rises.

DIARY OF SOCIETIES.

THURSDAY, MAY 2.

ROYAL SOCIETY, at 4.—Election of Fellows.—At 4.30.—The Spontaneous Crystallisation of Binary Mixtures. Experiments on Salol and Betol: Prof. H. A. Miers, F.R.S., and Miss F. Isaac.—On the Variation of the Pressure developed during the Explosion of Cordite in Closed Vessels: Prof. C. H. Lees, F.R.S., and J. E. Petavel.—Space described in a Given Time by a Projectile moving in Air: A. Mallock, F.R.S.

SOCIETY OF ARTS, at 4.30.—The Applicability to India of Italian Methods of Utilizing Silt: Sir Edward C. Buck, K.C.S.I.

LINNEAN SOCIETY, at 8.—The Fauna and Flora of Abyssinia compared with Those of West Africa: Prof. E. B. Poulton, F.R.S.—(1) Report on the Marine Biology of the Sudanese Red Sea (Communicated with an Introduction by the President); (2) Formation of the Shone Cliff near Alexandria; (3) Recent History of the Coral Reefs of the North-West Shores of the Red Sea: Cyril Crossland.—Polyplacophora collected by Mr. Cyril Crossland: E. R. Sykes.—On Chelonethi (Pseudoscorpions) from Asia and Australia: C. J. With.—Note on the Function of the Spiracle in certain Elasmobranchs: A. D. Darbishire.—*Exhibits*: (1) Probate of the Will of Richard Anthony Salisbury; (2) Manuscripts of Dr. W. J. Burchell, Presented to the University of Oxford by Francis A. Burchell, Rhodes University College, Grahamstown, Grand-nephew of the Great Naturalist and Explorer: Prof. E. B. Poulton, F.R.S.

CHEMICAL SOCIETY, at 8.30.—(1) The Chemical Action of Exradio, Part I., Action on Distilled Water; (2) The Chemical Action of Exradio, Part II., Action on Copper Salts in Solution. Preliminary Note: Sir W. Ramsay.—Freezing Point Curves of the Menthyl Mandelates: A. Findlay and E. M. Hickmans.—The Constitution of Homo-eriodictyol. A Crystalline Substance from Eriodictyon Leaves: F. B. Power and F. Tutin.—The Relation between Valency and Heats of Combustion. Preliminary note: G. Le Bas.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Use of Wooden Poles for Overhead Power Transmission: C. Wade.

FRIDAY, MAY 3.

ROYAL INSTITUTION, at 9.—Dexterity and the Bend Sinister: Sir James Crichton-Browne, F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—The Igneous Rocks of the Bristol District: Prof. S. H. Reynolds.—The Carboniferous Limestone Sections of Burrington Combe and Cheddar: T. F. Sibly.—Recent Researches in the Lower Carboniferous Rocks: Dr. A. Vaughan.

SATURDAY, MAY 4.

ROYAL INSTITUTION, at 3.—Scientific Work in the Sea-Fisheries: Prof. W. C. McIntosh, F.R.S.

MONDAY, MAY 6.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Works Chemist as Engineer: O. Guttmann.

TUESDAY, MAY 7.

ROYAL INSTITUTION, at 3.—Stimulation, Luminous and Chemical: Prof. William Stirling.

ZOOLOGICAL SOCIETY, at 8.30.

WEDNESDAY, MAY 8.

SOCIETY OF ARTS, at 8.—The Production of Coke and its Application in Domestic Fires: Paul Schlicht.

THURSDAY, MAY 9.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Anatomy of the Julianiaceæ considered from the Systematic Point of View: Dr. F. E. Fritsch.—The Ascent of Water in Trees, Second Paper: Prof. A. J. Ewart.—Increase in the Complement-Content of Fresh Blood-Serum: Dr. J. Henderson Smith.

ROYAL INSTITUTION, at 3.—Spectroscopic Phenomena in Stars, (1) Chemistry: H. F. Newall, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Telephonic Transmission Measurements: R. S. Cohen and G. M. Shepherd.

IRON AND STEEL INSTITUTE, at 10.30 A.M.—Presidential Address.—Electrically Driven Reversing Roller-Mills: D. Selby-Bigge.—(1) Steel Making from High Silicon Phosphoric Pig Iron by the Basic Bessemer Process: (2) Steel Making from Pig Iron containing Chromium, Nickel, and Cobalt: A. W. Richards.—The Use of Steam in Gas Producer Practice: Prof. W. A. Bone and R. V. Wheeler.

FRIDAY, MAY 10.

ROYAL INSTITUTION, at 9.—Recent Excavations on Forum Romanum, and the Forum Ulpium: Signor Comᵉ Giacomo Boni.

PHYSICAL SOCIETY, at 8.—Stereoscopy with long Base-line illustrated on the Screen: Dr. T. C. Porter

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—The Pairing of *Limnaea peugra* with *Planorbis corneus*: W. D. Lang.—Notes on *Achatina denisoni*, Reeve, and *Achatina magnifica*, Pfr.: E. A. Smith.—Review of the New Zealand Acmæidæ, with Descriptions of New Species and Sub-species: Henry Suter.

IRON AND STEEL INSTITUTE, at 10.30 A.M.—Sentinel Pyrometers and their Application to the Heat Treatment of Tool Steel: H. Brearley and F. Colin Moorwood.—Induced Draught with Hot-air Economisers for Steel-Works and Blast-Furnace Boilers: A. J. Capron.—The Influence of Process of Manufacture on Some of the Properties of Steel: F. W. Harbord.—The Distribution of Sulphur in Metal Ingot Moulds: J. Henderson.—The Ageing of Mild Steel: C. E. Stromeyer.—Carbon-Tungsten Steels: T. Swinden.—The Nomenclature of Iron and Steel: Report of a Committee of the International Association for Testing Materials.

SATURDAY, MAY 11.

ROYAL INSTITUTION, at 3.—Scientific Work in the Sea-Fisheries: Prof. W. C. McIntosh, F.R.S.

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