THURSDAY, AUGUST 15, 1895.

THE HISTORY OF EVOLUTION.

From the Greeks to Darwin: an Outline of the Development of the Evolution Idea. By Henry Fairfield Osborn, Sc.D., Da Costa Professor of Biology in Columbia College, &c. (New York: Macmillan and Co.)

THE object of this most interesting and useful work is to survey the last twenty-four centuries and bring together the thoughts—true and false—upon evolution. Examining and comparing the material which he has collected, the author concludes "that the influences of early upon later thought are greater than has been believed, that Darwin owes more even to the Greeks than we have ever recognised." In supporting this conclusion the author desires to give due credit to the earlier writers, but not to lower in any way the transcendant position occupied by Darwin. Indeed, so scrupulously fair is the treatment that the materials are thoroughly available to those who do not altogether follow the author in his conclusion. And many objections to the conclusion are most prominently brought forward. Thus the great interval between the beginning and the middle of the present century, when all continuity in evolutionary thought seemed to be broken, is described again and again. We read on page 12: "Perhaps the sharpest transition was at the close of the third period, in which a distinct anti-evolution school had sprung up and succeeded in firmly entrenching itself, so that Darwin and Wallace began the present era with some abruptness." Again, on pages 227 and 228, the strong prejudice against evolution which marks this peiiod is illustrated in many ways, and the section concludes: ". . . all the progress which had been made in the long centuries we have been considering was, for the time, a latent force. The Evolution idea, with the numerous truths which had accumulated about it, was again almost wholly subordinate to the Special Creation idea."

The recognition of this strongly-marked gap in the history of evolutionary thought, and, above all, the details which we learn from Darwin's "Life and Letters," tend to throw doubt upon the view that he drew much of his inspiration from the past. The great majority or naturalists could not entertain the idea of evolution unless some explanation of its cause was forthcoming. Darwin treated the process and the cause as entirely distinct, and was convinced of the one long before he had come to any definite opinion about the other. In accepting evolution as against special creation, we fail to find any evidence that Darwin was influenced by the arguments or conclusions of an earlier day. He was influenced and finally convinced by his conclusions from his own observations on the *Beagle* (quoted by Prof. Osborn on p. 233). In looking for the causes of evolution he was equally independent of the past; for he saw that adaptation was the central fact which required explanation, and which had received none at the hands of the naturalists with whose writings he was acquainted.

But whether the thread be broken or continuous, the history of thought upon this all-important subject is of the deepest interest, and Prof. Osborn's work will be welcomed by all who take an intelligent interest in evolution. Up to the present, the pre-Darwinian evolutionists have been for the most part considered singly, the claims of particular naturalists being urged often with too warm an enthusiasm. Prof. Osborn has undertaken a more comprehensive work, and with well-balanced judgment assigns a place to every writer.

The history of thought upon evolution from 640 B.C. to the present day is divided into two main phases, the second of which is further subdivided into three periods.

The first phase, "The Anticipation of Nature: Greek Evolution," and its effects on Christian Theology and Arabic Philosophy, lasted from 640 B.C. to 1600 A.D.

The second phase, "The Interpretation of Nature: Modern Evolution," opens with the period of "Philosophical Evolution," from 1600 to 1800, associated with the names of Bacon, Kant, Herder, Bonnet, Oken, &c. In this period the Greek traditions were largely shaken off, and inductive evolution began.

The next period, that of the rise and decline of "Modern Inductive Evolution," somewhat overlapping the last, is limited by the years 1730 and 1850, from Buffon to St. Hilaire. It depends upon the writings of Linnæus, Erasmus Darwin, Lamarck, Goethe, Treviranus, &c. At the close of this period, Owen and Herbert Spencer are placed.

The last period, that of the re-establishment of "Modern Inductive Evolution" upon a firmer foundation, dates from 1858 to the present day. It is associated with the names of Darwin and Wallace, and marked by the scientific evidences of evolution, by the theory of natural selection, by observation and speculation upon other factors of evolution.

The section which deals with the Greeks has been somewhat unfairly criticised. Some people appear to believe that an account of Greek ideas upon evolution can only be attempted with success by an eminent classical scholar. But classical scholars have already done their utmost in the way of translation and of study. It is now of far greater importance to have a critical account, like that in the work we are considering, by a writer who is an authority upon evolution.

In discussing "The Legacy of the Greeks" (pp. 64-68) the author points out that the first element is "scientific curiosity, their desire to find a natural explanation for the origin and existence of things." The complete dependence of all investigation upon this spirit is maintained, and it is truly said that "the ground motive in science is a high order of curiosity, led on by ambition to overcome obstacles." The final conclusion is that "the Greeks left the later world face to face with the problem of causation in three forms: first, whether intelligent design is constantly operating in nature; second, whether nature is under the operation of natural causes originally implanted by intelligent design; and third, whether nature is under the operation of natural causes due from the beginning to the laws of chance, and containing no evidences of design, even in their origin."

In this section of the work we find, as we might expect, that the genius of Aristotle completely overshadows that of the other Greek writers who attempted to face the problems of the origin and development of living forms.

In the long second period, that of the theologians and natural philosophers, "no advance whatever in the development of the evolution idea was made . . . ; scientific speculation and observation were at a standstill, except among the Arabs" (p. 70).

As we advance towards the work of the naturalists and philosophers of the two last centuries, the difficulties and dangers of interpretation increase. It is even easier to read preconceived notions into the single passages of dead writers than into the phenomena of nature; and we all know that the latter process is only too easy. If the results are not to be in the highest degree misleading, the author must, like Prof. Osborn, be entirely free from bias, and must possess a cool and critical judgment.

We meet with constant and timely protests against the rash conclusions which may be reached by selecting isolated passages from an author, and dealing with them apart from their context, and the full recognition of the great danger which underlies this too common practice, viz. that we unconsciously read into such passages our present knowledge (p. 80).

Prof. Osborn considers that too high a place has been assigned to Oken and Treviranus by Haeckel and Huxley respectively, and that Naudin's supposed anticipation of natural selection is far from being as satisfactory as Quatrefages and Varigny maintain. The suggestion that Oken anticipated the cell theory is acutely criticised: it is suggested that his conception of the cell as a sphere was probably only a result of the transcendant position occupied by this geometrical form in his system of philosophy (p. 124).

The suggestion (on p. 235) that Darwin's 1844 Essay should be published will, the present writer feels assured, meet with warm approval from the wide circle of readers who are eager to learn all that can be learnt of the history of Darwin's views upon the great work of his life.

The hope is expressed (on p. 245) that we shall learn the steps which led to Wallace's independent discovery of natural selection. That information is fortunately now before us, and we know that Wallace was led to the discovery by reflecting on Malthus' "Essay on Population," as he lay ill of intermittent fever at Ternate (quoted, without reference, in Milnes Marshall's "Lectures on the Darwinian Theory," London, 1894, pp. 212, 213, and to be found in the abridged form of the "Life and Letters of Charles Darwin"). Thus another most important detail is added to the extraordinary coincidence of the independent discovery of natural selection.

There is comparatively little to criticise in the volume. The idea of the marine origin of life, traced to Thales, is stated to be "now a fundamental principle of evolution" (p. 33); but at the end of the volume it is more correctly asserted that we are now too wise to answer the inquiry: Where did life first appear? (p. 247).

Concerning the debated question as to whether Lamarck was aware of Erasmus Darwin's writings, and made use of them without acknowledgment, the author (pp. 154, 155) quotes a passage from the "Animaux sans Vertébres," in which Lamarck states that his theory is the first which has been presented. This he considers to be "satisfactory evidence that Erasmus Darwin and Lamarck independently evolved their views." But if Lamarck borrowed without acknowledgment, it would be but a small step further to write the passage in question.

The statements and conclusions to which exception is chiefly to be taken concern the life of Darwin himself, which the author professedly treats in a very brief and imperfect manner, any detailed account being beyond the scope of this volume.

The author speaks (p. 227) of "Huxley's somewhat guarded acceptance of the theory" on the first appearance of the "Origin," and implies that he became a much stronger supporter of evolution in later years. But in reality his convictions on this subject never changed. In his letter to Darwin, written November 23, 1859, the day before the publication of the "Origin," Huxley expressed himself as "prepared to go to the stake, if requisite, in support of" those parts of the book which deal with evolution as apart from natural selection. As to the latter he says: "I think you have demonstrated a true cause for the production of species, and have thrown the *onus probandi* that species did not arise in the way you suppose, on your adversaries." And these were Huxley's views up to the last occasions on which he spoke on the subject, at the Oxford meeting of the British Association last year, and at the anniversary of the Royal Society when he received the Darwin Medal. On both occasions he carefully distinguished between evolution and natural selection, being prepared to defend the former to the uttermost, while he declined to commit himself upon the latter.

It is contended (p. 239) that Darwin's faith in natural selection reached its climax in 1858, and then gradually declined. The evidence quoted in support of this conclusion is a letter to Carus in 1869, in which Darwin says: "I have been led to infer that single variations are of even less importance in comparison with individual differences than I formerly thought." But this passage proves a strengthening, and not a weakening of his belief in the efficiency of natural selection, inasmuch as it is considered competent to work upon the minute differences which separate individuals instead of upon the ready-made material provided by single variations, however conspicuous. By "single variations" he meant single individuals differing widely and conspicuously from the average of their species. His letter to Carus was written shortly after he had been convinced on this point by Fleeming Jenkin's review of the "Origin" (*North British Review*, June 1867). A careful study of vol. iii. of the "Life and Letters" leaves no doubt upon this point; while the facts thus brought out tend to refute the argument on p. 245 as to the supposed antagonism between Darwin's and Wallace's conception of the operation of natural selection as expressed in their contributions to the Linnean Society in 1858.

A passage in the sixth edition of the "Origin" is referred to (p. 242) as having been published in 1880, and is therefore considered to be "among Darwin's last words upon the factors of evolution." The passage in question is referred to p. 424 of the "Origin," but occurs on p. 421 of the copies I have consulted. In it Darwin expresses his belief that evolution has been effected "chiefly" by natural selection, "aided in an important manner by the inherited effects of use and disuse of parts; and in an unimportant manner . . . by the direct action of external conditions . . ." This passage is considered by Osborn to prove that the progressive tendency towards the explanations of Lamarck and Buffon which he believes Darwin exhibited from 1859 onwards—culminated at the close of his life. But the sixth edition appeared in 1872, and the date 1880 is merely that of a reprint. The words in question were certainly written before the former date, and even in the fifth edition (1869) Darwin inserted the word "chiefly" to qualify an expression of confidence which might have been interpreted as a belief in the all-sufficiency of natural selection.

The fact appears to be that there was no progressive change in Darwin's attitude on this subject, but that his opinion fluctuated as various classes of evidence were brought before him, and at the very end of his life his belief in the direct action of external conditions was seriously shaken by the resu ts of Hoffmann's experiments. The effect produced on him is well shown in his letter to Semper, written July 19, 1881, less than a year before his death ("Life and Letters," vol. iii.). But although Darwin's opinion fluctuated as to the relative value of the supposed causes of evolution other than natural selection, his views as to the paramount importance of the latter never varied in any of his published utterances. The words which conclude the Introduction of the 1859 "Origin" are repeated without change in each succeeding edition and reprint. "Furthermore, I am convinced that natural selection has been the main, but not the exclusive means of modification."

The printing and general get-up of this interesting work leaves nothing to be desired, being far above the average that obtains in scientific publications. It may confidently be predicted that the book will be widely read and greatly appreciated. E. B. P.

THE ELEMENTS OF ARCHITECTURE.

Architecture for General Readers, &c. By H. Heathcote Statham. 8vo. (London: Chapman and Hall, 1895.)

THE aim of this treatise, as stated in the preface, is certainly a good one, namely, to supply the "general reader" with the means of criticising architecture in an intelligent manner, and principally by giving an analysis of the two most logical and complete styles that have ever existed, namely, the Greek and the Gothic; the former representing the trabeated, and the latter the arcuate system of building. Our author, however, very properly does not confine his attention to these two styles and their later developments, but also makes wide digressions in the direction of Egyptian, Byzantine, and Mahommedan structures, all of them being copiously illustrated and discussed at considerable length. The work exhibits throughout the author's great and varied acquaintance with his subject, and cannot but be of much interest and value to any reader who desires to dive more deeply than amateurs are accustomed to do into the principles which ought to guide the professional architect, and which, indeed, do guide all those who achieve anything worthy of the art in which they practise.

In page 20 the importance of planning is properly insisted on. The plan is shown to be the very "backbone" of the structure, and the attention of the "general reader" is rightly called to this. It may be doubted, however, whether the general reader is prepared for the minute criticism, which we find a little further on, respecting certain competition designs, which criticism is rendered the more difficult to follow, in consequence of the small scale of the plans by which these designs are illustrated, and he may, perhaps, wish that he had been led into such deep water more gently. In page 31, with reference to the proportions of buildings as affecting the eye, the author appears to doubt whether—with the exception of the late Mr. W. W. Lloyd's discovery of the system which prevails in the Parthenon—any definite and clear case has been made out for the establishment of proportion theories. The author is probably quite justified in his refusal to accept any general adoption of a system for proportioning buildings "on the basis of geometrical figures, especially triangles of various angles." There could not possibly be any æsthetic value in confining the main lines of the architecture within such limits; but rectangular proportions in low numbers (of which nature are the proportions of the Parthenon) are on a different footing, and it is extremely probable that they do produce harmonious effects. They are to be found in many other Greek examples besides the Parthenon, and in one Gothic building at least, namely, the work of Bishop Grosetete in the nave of Lincoln Cathedral (see the *Transactions* of the Archæological Institute of Great Britain, &c., for 1848), where rectangular proportions of this character come out without any "coaxing" with remarkable exactness; and as Bishop Grosetete, besides being a great ecclesiastic, was one of the most prominent philosophers of his day, there is the more reason to accept it as having been intentional.

In p. 34, the chief characteristics of the Egyptian, the Greek and the Gothic are summed up in a few words, as Mystery, Rationalism, and Aspiration. In p. 43, the meed of merited praise is given to Mr. E. L. Garbett's excellent little treatise on "The Principles of Design in Architecture." In p. 58, doubt is thrown on the wooden origin of the Greek entablature. The reader, however, may be referred to MM. Perrot and Chipiez' recent work on "The Arts of Primitive Greece," in which this derivation is shown from the remains at Tiryns, Mycenæ, and Orchomenus. In p. 73, the Corinthian example of the temple of Jupiter Olympius at Athens should not be attributed to a Roman source; it dates from Antiochus Epiphanes, the Greek founder, and the prototype of the capital is found in the *tholos* at Epidaurus, a pure Greek building. No doubt at the time the Athenian temple was built, about 170 B.C., Rome was pushing her way towards the East, and Antiochus himself had been sent as a hostage to Rome after the defeat of his father by Scipio. There may have been something political in his employment, as we are told of a Roman citizen as his architect, but the architecture itself, at that date, could not but have been thoroughly Greek.

In p. 78, the author well illustrates his argument, showing the superiority of constructive simplicity in a design over another decorated with meaningless architectural detail, by the contrast of London and Blackfriars Bridges; but it is not so clear, as maintained in the previous page that the combination of columnar and arcuate design in the same wall is a "Roman sham." It is no doubt a departure from primitive simplicity, but there seems no reason for calling it a sham, in cases where both types are used constructively. The "general reader" may certainly be justified in passing over the "approximate theory" of the strains of arches, but the subject of pendentives (in p. 95) is more to the point, having very important relation to the construction of cupolas. Much more seems to be made in the criticism on the shams of St. Paul's (p. 98) than the subject warrants. The design is blamed because the interior cupola is distinct from the external. There would be as much reason to blame the magnificent central towers of some of our cathedrals because the open lantern chamber over the crossing does not rise to the summit of the tower or spire. The author, however, duly praises Sir Christopher Wren's first design, the Greek cross plan, of which a good judge, the late Rev. J. L. Petit, has maintained that if this design had been executed it would have been the finest interior in the world. On the subject of vaulting (pp. 107-116), the development of which is well and clearly followed out, it is stated that the pointed arch was *invented* for the purpose of facilitating the construction. This could hardly have been the case, because the pointed arch had been used in the East long before the period referred to; but its great applicability to that favourite architectural feature was then recognised, and when once introduced for constructive reasons, it soon began to influence the whole structure.

In p. 125 commences a chapter on the theory and use of mouldings, which play so important a part in architectural design that it is quite essential that an amateur who desires to form a right judgment on architectural subjects, either historically or critically, should study their development and application; he will find the subject clearly and logically explained in this chapter. In chapter v. are some judicious remarks on ornament, showing on the one hand that however valuable a help it may be, the art is really independent both of sculpture and carved ornament, and that the latter is inferior in expression to mouldings properly used. In pp. 184-188 are some just views on the combination of architecture with scenery. Without going so far as to say that a spire on a hill—such, for instance, as Harrow—must necessarily be ill-placed, the statement of the incongruity of this feature in a mountainous country may be supported by citing the example of incongruous effect of the Ambleside spire in a Westmoreland valley.

The work ends with an historical sketch, which shows much thought and learning. The author can, however, scarcely be correct in speaking of such structures as the Treasury of Atreus at Mycenæ as formed of large blocks of masonry with no architectural details whatever. It is possible that the ornate elaboration of the Beehive tombs at Mycenæ and Orchomenus, as shown in Perrot and Chipiez' work, before referred to, may be a good deal exaggerated; but there certainly exists evidence for a very considerable amount of architectural embellishment. In speaking of the derivation of the Corinthian capital, it seems unnecessary, with the small amount of evidence to the contrary which exists, to relegate to the regions of fable the touching little story told by Vitruvius (chapter iv. p. 1) of its invention by Callimachus, especially as the earliest known example, in the temple at Bassæ, was the work of a contemporary, and probably a friend of the reputed inventor.

In p. 255 the very important derivation of the dome is traced from the Pantheon, of which the date (in the reign of Hadrian) has lately been established, and then the addition of the spherical pendentive by Justinian's architect (Anthemius of Tralles) in the great church of St. Sophia. To this is added the derivation of the architecture of the Western churches—which is traced—following Prof. Baldwin Brown ("from the Schola to Cathedral"); from the Roman house, of which the atrium and peristylium became the forecourt or parvis and the porch, whilst the basilica supplied the apse, and the widening of the basilica on each side of the tribunal gave the germ of the transepts of our cathedrals. In the summary of the different contributions made by the European nations to Gothic architecture, Italy is denied altogether a specimen of true Gothic—and yet it possesses in Milan Cathedral an interior perhaps more impressive than that of any other church.

"*PARTURIUNT MONTES.*"

The Story of the Plants. By Grant Allen. (London: George Newnes, Limited, 1895.)

MR. GRANT ALLEN tells the story of plants in a readable and very inaccurate manner. The keynote to his work is struck in his preface, in which he informs his reader that he has "wasted comparatively little space on mere structural detail," and, later on, that he makes "trivial sacrifices of formal accuracy" in order to expound general biological relationships. It is true that he apologises for these amiable little weaknesses, but adds, in the same breath, that he lays before his "untechnical readers all the latest results of the most advanced botanical research." It is impossible to avoid giving some samples of these "latest results."

For Mr. Grant Allen, the plant is essentially the *green* plant, and the essential function of this plant is constructive metabolism. On the other hand the animal is the very opposite of this, "he is a destroyer, as the plant is a builder." But we fancy most people will hardly admit this antithesis nowadays. Plants and animals both exist by breaking down complex bodies to simple ones, but plants as a whole can get the energy required for first building up these complex bodies at a less expensive outlay than animals, and the green plants, as Mr. Allen perfectly correctly observes, are further able to make use of sources of energy (*i.e.* vibrations of ether) from which their less fortunate relatives are debarred. But to draw the distinction just quoted as the *essential* difference between the two kingdoms, is obviously misleading. However, Mr. Allen is at least consistent in his views, since he states that the first plants "must have been green."

In the account given of the *modus operandi* of the building up of organic matter in the plant, the author's claims to up-to-date knowledge will, we fear, hardly be admitted. Chlorophyll is said to be the active agent in splitting up (under the influence of sunlight) the carbon dioxide and water to form starch. Now every student knows that chlorophyll can do no such thing, and further he knows, or should know, that starch is certainly not a primary product of assimilation. The latter, perhaps, is a "trivial detail," but Mr. Allen hastens to insist on the importance of "living chlorophyll" as the "original manufacturer and prime maker" of all the material of life, either vegetable or animal. Evidently chlorophyll is here doing duty for the alliance of chlorophyll with a vastly more important substance, protoplasm, but the author could hardly expect "untechnical readers" to appreciate this; and his statement that chlorophyll is a variety of protoplasm will certainly not meet with the assent of botanists. Again, the statement that "plants alone know how to make protoplasm" is one which is contradicted, fortunately for us all, by the experience of daily life; in order, however, that we may be quite clear as to the author's conception of protoplasm, he defines it (in italics) as "*the only living material we know*"; and this would seem to make it clear that he had not by a *lapsus calami* written protoplasm when he meant proteid. For a continuation of this subject, the critical reader may refer to pp. 190–191.

When Mr. Allen comes to deal with what we gather from his preface he considers the most important part of his work, we find evidences of hasty generalisations on insufficiently ascertained facts. Many plants which are certainly not degenerate, are regularly self-fertilised; and we submit that in most districts in England the humble bee has far more to do with the fertilisation of the Tropæolum than the Humming-bird hawk-moth; and this latter insect is certainly *not* the only one in Europe capable of performing this office.

But it is needless to multiply examples further. All we can say is that those readers who are ignorant of the real facts may find the book pleasant, though we can hardly add profitable, reading.

OUR BOOK SHELF.

Low's Chemical Lecture Charts. (London: Sampson Low, Marston, and Co., 1895.)

THIS is a series of diagrams intended to illustrate various chemical and metallurgical processes and apparatus, and designed more especially for the use of teachers who are preparing students for the examinations of the Science and Art Department, the London Matriculation, Oxford and Cambridge Local, &c.

There is no doubt that a good set of useful diagrams, of convenient size and moderate price, would be gladly welcomed by a large number of teachers, but the charts before us can scarcely be said to fulfil all the requirements of such a set of diagrams. The size of the sheets, namely, 30 in. × 40 in., is sufficiently large for the use of such classes as they are intended for, and it does not render them too bulky for convenient storage. In most cases the illustrations are very roughly executed enlargements of familiar cuts from various text-books and treatises on chemistry, sometimes well chosen, sometimes not. Many of the sheets contain several pictures, and where it happens that the subjects represented are in a manner related, this does not detract from their merit, except in so far as it necessitates the illustrations being smaller than if each occupied a single sheet. But in a number of instances the subjects depicted on the same diagram have no connection; thus, on the same sheet we find a representation of Hofmann's apparatus for showing the volume composition of water, and illustrations of certain apparatus used by Dewar in making experiments at low temperature.

Again, another diagram contains the following illustrations: (1) Hofmann's apparatus for composition of sulphur dioxide; (2) ozone apparatus; (3) apparatus for composition of ammonia; (4) apparatus for composition of hydrochloric acid; (5) Andrews' and Tait's ozone tube; (6) apparatus for composition of nitrous oxide; (7) Smithell's flame cone separator. With so many illustrations on one sheet, 30 in. × 40 in., each one must be almost insignificantly small, and quite erroneous ideas of the relative sizes of various pieces of apparatus are likely to be conveyed to the student. With some of the figures still more serious exception must be taken; thus, Fig. 2, Sheet 14, depicts a piece of apparatus, the design of which is of more than questionable feasibility; while Fig. 2, Sheet 17, is an impossible arrangement.

Many of the metallurgical figures are badly chosen. Thus, the old method for extracting zinc, known as "distillation per descensum," which has been quite obsolete for many years, is brought to life again in Diagram No. 11.

If these diagrams were a little better executed, and could be purchased singly, they would be of much more service to the general run of teachers, who could then select from a catalogue such as they might require.

G. S. N.

Brasilische Pilzblumen. Von Alfred Möller. Mit 8 Tafeln. (Jena: Gustav Fischer, 1895.)

THIS volume forms the seventh part of the "Botanische Mittheilungen aus den Tropen," edited by Prof. Schimper, of Bonn. The title—"Fungus-Flowers"—is suggestive of a popular and æsthetic treatment of the subject, but this impression is somewhat misleading, for Dr. Möller's work is of a strictly scientific character, and appeals more especially to systematic mycologists. At the same time, the extraordinary forms of the Fungi described give a considerable degree of general interest to the book, which is enhanced by the pleasant style in which the subject is treated. Dr. Möller is already well known for his mycological investigations, particularly for his fascinating work on the cultivation of Fungi by South American ants. The "Fungus-Flowers" are simply gastromycetous fungi of the family Phalloideæ, of which that repulsive plant the "Stinkhorn" (*Ithyphallus impudicus*) is the best-known British representative.

The author has been most fortunate in his investigation of the remarkable Brazilian forms of this family, which includes perhaps the most highly differentiated of the Fungi. He has founded no less that four new genera on his discoveries. One of these (*Protubera*) is referred to the Hymenogastreæ, and is of special interest, for it appears to connect that family with *Clathrus* among the Phalloideæ. The other new genera (*Blumenavia*, *Aporophallus*, and *Itajahya*) are members of the Phalloideæ, *Blumenavia* showing affinity with *Clathrus*, while the remaining two belong to the tribe Phalleæ. Eight new species are described in all.

The book is full of interesting details of the occurrence and mode of growth of these Fungi. It is illustrated by eight fine plates, many of the figures in which are from photographs of the specimens, while others represent their more minute structure. The first plate, a coloured representation of "the most remarkable of all Fungi," *Dictyophora phalloidea*, is especially striking. This is not one of the new species, but has never been adequately figured before. This extraordinary fungus bears a general resemblance to *Ithyphallus*, but is distinguished by the presence of an immense net-like indusium surrounding the stem, from which it stands out like a crinoline. The German colonists at Blumenau have given it the name of "the veiled lady."

Dr. Möller's book will be indispensable to students of mycology, and will no doubt attract more general attention to a most interesting group of plants, about which much still remains to be discovered. D. H. S.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The University of London.

SIR JOHN LUBBOCK does not seem to me to appreciate in the smallest degree the facts of the position.

His proposal is, as I and others understand it, that the result of the labours of the Statutory Commission "should be submitted to Convocation for their approval, *to be signified as at a senatorial election.*"

The words which I have placed in italics propose a new procedure which I presume would have to be provided for in the Act. This is what for the sake of brevity has been called the *referendum.*

For reasons which I have sufficiently set out in my former letter I think the institution of the *referendum* extremely undesirable under any circumstances, and peculiarly open to objection in the present instance.

But I think we are now entitled to ask Sir John explicitly what he means when he says "it is the law at present," and that his "constituents highly value this right." In so grave a matter it is difficult to believe that he is indulging in a mere logomachy, or that he means seriously that the veto exercised under existing conditions and the new *referendum* are one and the same thing.

The meaning of the whole business is, of course, very simple. Convocation, in common with the Senate and practically every body interested in the higher education in London, has expressed its approval of the Report of the late Commission as affording a basis for the reorganisation of the University. As Convocation is not to be moved from its decision expressed in the customary and constitutional way, the leaders of the minority, mainly drawn from the Faculty of Laws, have induced Sir John Lubbock to suggest a fundamental change in our procedure. The hope, of course, is that by this means a different result may be manipulated. I say "manipulated" because I entirely agree with Mr. A. W. Bennett, who in his admirable letter clearly indicates the kind of tactics we may expect. As the avowed object of the whole scheme is to set aside and nullify the action which Convocation has taken, I do not think that the language in which I described it is in any way inappropriate.

Sir John may be as polite as he likes to our intelligence. But what he has done is to constitute himself the instrument of those who would destroy the prospects of academic study in London, and of making the University of London a better mechanism for the purpose for which it exists. And this is not what we had a right to expect of Sir John Lubbock.

Kew, August 10. W. T. THISELTON-DYER.

Note on Quaternions.

ON reading Cayley's famous memoir on matrices,[1] I have noticed in passing that in McAuley's[2] notation we may write in general,

$$\left.\begin{array}{l} \phi^{-1} = \underset{\phi}{\mathrm{D}}\log m, \qquad \phi'^{-1} = \underset{\phi}{\mathrm{D}}\log m\,; \\ \text{or} \\ \psi = \underset{\phi'}{\mathrm{D}}m, \qquad \psi' = \underset{\phi'}{\mathrm{D}}m\,; \\ \text{or} \\ \phi\underset{\phi'}{\mathrm{D}}\log m = \phi'\underset{\phi}{\mathrm{D}}\log m = \psi^{-1}\underset{\phi'}{\mathrm{D}}m = \psi'^{-1}\underset{\phi}{\mathrm{D}}m = \mathrm{I}. \end{array}\right\}\ldots(\mathrm{A})$$

Where m is an invariant of ϕ, which being the original linear vector function, ψ is Hamiltonian inverse function, and I is Gibb's idemfactor ; they are respectively defined by

$$m\mathrm{S}\lambda\mu\upsilon = \mathrm{S}\phi\lambda\phi\mu\phi\upsilon = \mathrm{S}\phi'\lambda\phi'\mu\phi'\upsilon,$$
$$\psi = m\phi^{-1}, \qquad \mathrm{I}\rho = \rho.$$

Indeed, we may prove the above relation by the variation formula,

$$\delta\mathrm{Q} = -\mathrm{Q}_1\mathrm{S}\delta\phi\zeta\underset{\phi}{\mathrm{D}_1}\zeta,$$

given by McAuley[3]; thus

$$\delta m = -m_1\mathrm{S}\delta\phi\zeta\underset{\phi}{\mathrm{D}_1}\zeta = -\mathrm{S}\delta\phi\zeta\underset{\varphi}{\mathrm{D}}m\zeta = -\mathrm{S}\delta\phi\zeta\psi'\zeta$$
$$= -\mathrm{S}\delta\phi i\psi' i - \mathrm{S}\delta\phi j\psi' j - \mathrm{S}\delta\phi\kappa\psi'\kappa$$
$$= -\mathrm{S}\delta\phi i\phi j\phi\kappa - \mathrm{S}\delta\phi j\phi\kappa\phi i - \mathrm{S}\delta\phi\kappa\phi i\phi j$$
$$= -\delta\mathrm{S}\phi i\phi j\phi\kappa = \delta m.$$

If W be any scalar function of ϕ, and if its independent variable be m (as it is so in some cases of the problems in elasticity, where m is the volume-dilatation), we might dispense with the notation $\underset{\phi}{\mathrm{D}}$, for we may write in general,

$$\underset{\phi}{\mathrm{D}}\mathrm{W} = \frac{d\mathrm{W}}{dm}\psi' \quad \ldots\ldots\ldots\ldots (\mathrm{B})$$

Also, if Q be any quaternion function of ϕ, and if its independent variable be m, we have again

$$\delta\mathrm{Q} = -\frac{d\mathrm{Q}}{dm}\mathrm{S}\delta\phi\zeta\psi'\zeta \quad \ldots\ldots\ldots (\mathrm{C})$$

For, beginning with McAuley's form, we have

$$\delta\mathrm{Q} = -\mathrm{Q}_1\mathrm{S}\delta\phi\zeta\underset{\phi}{\mathrm{D}_1}\zeta = -\frac{d\mathrm{Q}}{dm}\mathrm{S}\delta\phi\zeta\psi'\zeta$$
$$= -\frac{d\mathrm{Q}}{dm}[\mathrm{S}\delta\phi i\psi' i + \mathrm{S}\delta\phi j\psi' j + \mathrm{S}\delta\phi\kappa\psi'\kappa]$$
$$= \frac{d\mathrm{Q}}{dm}\delta m = \delta\mathrm{Q}.$$

SHUNKICHI KIMURA.

Japanese Legation, The Hague, July 16.

[1] P. 22.
[2] "Utility of Quaternions, &c."
[3] I cannot refer to the page, as I have not the book in hand.

To Find the Focal Length of a Convex Mirror.

THE following method is so much simpler than those ordinarily used, that it may be of interest to your readers.

Use as object an opaque screen with a hole and pin-point, and painted white, or covered with white paper.

Set up on the bench in line, say, with the left edge of the hole, the convex mirror and an auxiliary biconvex lens of short focal length (six inches or so), and adjust the lens so that the image of the hole and pin-point is formed side by side with the object. The centre of the mirror is now at the point at which the image would be formed by the lens alone ; this position may either be calculated or found (after noting the position of the mirror and then removing it) by means of a screen. Thus the radius is easily measured.

If the focal length of the mirror be greater than f that of the lens, the simplest way of adjusting is to put the lens as close as possible to the mirror, put the object at principal focus of lens, and move the object back until the image is formed as above.

If, however, the focal length be less, we can be sure of finding the position by putting the mirror at a distance of $4f$ from the object, and the lens at $2f$, and moving the lens back until the desired position is reached.

The following is a simple way of making a direct measure of the focal length of a concave lens:—

Use an object like the one mentioned above, an auxiliary convex lens (say six inches focal length) to produce a convergent beam, and an auxiliary plane mirror, placed beyond the concave lens.

Adjust until the image is formed side by side with the object as before, then the rays must be emerging parallel to one another from the concave lens, and hence the convergent beam from the convex lens will (when the concave lens and mirror are removed) form an image at the principal focus of the concave lens. A direct measure can thus be made of the focal length.

I may add that both methods are very simple in practice.

Grammar School, Macclesfield. EDWIN BUDDEN.

Oceanic Islands.

IT is to be hoped that in the programme of the present Government a place will be found for an item humble and unimportant in the politician's eyes, but to the biologist of the utmost urgency—the sending out of a scientific expedition or expeditions to study the fauna and flora of oceanic islands before they are exterminated by continental importations. Let it be granted that men of science are busy with problems of even greater interest than those which such expeditions might help to solve. But among all the ambitious aims of science, it would be hard to find one to which delay would be more ruinous than to this—the thorough knowledge of the inhabitants, whether animal or vegetable, of oceanic islands. The work must be done speedily, or it will be too late; and it is work that can hardly be undertaken on a sufficiently extensive scale without aid from Government.

Haileybury College. F. W. HEADLEY.

MICROGRAPHIC ANALYSIS.

METALLURGISTS would have been greatly astonished if they had been urged at the beginning of the present century to gather information as to the composition of samples of iron and steel by merely looking at polished and etched specimens through a microscope. The operation is, nevertheless, rapidly taking its place in the ordinary routine of a works laboratory.

As regards the history of the development of this new branch of investigation, it appears that micro-metallography has not been developed from petrography. It is the natural extension of the study of meteoric iron, and, as has often happened in the history of science, it seems to have had more than one independent origin. Priority of date rests with our own countryman Dr. Sorby. In 1864 he submitted to the British Association photographs of opaque sections of various kinds of iron and steel, and he endeavoured to develop a method for the industrial examination of such sections under high powers, preferring polished sections to fractured surfaces. The abstract of his paper is very brief; but looking back, it seems strangely comprehensive and suggestive. He claimed that the sections showed "various mixtures of iron, two or three well-defined compounds of iron and carbon, of graphite, and of slag; and these, being present in different proportions, and arranged in various manners, give rise to a large number of varieties of iron and steel differing by well-marked and very striking peculiarities of structure."

Later, Prof. Martens, in Berlin, without neglecting the examination of sections, carefully studied, in 1878, the general laws which govern the occurrence and formation of fractures, fissures, blow-holes, and crystalline structure in metals and alloys. His work, therefore, presents all the characteristics of perfect originality. It was not long after the publication of Martens' work that M. Osmond, then engineer at the Creusot Works, began, with his colleague M. Werth, investigations on the cellular structure of cast steel. This work was published by the *Académie des Sciences* in 1885, and in order to trace the progress which has been made in micro-metallography during the past ten years, it would be difficult to do better than consult the beautiful monograph by M. Osmond which has recently been published by the *Société d'Encouragement* of Paris.[1]

As M. Osmond justly observes, metallography should in its early days be descriptive; it should enable us to determine the form and nature of the various constituents of alloys, to ascertain their mode of distribution, and to measure their dimensions. Later on, when sufficient data have been established, it will be possible to apportion the observed facts to their respective causes (1) by ascertaining the way in which the structure of a given metal changes under the influence of the three combined factors—temperature, time, and pressure, and (2) it will be possible to trace the relations between the observed facts and their consequences by defining the mechanical properties which correspond to a particular structure.

The first step in the complicated procedure is to cut and polish the opaque specimens of steel. The methods do not admit of condensed description, and the original memoir must be consulted, as even the technical manuals of crafts, in which the polishing of metals plays a part, give but little information that is useful in the preparation of metallic sections for the microscope. It must, however, be added that one method of polishing is specially designed with a view to wear away the softer constituents of the specimen, and bring the harder into relief. It is often useful to attack a polished specimen of steel with a reagent which will colour certain constituents only. For this purpose M. Guillemin treats sections of bronze by oxidation, at regulated temperatures, which produces varied colourations on several constituents of the alloy, while M. G. Charpy prefers an electrolytic attack. It is somewhat surprising to find that an infusion of *coco* (a popular French term for an infusion of liquorice) is very useful for the purpose, which recalls the fact that Japanese artificers have, for centuries, used plum-juice vinegar, decoctions of finely-ground beans (*Glycine hispida*), or extracts of the roots of certain plants, as valuable agents for colouring the peculiar alloys which they employ in art metal-work. It may be that the micro-metallographer has much to learn from the Japanese.

The "attack" of polished specimens is made by suitable reagents, which may be divided into the three classes—acids, halogens, and salts. Of the acids, nitric acid of 36° Baumé appears to be the most useful. Of the halogens the pharmaceutical tincture of iodine gives excellent results, as it removes carbon from the steel, and colours certain portions of the specimen. Such treatment, the nature of which has been so briefly sketched, will serve to reveal the main constituents of steel. These are five in number, and it has been found convenient to give mineralogical names to them, following the suggestion of the distinguished American metallurigist, Mr. Howe. Thus pure iron is called *ferrite*; the carbide of iron, Fe_3C, of Abel, *cementite*. This is not coloured by the infusion of *coco* or tincture of iodine, which latter leaves it of a silver-white brilliancy under vertical illumination. Dilute nitric acid in the cold does not affect *cementite*. The third material is one of the components of the "pearly constituent of Sorby," which may be coloured by coco or by iodine, and M. Osmond proposes the name of *sorbite* for it, though he is uncertain as to its exact constitution. The fourth constituent, to which he gives the name of *martensite*, is that which is ordinarily obtained by the rapid cooling of a specimen of steel during the familiar operation known as "hardening." It is a crystalline, fibrous substance which iodine colours readily either yellow, brown or black, according to the amount of carbon it contains. Now, martensite preserves its characteristic forms equally well in very low carbon-steels which have been hardened, as well as in high carbon-steels which have been subjected to this process. It may be urged, therefore, that martensite is not a carbon-iron compound which has liquated out of the mass, but that it represents the crystalline organisation, formed under the influence of carbon by one of the allotropic forms of iron.

The last of the five constituents of steel, marks the transition of soft iron into hardened steel. The name of *troostite* is after the eminent chemist, and it resembles sorbite, but its composition is as yet uncertain. This name is not well chosen, as a variety of silicate of zinc has long been known as troostite.

It will be evident that a micro-section of a mass of steel closely resembles a rock-section which has constituent minerals distributed through it. It should, however, be pointed out that there are cases in which the existence of these several constituents cannot be sharply defined, as it is frequently necessary to deal with transition forms which defy classification. Sorbite, troostite, and martensite appear to be solidified solutions of various forms of carbon in diverse forms of iron, for it seems clear that metallographic work on steel brings into prominence the existence of allotropic forms of iron.

In order to realise how complicated the structure of

[1] "Méthode générale pour l'Analyse micrographique des aciers au carbone," par M. F. Osmond (*Bull. de la Soc. d'Encouragement*, vol. x. p. 480, 1895).

ordinary steel really is, reference must be made to some facts recorded in NATURE, vol. xli. 1889, p. 32. An attempt was therein made to show that notwithstanding the importance of the part played by carbon in the hardening of steel, the phenomena of hardening cannot be explained solely by a change in the relations of carbon to iron. The iron itself appears to change its state, and M. Osmond has shown that it probably assumes at least three distinct allotropic forms, which he designates respectively as α, β, and γ iron.

The fact that the iron itself may exist in more than one state, brings into prominence the causes which under-

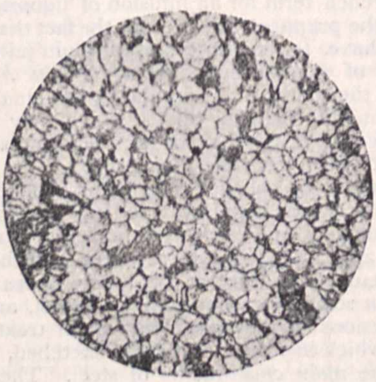


FIG. 1.

lie the difference between an ordinary rock-section and that of a metal or metallic alloy. In granite, for instance, as the fused mass cools the quartz, mica and feldspar fall out of solution in distinct crystalline masses; and although the fusibility of the mass, and consequently its structure, may be greatly influenced by the presence or absence of a small quantity of impurity, say two or three per cent. of sodium, still, so far as we know, complications do not arise from allotropy of the constituent elements of the rock. In the case of a specimen of carburised iron the conditions are widely different. It is certain that one very vital change in the relations between the

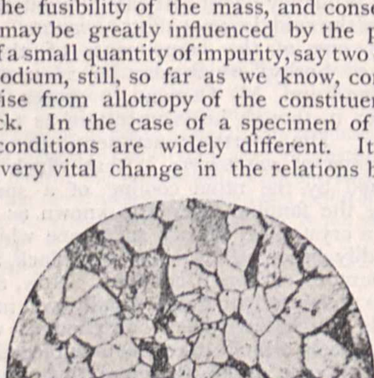


FIG. 2.

carbon and the iron does actually take place at 650° C., that is to say, at a temperature far below the fusing point of the mass. The decomposition of the carbide of iron, Fe_3C, may take place at various rates. Cementite can, for example, under sufficient pressure, resist decomposition at a temperature well above that at which it would ordinarily decompose, and we are confronted with the complications which ensue when carbon is united, not merely with α iron, but with β or γ iron, so as to form either $Fe\beta^3C$ or $Fe\gamma^3C$.

A few examples will serve to make the method of investigation clear. The effect of annealing steel is very remarkable. The operation consists in raising the metal to a high temperature and in allowing it to cool slowly. A granular structure is thus developed in the metal, the size of the polyhedral grains being proportional to the temperature to which the metal is raised. If the temperature is over 1000° C. the grains of ferrite (iron) will be large, while the perlite remains outside the grains and arranges itself in the joints round them. Fig. 1 represents a sample of very mild steel containing 0·14 per cent. of carbon which had been forged and etched with dilute nitric acid; while Fig. 2 represents the same steel which has been cooled from an initial temperature of 1015° C.

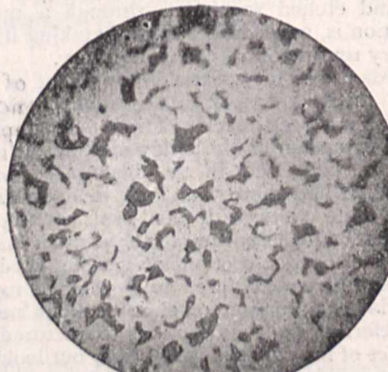


FIG. 3.

In it the ferrite has arranged itself in larger grains than was the case in the first section, which had not been raised to nearly so high a temperature before cooling. Now compare this with Fig. 3, which shows the effect of raising the steel to an initial temperature of 960° C., allowing it to cool down to a temperature of 770° C., and then cooling it rapidly by quenching it in water. Microscopic examination shows that the interstitial matter is martensite, together with some troostite, while the principal mass is still ferrite in grains. These three specimens, chosen, it should be remarked, from the eighty-five beautiful photographs given

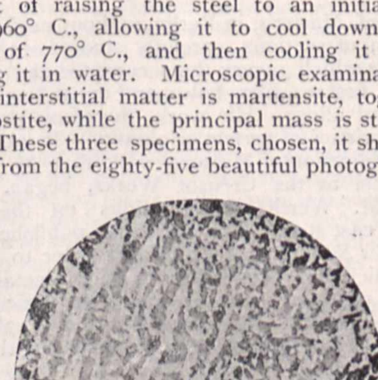


FIG 4.

by M. Osmond, serve to show how much the structure of the same variety of steel will vary with the thermal treatment to which the metal has been subjected. Fig. 4 shows a sample of more highly carburised steel polished with rouge, which presents a vermicular surface of ferrite and perlite.

There would appear to be no limit to the applications of micrographic analysis, as all metals and all alloys may be subjected to its action. It is known, for instance, that the qualities of the copper alloys are greatly modified by the addition of minute quantities of deoxidising agents, such as phosphorus, aluminium, or silicon, and

M. Guillemin, in an admirable paper on the metallography of the alloys of copper presented to the French "Commission des Méthodes d'essai des Matériaux de Construction,"[1] has given evidence that it is possible to pronounce with certainty, by the examination of etched surfaces of examples of the alloys, which deoxidiser has been employed.

It remains to be seen in what way the mechanical properties of steel are connected with the structural changes revealed by micrographic examination. In every specimen of steel, as has already been stated, at least three great molecular changes are produced as the metal is raised from the ordinary temperature to a white heat. The belief that the rearrangement of atoms in the molecule of iron (which is, in fact, allotropy) is really fundamental to these molecular changes, is rapidly gaining adherents, but authorities on hardening of steel are by no means in accord as to the true significance of allotropy in relation to that important industrial operation. The writer of this paper has long declared himself to be a pronounced allotropist, and many patient experimenters are hard at work at the problem. M. Charpy,[2] for instance, had already pointed to the peculiar behaviour of steel under longitudinal stress, as proof that the metal undergoes allotropic change. He now seeks, by an elaborate series of experiments, to ascertain whether the mechanical tests of steel which has been quenched at definite temperatures, support Osmond's view as to the significance of the part played by allotropy of iron in the hardening of steel. Charpy's opinion seems to be that, on the whole, his experiments do not afford conclusive evidence in support of Osmond's view. It may, however, be urged that in the case of steel, mechanical tests could not be expected to afford decisive evidence in relation to the theoretical significance of allotropy, because, as M. Osmond's micrographic work shows, the structure of steel is so complex and varies so much with thermal treatment. It is, of course, ultimate structure which determines the strength and elasticity of steel, and none of us claim that allotropy is the sole factor in the production of structure.

The magnetic behaviour of steel, on the other hand, as M. Curie has recently pointed out, is greatly influenced by temperature, for, within the range of 20° to 1350°, rapid variations in magnetic properties of soft iron reveal themselves at about 750°, 860°, and 1280°. This, as he says, is favourable to the views of M. Osmond, because on independent evidence we are led to conclude that at temperatures near these points the metal undergoes allotropic modifications.

It is to be hoped that microscopic analysis will soon take its place in the ordinary routine of every steel works laboratory, and it should be added that in this country two well-known authorities, Mr. T. Andrews and Mr. J. E. Stead, constantly employ it, while Mr. A. Sauveur[3] has originated the system already in the works of the Illinois Steel Company.

W. C. ROBERTS-AUSTEN.

THE SCIENTIFIC RESULTS OF THE ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION.

THE annual meeting of the British Medical Association is, no doubt, increasing in importance, since it is becoming a congress for the demonstration of the advance of medicine. The work of the meeting may be considered as belonging to two classes, the practical and the scientific. Many, no doubt, who attend the annual meeting, do so with the object of gaining practical help in both the medical and the surgical treatment of their patients; and this help the annual meeting gives in abundance. One of the most important parts of the meeting, however, is that which is occupied with the progress of scientific medicine, and consists not so much in the announcement of startling discoveries (for with these medicine has but little to do), but in the revision and criticism of the facts discovered by experiment and at the bedside.

Medical science is becoming more exact, as the knowledge of the functions of living tissues (physiology) and their changes in disease (pathology) increases.

It is not so many years ago when the chief subject in what was called physiology was histology, or the structure of the tissues. Physiology proper then rapidly progressed, and although at first it was considered from a somewhat too physical standpoint, and indeed is still so considered by some, yet it has received an enormous impetus by being associated with the study of chemistry and of the action of the chemical constituents of the body on the living tissues. This is evidenced in the excellent address on "Internal Secretion," given by Prof. E. A. Schäfer, F.R.S., of University College, a subject which in its scientific aspects is of a quite recent development. A secretory organ may, like the stomach, salivary glands, &c., separate materials from the blood and pour them into a cavity, in which they are utilised; this may be called external secretion. On the other hand, "some secreted materials are not poured out upon an external surface at all, but are returned to the blood"; these may be called internal secretions. Although it is probable that in the widest sense every tissue has an internal secretion, yet this is most obvious in the ductless glands, such as the thyroid, the suprarenal bodies, and the pituitary body. But in one gland with an important external secretion, viz. the pancreas, there is also an internal secretion which is of great value in the economy.

The subject of internal secretion has developed hand in hand with clinical medicine, and it was the observation of patients which first, as in the case of the thyroid, gave the clue to the line of investigation. It is impossible in this place to give a detailed account of Prof. Schäfer's address; it is well worthy of study by every one interested in the progress of biological science. It will not be out of place, however, to illustrate the subject of internal secretion by quoting as examples the investigation of the pancreas and the suprarenal capsules, the latter of which has been the subject of special study by Prof. Schäfer, in conjunction with Dr. G. Oliver and Mr. Moore.

The association of disease of the pancreas with the presence of sugar in the urine has long been noted; although only a certain proportion of cases of diabetes show any great changes in this organ. If the pancreatic juice be diverted from the intestine, or if the duct be blocked, the animal experimented upon does not die, there is no glycosuria, nor does it apparently suffer any great nutritional change. If, however, the pancreas be totally extirpated, glycosuria appears, and the animal invariably dies; this does not occur, however, if only a part of the organ be removed. More than this, if a portion of living pancreas be successfully grafted into an animal from which the organ is subsequently completely removed, no evil results follow. Besides its obvious and important function of secreting a digestive juice, the pancreas therefore produces some material which it gives to the blood, and which is essential for the continuance of life; this is the internal secretion. On the other hand, it is suggested that the organ nominally separates and transforms some toxic substance which is fatal to existence; this is the theory of auto-intoxication. The internal secretion of the suprarenal capsule is more obvious, perhaps, than that of the pancreas. The capsule is a ductless gland; it has no external secretion. The complete

[1] "Analyse Micrographique des Alliages." (*Comptes rendus*, vol. cxv. p. 232, July 25, 1892.)
[2] "Bull. de la Soc. d'Encouragement," vol. x. 1895, p. 660.
[3] "Trans. Amer. Soc. Mining Engineers," vol. xxii. p. 546.

removal of both suprarenal capsules results in rapid death, which is preceded by great muscular weakness, diminished tone of the vascular system, and some nervous symptoms; a combination of events which is seen in Addison's disease, which is a disease of these organs. From the medullary portion of the gland, Schäfer has obtained an extract containing an active substance which is remarkable as producing its effects in very small doses (as little as $5\frac{1}{2}$ milligrams in a dog weighing 10 kilos.), and as being capable of withstanding for some time the temperature of boiling water. This substance increases the duration of the contraction of muscle, as tested by the apparatus ordinarily in use in the physiological laboratory; but it has a more remarkable effect in greatly increasing the blood pressure, a result following a direct action on the peripheral arteries. In the case of the suprarenal capsule, there is thus distinct evidence of internal secretion; that is, of the presence in one part of the gland of a substance which has a well-marked physiological effect. Into all the questions arising out of this subject it is impossible now to enter. The subject is one of vast importance to scientific practical medicine. As the results of future investigation, we may hope to obtain not only a greater knowledge of the pathology of some obscure nutritional diseases, but some indications for their relief and treatment. This has already been accomplished in the case of myxœdema, in which the thyroid gland is degenerated, and in which very great benefit is obtained by feeding the patients with fresh thyroid gland, or by injecting the extract.

One other scientific result of the annual meeting may be viewed. It is the predominant place now given in the study of disease to the question of infection. All disease is not infective, but infection, in theory, has for many decades played an important part in pathology. The great change which has come over medical science is, that the question of infection is now studied from an experimental point of view. Vague theories have given place to facts, which are of prime importance, not only in the understanding of disease, but in its treatment. In the investigation of diseased, as well as of normal functions, the application of chemical methods has been of great service, and is destined to be of still greater importance.

The accurate study of infection deals with a far wider subject than the characteristics of the infective agent; since it is also concerned with the reaction of the body against the micro-organism and the poisonous chemical substances this produces. The study of this reaction of body has, from the morphological point of view, given a clearer view of the processes occurring in inflammation; and from the chemical point of view, it has opened up a wide field of possible therapeutical agents. The prospect is one which is reassuring for the future. The fact that infection is being so closely studied, and that the infective agents in so many diseases have been isolated, is of great importance to the human race; since infection is preventible. The fact that the body, in reacting against an infective disease, produces a substance which counteracts invasion, as well as the poisonous bodies formed by the infective agent, is of as great importance as the first point; since an infective disease may be cured. At the annual meeting, the discussion on pneumonia as an infective disease—a discussion which would have been impossible, and would even have been considered ludicrous only a few years ago—as well as the discussion on the utility of the diphtheria anti-toxin, illustrates the points mentioned. In the discussion on diphtheria, the great majority of the speakers, both those who considered the subject from the scientific aspect and those who looked at it simply from the practical point of view, agreed that the use of the anti-toxin in the disease was not only based on a firm scientific basis, but that it had completely changed the aspect of the disease. Whatever the limitations of the treatment by anti-toxic serum may in the future be proved to be, there can be but little doubt that its discovery marks an epoch in the treatment of infective disease.

THE IPSWICH MEETING OF THE BRITISH ASSOCIATION.

THE arrangements for the meeting of the British Association at Ipswich this autumn are making rapid progress. The General Election somewhat interrupted the preparations of the local secretaries, but the excitement being now over, general attention in the locality is again centred on the coming visit of the Association, and great efforts are being made in the town and neighbourhood to ensure the success of the meeting. The chief public buildings in the town are just emerging from the hands of the painter and decorator. The reception room will be located in the Town Hall, the council chamber being the room actually set apart for the purpose, whilst the library will be the writing room. The President's address and the evening discourses will be delivered in the public hall, as will also the lecture to working men. In the matter of Section rooms, the Local Committee will be able to offer the Association very good accommodation, as there are fortunately a number of suitable rooms and halls in the town within a very short distance of each other, and all are close to the reception room. The two halls at the Girls' High School, which were formerly the New Assembly Rooms, and were used for the reception room and for Section E on the occasion of the Ipswich meeting in 1851, will be allotted to Section A (Mathematical and Physical Science) and Section B (Chemistry). About two hundred yards distant is the Co-operative Hall, in which Section G (Mechanical Science) will meet. Section C (Geology) will be accommodated in the Art Gallery adjoining the Museum. Section D (Zoology) and the new Section K (Botany) will have, respectively, the banquet room and the lodge room at the Masonic Hall. The Lecture Hall, adjoining the Ipswich Institute, will be given over to Section E (Geography), whilst across the street, the Working Men's College (formerly known as the Old Assembly Rooms) will be set apart for Section H (Anthropology).

The proceedings will commence on the evening of Wednesday, September 11, when the Marquis of Salisbury will retire from the presidential chair, and Sir Douglas Galton will take his place. The new President will then proceed to deliver his address. The second evening will, as usual, be devoted to a conversazione, which will probably be held in the museum and the adjoining buildings, used as art and technical schools. On Friday evening Prof. Silvanus P. Thompson will deliver a lecture on "Magnetism in Rotation." On Monday evening Prof. Percy F. Frankland will discourse on "the work of Pasteur and its various developments," and on Tuesday there will be a soirée given by the Ipswich Scientific Society and the Suffolk Institute of Archæology jointly. This, like the first soirée, will probably be held in the Museum buildings. The lecture to working men will be given on the Saturday evening by Dr. Alfred H. Fison, who takes "Colour" for his subject.

In response to a special invitation which the Local Committee issued to foreign men of science, the following gentlemen have signified their intention of being present at the meeting:—Prof. A. Gobert (Brussels), Prof. W. E. Ritter (Heidelberg), Rev. T. Adams (Canada), M. J. Dantzenburg (Paris), Dr. O. Maas (Munich), M. Boule (Museum d'Histoire naturelle, Paris), Prof. Ira Remsen (Johns Hopkins University, U.S.A.), Prof. Runge (Hanover), Prof. E. C. Hansen (Copenhagen), Dr. van Rijckevorsel (Rotterdam), M. G. Dolfus (Paris), His Excellency Don Arturo de Marcoartu, M. E. van den Broeck

(Brussels), Prof. Michie Smith (Madras), M. A. P. N. Franchimont (Leiden), Dr. H. Haviland Field (New York), Dr. Bashford Dean (Colombia College, New York), Prof. J. W. Langley (Ohio, U.S.A.), Dr. Paschen (Hanover), Dr. Conwentz (Dantzic), M. Berthelin (Paris). A large number of the leading scientific men in England have already notified that they will attend the meeting.

The hon. local secretaries for the meeting are Messrs. S. A. Notcutt, G. H. Hewetson, and E. P. Ridley. All communications to them should be addressed to the Museum, Ipswich.

BAILLON, BABINGTON, EATON.

BY the death of Henri Ernest Baillon, France has lost one of her most accomplished botanists, and certainly her leading systematist. Under date of the 19th ult. the writer received the following lines from a friend at the Muséum d'Histoire naturelle, Paris.

"Je vous écris sous une bien pénible impression; M. Baillon est mort hier soir subitement. Dans l'après midi il était venu au laboratoire selon son habitude. À 5 heures et demie il prit un bain; à 6 heures son fils rentrant de l'École de Médecine le trouva mort. On croit que le bain, un peu trop chauffé, a déterminé une congestion.

"C'est une grande perte pour nous et pour la botanique. S'il avait des ennemis implacables, il avait aussi des amitiés fidèles. Je ne doute pas que l'avenir ne montre que derrière un ésprit, dont les manifestations parfois acerbes visait moins la personnalité que ce qu'il jugeait être l'erreur, se cachait un cœur sensible a l'excès. Il est un bon nombre de ses élèves pauvres qui savent de quelles délicatesses il savait entourer une aumône.

"Quoiqu'il en soit c'était un grand botaniste; vous le jugez ainsi, n'est ce pas?

"Ses quatre enfants vont se trouver dans la misère la plus profonde qu'on puisse imaginer. Ce qu'il n'a pas dépensé de sa fortune pour la publication de ses livres a disparu dans le gouffre des dettes de celle qui a porté son nom. Aujourd'hui il ne reste rien."

The allusion to Baillon's personal character in the foregoing letter will appeal to the sympathies of those who knew him on this side of the channel. Unfortunately he quarrelled with some of the foremost French botanists of assured position, which led to regrettable and undignified recriminations on his part, and resulted in closing the doors of the Académie des Sciences against him for ever. This embittered his life considerably, and rendered his relations with a section of the botanists of Paris almost unbearable.

For most of the following particulars of Baillon's career I am indebted to the author of the above letter. Henri Baillon, as he usually signed himself, was born at Calais, November 29, 1827, of a family of good position and reputation in the town and district. He studied with great distinction at the Lycée de Versailles, and commenced his medical education at the age of seventeen. In 1854 he became house-surgeon at the Hôpital de la Pitié, Paris, a position obtained only by severe competition; and he was so brilliantly successful in his work, that he was unanimously awarded the gold medal of the Internat, the highest reward at the disposal of the Faculté de Médecine. His candidature for the degree of Docteur en Médecine was a perfect triumph, for he completely held his examiners, both by the elegance of his diction and the depth of his scientific views. In 1863 he succeeded Moquin Tandon in the Chair of Botany at the École de Médecine, and he filled this chair up to the time of his death; and for some time was Professor of Botany at the Lycée Napoléon as well. He was also Docteur ès Sciences. In 1875 he was elected a foreign member of the Linnean Society of London, and last year he received the same distinction from the Royal Society. This gave him much pleasure, and consoled him, in some measure, for the implacability of his own countrymen. In 1866 he and a few others founded the Société Linnéenne de Paris. He was elected president, and continued to act as such until his death. For some years the *Proceedings* of this very small Society were published in Baillon's own periodical, *Adansonia*, and then a *Bulletin Mensuel* appeared, and has continued to appear down to the present time, entirely owing to the energy and industry of the president. This organ was not published, but distributed to the leading botanical establishments; hence there is no record of Baillon's numerous articles therein in the Royal Society's catalogue of scientific papers. Yet, omitting these, the catalogue contains the titles of 230 of his papers, published between 1854 and 1883. But Baillon was a most prolific writer, and covered a considerable range, though systematic botany was his chief study. I need only name his *Adansonia*, twelve volumes, 1866 to 1879; "Dictionnaire de Botanique," four volumes, 1876 to 1892; "Histoire des Plantes," 1867–95, and still unfinished. Baillon, too, was the only French botanist who occupied himself on the rich collections of flowering plants in Paris from Madagascar; being the author of the uncompleted "Histoire des Plantes de Madagascar," forming a portion of Grandidier's great work on Madagascar.

Baillon was one of the few existing botanists having a good knowledge of the phanerogamic flora of the world. As a writer, however, he was more critical than methodical, and many of his original observations and suggestions have been overlooked by botanists who have subsequently gone over the same ground. This is owing to the fact that the titles of many of his articles do not sufficiently describe their contents. Not infrequently a new genus or a new species is described in the body of a paragraph, and sometimes so informally, that only by careful reading is it possible to arrive at the fact. This often caused the author himself chagrin, especially as he was very sensitive and apt to believe that his work had been purposely ignored. I had almost forgotten to mention that the Euphorbiaceæ were one of his favourite families, and his "Étude Générale du Groupe des Euphorbiacées" is one of his most finished works. This is not the place to enter into a more critical examination of his works, but I cannot help mentioning that the illustrations almost throughout are of a high order of merit. Dr. Baillon has been a frequent visitor to Kew and the British Museum during the last thirty years, and many botanists will join me in regret for his sudden death whilst apparently in almost the full vigour of life.

The veteran Professor of Botany, Charles Cardale Babington, in the University of Cambridge, whose death has lately taken place, was born at Ludlow in 1808, and educated at St. John's College, Cambridge, taking his B.A. in 1830 and M.A. in 1833. As long ago as June 1830, he was elected a Fellow of the Linnean Society; yet there are still two of earlier date in the Society's list, namely, Dickinson Webster Crompton and William Pamplin, both elected the previous January. There are only two others, Thomas Archer-Hind and James Bateman, who have been Fellows of the Society for upwards of sixty years. In 1851 Babington was elected a Fellow of the Royal Society, and among the fifteen of that year, it may be mentioned, were the late Prof. Huxley, Lord Kelvin, Sir James Paget, and Sir Gabriel Stokes. In 1861 he succeeded the Rev. J. S. Henslow in the Botanical Chair at Cambridge, a post he held up to his death, though for many years he was incapacitated from performing the duties. Prof. Babington was, in his early years at least, a prolific writer, his first paper appearing in 1832. His writings were almost exclusively on the British flora; and his name will stand in the history of British botany as the inaugurator of a more critical delimitation of species than had previously found favour in this country. Taking Koch and Fries as his models, from whom he largely borrowed, he published the first edition of his "Manual" in 1843. This new departure caused considerable commotion and opposition from the older school of botanists; and the fact that Babington did not possess the critical acumen and originality of the masters in his adopted school, sometimes exposed him to attacks. Nevertheless the "Manual" was a success, passing through eight editions, the last of which appeared in 1881; and it still enjoys great favour, even among those who do not go so far in the matter of species. Babington was also author of several local floras; the first being the "Flora Bathoniensis," 1834; followed by the "Flora Sarniensis," 1839, and a "Flora of Cambridge," in 1860.

Daniel Cady Eaton, who belonged to a school of American botanists, of whom very few survive now, was the grandson of Amos Eaton, the author of the formerly famous "Manual of the Botany of North America," which passed through many editions; and son of General Amos E. Eaton, also a devotee of natural history. D. C. Eaton was born in 1834, and early evinced a liking for botany. After a successful career at school and college, he experienced many changes, including service in the federal army during the civil war. In 1867 he was called to the Botanical Chair of Yale College, New Haven, which he held until his death. As an author he will be best remembered by his writings on North American, Mexican, and West Indian ferns. His principal, or at least most popular, work is his "Ferns of North America," illustrated in colours by J. H. Emerton and C. E. Faxon.

W. B. H.

NOTES.

DR. BERGH, of Copenhagen, has been elected a Correspondant of the Paris Academy of Sciences, in the Section of Anatomy and Zoology.

THE resignation is reported of Mr. R. Trimen, F.R.S., Curator of the South African Museum, Cape Town, and also of Mr. R. L. J. Ellery, C.M.G., F.R.S., Director of the Observatory at Melbourne.

THE deaths are announced of Dr. Adolf Gerstäcker, Professor of Zoology in the University of Greifswald; Dr. Pellegrino Strobel, Director of the Natural History Museum at Parma; Prof. H. Witmeur, Professor of Mineralogy and Geology in the University of Brussels; and Dr. W. Fabritius, Astronomer at the Kieff Observatory from 1876 to 1894.

THE French Association for the Advancement of Science met at Bordeaux last week. It was at Bordeaux that the Association held its first meeting in 1872, and this year the same cordial hospitality was accorded to its members as was given twenty-three years ago. The president of the recent meeting was M. Émile Trélat, and in his presidential address on "La Salubrité," he indicated the place of hygiene among the sciences, and traced its limits.

THE annual congress of the British Institute of Public Health was opened at Hull on Thursday last, under the presidency of the Mayor. On Friday, Sir A. Rollit delivered an address as president of the municipal and parliamentary section of the Institute, and Dr. Cameron delivered an address in the section of preventive medicine. It was resolved on Monday—"That in the interests of public health all municipal and local authorities should be empowered to provide crematoria, and that a petition be presented to Parliament in support of the Bill about to be presented to secure this object." Prof. W. R. Smith brought forward the subject of the influence of schools on diphtheria, and in the course of his remarks contended that schools did not play that important part in the spread of diphtheria which they had been supposed to do. The final sitting of the congress was held on Tuesday, when the reports of the several sections were adopted, and a resolution was passed that every house in a watering-place where lodgers were accommodated should undergo a survey by the sanitary authority, and that a certificate of fitness should be compulsory.

THE annual summer meeting of the Institution of Junior Engineers, the headquarters of which are in London, takes place from August 17 to 24, the rendezvous being Belgium. The towns to be visited include Antwerp, where the municipal docks, M. Kryn's diamond-cutting works, and other places of interest will be opened to members' inspection. At Ghent, MM. Carel's engine works, M. de Hemptinne's cotton-spinning works, and M. Van Houtte's nursery gardens will be seen; at Brussels, the electric lighting station; whilst at Liège, the works of the Société Cockerill, the Vielle Montagne zinc works, the St. Leonard locomotive works, the Val St. Lambert glass works, the Small Arms Factory, and the Electric Tramway Installation will be visited. In honour of the Institution a banquet is to be given by the Liège section of the Society of Engineers from the University, and the members will also be the guests of the Société Cockerill. An excursion to Verviers, where the Chamber of Commerce will entertain the visitors, is arranged for the purpose of seeing works in connection with the woollen cloth industry. Here MM. Peltzer's works and those of M. Duesberg-Delrez, La Vesdre, and M. Hauzeur Gerard fils, will be opened. The celebrated Gileppe reservoir, from which Verviers receives its domestic and manufacturing supply, is also included in the programme. A large number of members have notified their intention of being present at the meeting, which promises to be one of the most successful the Institution has held.

AN auto-mobile carriage race between Chicago and Milwaukee, promoted by the *Times-Herald* of Chicago, will be decided on Saturday, November 2, the object being to encourage and stimulate the invention, development, perfection, and general adoption of motor carriages. The amount offered in prizes is 5000 dollars, apportioned as follows:—First prize, 2000 dollars and a gold medal, open to competition to the world; second prize, 1500 dollars, with a stipulation that, in the event the first prize is awarded to a vehicle of foreign invention or manufacture, this prize shall go to the most successful American competitor; third prize, 1000 dollars; fourth prize, 500 dollars. The third and fourth prizes are open to all competitors, foreign and American. The rules laid down stipulate, among other things, that no vehicle shall be admitted to competition which depends in any way upon muscular exertion, except for purposes of guidance. Competing vehicles which derive their power from petroleum, gasoline, electricity, or steam, and which are provided with receptacles for storing or holding the same, will be permitted to replenish the same at Waukegan, Ill., and at Kenosha, Wis., but at no other points.

DURING the past week the weather over the United Kingdom has been very unsettled, owing to the advance of various low-pressure areas from the Atlantic. Several heavy thunderstorms have occurred, the most severe being on Saturday night, the 10th inst., over the southern and south eastern parts of England. In London the storm was very violent, and the lightning was of unusual brilliancy. The disturbance travelled from south to north, and was accompanied by heavy rain. An exceptionally heavy thunderstorm also occurred at Holyhead on the same night, and the rain measured there on the next morning amounted to 2·68 inches. The *Weekly Weather Report* of the 10th inst. states that the rainfall for the week exceeded the average in all districts, the amount over England being about twice as much as the mean.

THE Meteorological Office has received through the Colonial Office a report from the Governor of Hongkong, according to which it appears that the colony was recently suffering from a great drought; the rainfall from January 1 to June 23 last having been only 13·7 inches, being a deficit of no less than 28·7 inches on the mean of the corresponding period of the previous five years. The Governor draws attention to the fact that between October 1893 and April 1894, the colony suffered much from want of rain, and that the plague of the latter year was supposed to have originated from a deficient water supply. Though the drought of the first half of this year has been far more serious than that of 1893–94, the plague has not yet re-appeared in an epidemic form; but the reservoirs had, at the date of the despatch (June 26), only about a week's supply left in them. From a return furnished by the Director of the Hongkong Observatory, it appears that the greatest deficiency has occurred during May and June, when it amounted to 11 and 12½ inches respectively.

La Technologie Sanitaire is the title of a new journal devoted to questions of water supply and applied hygiene. It is published in Louvain, and is edited by a civil engineer, Victor J. Van Lint. The first number, amongst other contributions, contains an interesting and useful article by M. Ad. Kemna, the well-known Director of the Antwerp Waterworks, on "The Theory of Sand Filtration." The practical genius of the English in the past is emphasised in commenting upon Simpson's introduction of sand filters in London in the year 1839, and we are told that having produced such brilliant results, it is not surprising that as a nation we are so slow and reluctant to adopt more modern methods and change our system of technical instruction! Besides original articles, reviews of books are also appended, and what, perhaps, is one of the most useful features of this undertaking, is the bi-monthly issue of a supplement, international in character, containing a bibliography of books, pamphlets, &c., published on subjects connected with water supply, together with short notices of public hygienic enterprise in different parts of the world.

INFRA-RED light is invisible to us either because the humours composing the eye are opaque to it, or because the light is incapable of exciting the retina. Cima and Janssen have adopted the former explanation, but the alternative one has been accepted by Tyndall, Engelmann, and others, while Helmholtz maintained that the strong absorption suffered by infra-red rays in their passage through the eye is sufficient to account for their invisibility. That they are strongly absorbed has been found by all observers, but Herr E. Aschkinass proves, in the last number of *Wiedemann's Annalen*, that there is no sudden increase of absorption beyond the red end of the spectrum, and that the absorptive powers of the various media of the eye are practically the same as that of water. The apparatus used for this investigation contained a fluor-spar prism and a bolometer. Thin layers of the humours of an ox eye and a human eye were interposed in the path of the rays from a zircon burner, and the absorptive effects noted by means of the bolometer. It was found that at a wave-length of 0·81 μ, the limit of the visible spectrum, the absorption was 5 per cent. for the whole human eye. This increased to 10·5 per cent. at 0·872, reached 60 per cent at 0·98, decreased to 34·5 per cent. at 1·095, and finally reached 100 per cent., or total absorption, at 1·4 μ. This shows that a large proportion of infra-red light does reach the retina through the eye, but is not capable of affecting the nerves and producing visual sensation.

THE last number of the *Wissenschaftliche Beihefte zum Deutschen Kolonialblatte* (Bd. viii. Ht. 2) is a further illustration of the care with which the German Colonial Society is organising the scientific investigation of German Africa. The present number contains the calculations by Dr. Fritz Cohen, Dr. L. Ambronn, and Dr. W. Brix, of the astronomical observations made by Dr. Grüner in Togo-land, and by Ramsay and Stuhlmann in German East Africa. There are also valuable tables of meteorological observations, made in German South-West Africa, and in Kondeland, and from the Marshall Islands; from the last locality comes an especially useful table showing the diurnal variation in atmospheric pressure, and giving the mean reading for every hour for each month in the year. Preuss contributesa report on the geography of the Smaller Cameroons, and Steinberg one on the diseases of the natives of the Marshall Islands. There is also a detailed study, by Dr. O. Warburg, of a beetle (*Herpetophygas fasciatus*) parasitic on the coffee trees in German East Africa. A good plate shows the insect in its various stages, and also illustrates its ravages on the trees.

HERR OSCAR NEUMANN has published a preliminary account of his recent important expedition across Masai-land to Uganda in the last number of the *Verhandlungen der Gesellschaft für Erdkunde zu Berlin* (Bd. xxii. No 4–5). Herr Neumann went out to East Africa in November, 1892, and after spending some months in preparation there, left for the interior on April 27, 1893. The caravan, consisting of 135 men, started from Tanga, and passing the southern border of the Usambara country, crossed Nguru to Irangi. Here a series of accidents, exhaustion of supplies, and some severe fighting with the natives, during which Herr Neumann was wounded in the mouth by an arrow, compelled the expedition to retreat southward to Mpwapwa. After resting there the party went northward across Irangi to the Gurui Mountain. This was ascended, though with considerable difficulty. Upon the higher slopes an interesting series of Alpine plants were found, including Azalea and Rhododendron. No trace of a crater remains near the summit, but some small craters occur in an adjoining valley. From Gurui the expedition followed up the East African Rift Valley, along Baumann's route past the salt lakes of Manyara and Natron. He examined the volcanoes Doenyo Kavinjiro and D. Ngai; on the latter he found a steam vent below the summit. From this point he followed Fischer's track past Nguruman to the south-west of the volcano of Suswa. Thence he turned westward to the shore of the Victoria Nyanza in Kavirondo, where the expedition again had great difficulties with the natives. Marching round the Nyanza through Usoga, he reached Uganda, but the excessive caution of an English officer prevented his reaching Mt. Elgon. From Uganda, which he describes as unhealthy and poorer than Usoga, he returned along the English road, across Mau, and past Naivasha and Machakos to Kibwezi, whence he diverged to Taveta, and Kilima Njaro, and thus back to the coast at Mombasa, where he arrived on February 5, 1895. The zoological collections made are very extensive, including 600 species of birds, 90 species of reptiles and amphibia, 50 species of mollusca, and about 1000 species of insects, and 90 species of mammals, of which five have been described as new by Matschie.

DR. OTTO KUNTZE has recently issued, under the title of "Geogenetische Beiträge" (Leipzig, 1895, 78 pp.), a series of papers dealing with various geological problems, on which his journeys have thrown light. The first paper gives the evidence for some oscillations of level in the Andes, based on the inclination of some beds of iron-stained sands and laterite, and on the distribution of plants. He states the evidence with care, as it shows that the alterations of level have occurred quietly and without any sudden catastrophic changes. A second paper discusses the evidence on which it is claimed that there was a glaciation in Carboniferous times. The phenomena, often regarded as a proof of this, is attributed by Dr. Kuntze to wind erosion. He gives a figure showing perched blocks and rounded rock surfaces in the Sierra de Tandil in the Argentine Republic, which have thus been formed. The third article in the series discusses the organic and chemical theories of the origin of the Chilian deposits of saltpetre. The next subject considered is the method of the silicification of fossil wood: the author readvances his old theory, and replies to the criticisms made by Rothpletz and Solms-Laubach upon it, and advances nine arguments against Solms-Laubach's rival theory. The fifth paper describes cases in which deposits of salt have been formed under continental instead of marine conditions, which the author explains as due to the decomposition of minerals containing chlorine in rocks destroyed by subaerial denudation. The last and longest paper in the collection, rediscusses the old problem of the formation of coal. He considers the three alternative theories as to whether coal is allochthon, *i.e.* formed from vegetable material deposited elsewhere than on its place of origin; or is autochthon, or formed by the decay of plants *in situ;* or is pelagochthon, *i.e.* formed under the sea. The author advocates the last. He gets over the difficulty of Stigmaria, by declaring that his fellow botanists are wrong, and that its supposed rootlets are really floating leaves. He says that the figures, given in the text-books, are all copied from one source, and declares that there are no specimens in the museums of "Dresden, Vienna, London, Paris, Berlin, &c.," which give any support to the rootlet theory. He gives an ideal view of a landscape in the Carboniferous period, showing the Stigmaria spreading over the floor of a sheet of water, with the "rootlets" rising as aquatic leaves.

MR. JAMES R. GREGORY, the mineralogist and dealer, wishes it to be known that he has removed from 88 Charlotte Street, Fitzroy Square, to more convenient premises at 1 Kelso Place, Kensington, W.

MESSRS. CHAPMAN AND HALL have been constituted sole agents in this country, the continent, and the colonies, for the sale of the important scientific and technological publications of Messrs. Wiley and Sons, of New York.

THE August *Journal* of the Anthropological Institute contains papers on Prehistoric remains in Cornwall; the northern settlements of the West Saxons; changes in the proportions of the human body during the period of growth; the languages spoken in Madagascar; and on a collection of crania of Esquimaux. There is also a description, by Mr. M. V. Portman, of the methods that should be employed by anthropological photographers.

WE have received a copy of a "Report on Slavery and the Slave Trade in Zanzibar, Pemba, and the Mainland of the British Protectorates of East Africa," by the Special Commissioner of the British and Foreign Anti-Slavery Society. The Commissioner spent pretty nearly six weeks in East Africa in studying the subject. Probably the most valuable and trustworthy conclusion in this report, though perhaps not the one to which its author attaches most importance, is that "the whole question of slavery in Zanzibar and Pemba is a very complicated question."

THE volume of *Transactions and Proceedings* of the New Zealand Institute for the year 1894, has reached us. A few of the papers have already been noted in these columns, and as more than seventy papers are included in the volume now published, it is only possible for us to refer to a few of them. A synoptical list of Coccidæ, reported from Australia and the Pacific Islands up to the end of last year, is given by Mr. W. M. Maskell. Sir W. L. Buller, K.C.M.G., F.R.S., has several ornithological papers in the volume, and Captain F. W. Hutton, F.R.S., adds to the knowledge of the axial skeleton in the Dinornithidæ, and there are a number of other papers referring to the same birds. Prof. Arthur Dendy describes some land planarians, bringing the total number of species found in New Zealand up to twenty. The editor of the volume, Sir James Hector, K.C.M.G., F.R.S., contributes several papers to it, and the Rev. W. Colenso, F.R.S., with others, make contributions to the knowledge of the botany of New Zealand.

AMONG the new editions lately received is a translation of Prof. Oscar Hertwig's book "Die Zelle und Die Gewebe," published by Messrs. Swan Sonnenschein and Co. The work has been translated by M. Campbell, and edited by Dr. H. Johnstone Campbell. As we reviewed the original edition in 1893 (vol. xlvii. p. 314), it is only necessary to express satisfaction that such an important treatise on the functions and structure of cells has been brought within the reach of students who do not read German easily. Under this translation from the German, we find on our table two translations into German of papers by British men of science. The papers are published by W. Engelmann in Ostwald's *Klassiker der Exakten Wissenschaften.* No. 61 of this series contains George Green's essay on the mathematical analysis of the theories of electricity and magnetism, edited by Dr. A. J. von Oettingen and Prof. A. Wangerin, and No. 62 is a translation of papers on the physiology of plants, published by Thomas Andrew Knight between 1803 and 1812. This is edited by Prof. H. Ambronn. A third volume (No. 60), just received in the same series, contains papers by Jacob Steiner on geometrical construction, and is edited by Dr. Oettingen. In the Aide-mémoire Series, published by Gauthier-Villars, we have received two books on ballistic subjects, viz. "Balistique Extérieure," by M. E. Vallier, and "Bouches à Feu," by Lieut.-Colonel E. Hennebert. We have also before us "An Elementary Text-book of Mechanics," by Mr. W. Briggs, and Mr. G. H. Bryan, F.R.S., published in the Tutorial Series of the University Correspondence College. The volume is concisely and clearly written, and may be recommended as a useful text-book.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mr. R. Norton Stevens; a Yellow Baboon (*Cynocephalus babouin*, ♀) from Parrapatti, Eastern Coast of Africa, presented by Mr. J. V. Williams; a Kinkajou (*Cercoleptes caudivolvulus*, ♀) from Demerara, presented by Mr. Sydney Matthews; three Alligators (*Alligator mississippiensis*) from Florida, presented by Mr. Ernest H. Shackleton; two Green Turtles (*Chelone viridis*) from Ascension, presented by Commander Duncan Campbell; a Common Viper (*Vipera berus*), British, presented by Mr. A. Old; a Macaque Monkey (*Macacus cynomolgus*) from Java, a Lion (*Felis leo*, ♀) from India, a Sooty Phalanger (*Phalangista fuliginosa*, var.) from Tasmania, a Larger Hill Mynah (*Gracula intermedia*) from Northern India, a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, a Derbian Sternothere (*Sternothærus derbianus*) from West Africa, three South American Rat Snakes (*Spilotes variabilis*) from South America, deposited; a Blossom-headed Parrakeet (*Palæornis cyanocephalus*) from India, a Tuberculated Iguana (*Iguana tuberculata*) from the West Indies, purchased; three Pumas (*Felis concolor*), eight Black Salamanders (*Salamandra atra*), born in the Gardens, two Triangular-spotted Pigeons (*Columba guinea*), two Crested Pigeons (*Ocyphaps lophotes*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE ROTATION OF VENUS.—Since our note last week on this subject, Signor G. Schiaparelli has published in the *Astronomische Nachrichten* (No. 3304) two letters concerning markings observed on the planet in July, and their bearing upon the question of rotation. The planet was observed from July 3 to 8 under all kinds of conditions, and the conclusion arrived at was that "the aspect of the dusky markings distributed over the disc did not undergo any important modification in form or situation during this period. Save a few small exceptions, all the variations observed belong to the category of those apparent changes of diurnal period which may be explained by the varying state of rest and purity of the atmosphere and the different grades of illumination of the background of the sky. I have sought with particular care for an indication of any change of place of the most pronounced markings, with reference to the horns and with reference to the terminator; but I have not been able to make out anything with certainty which would indicate a more rapid rotation." This letter is accompanied by a sketch showing a marking diverging from the north pole, and another and more decided one proceeding from the terminator near the south pole in an easterly direction, and then curving round towards the north in the direction of a meridian. This marking underwent some slight change between July 5 and 7, the marking along the meridian only appearing on the latter date. In conclusion, Schiaparelli observes that the period of 224·7 days appears to be placed beyond all reasonable doubt. The second letter, written after the publication of Brenner's observations, contains a detailed description of Brenner's great marking, which is identical with the marking just described, and also with that observed in December 1877. Schiaparelli remarks that the view, advanced by him in "Considerazioni sul moto rotatorio del Pianete Venere," that the markings, though in reality atmospheric phenomena, depend to a certain extent upon the topographical conditions underneath, and recur under the same conditions, appears to be confirmed.

THE OBSERVATORY OF YALE UNIVERSITY.—The report of Dr. W. L. Elkin on the work done and in hand at the Observatory of Yale University, has been received. From the report we learn that the series of heliometer measures on the parallaxes of the first magnitude stars has been brought to a close, and the definitive results will be presented in the near future. The series on the parallaxes of the larger proper motion stars, on which Dr. Chase has been mainly engaged, now comprises 99 stars, all but two of which have been observed at two parallax maximum epochs, in general on three nights. Before drawing any conclusions from these data, it is proposed to secure two further epochs for each star, in order to eliminate the effect of the proper motion. An arrangement has been made with Dr. Gill that the observations and discussion of the *Iris* series for the determination of the solar parallax should be printed and included with his similar investigations on *Victoria* and *Sappho*. For the photography of meteor trails, an equatorial mounting, to carry a number of cameras, has been constructed and set up. The mounting carries four cameras, two with lenses of about 6 inches, and two with lenses of about 5 inches effective aperture. Some valuable results will, undoubtedly, be obtained from the photographic data accumulated by instruments of this kind. Already the Yale Observatory is in possession of some twelve impressions of Perseid trails, four of which were secured there and two at Ansonia by Mr. John E. Lewis, working in collaboration with Dr. Elkin. Prof. Barnard has sent three plates exposed also on August 9, 10, and 11, 1894, for about 8 hours in all, which show four and possibly five meteor trails. And Prof. Pickering has found on an examination of the Harvard Observatory plates one fine trail on a plate taken August 8, 1893, and sent it to Yale for measurement. Dr. Elkin has carried out a discussion of these trails, which will be very shortly ready for publication, and seems to lead to some interesting conclusions.

THE NEBULA N.G.C. 2438.—The first of a new series of celestial photographs, taken by Dr. Isaac Roberts, appears in the current number of *Knowledge*. It is a photograph of a portion of the constellation Argo, and shows the beautiful cluster M 46, and the involved nebula N.G.C. 2438. The nebula is a very small one, and was classed as a planetary nebula by Sir John Herschel; Lord Rosse, however, on some occasions, observed it as an annular nebula with two stars and a suspected third one enclosed; Lassell described it as a planetary nebula with two stars involved. The photograph, which was exposed for 90 minutes in the 20-inch reflector, shows the nebula to be as perfectly of the annular type as that in Lyra. It is circular in form, with three stars in the interior, the ring being most condensed on the north following side. The brightest star is near the centre, and is estimated at from 13th to 14th magnitude; on the south preceding side is a star of about 16th magnitude, and a still fainter one almost touches the ring on the south preceding side. There are indications of faint luminosity in the interior of the ring.

The cluster depicted in the same photograph is a "magnificent aggregation of stars between the 9th and 16th magnitude."

THE VOYAGE OF THE "ANTARCTIC" TO VICTORIA LAND.[1]

ALLOW me first to explain that my scientific observations were made under the disadvantageous circumstances of a sailor before the mast on board the whaler *Antarctic*. There seemed no choice between adopting this course and remaining on shore, and I was consequently able to take very few instruments. This explanation may to some extent lighten the criticism of my results.

We left Melbourne on September 20, 1894. It was originally our intention to spend a few weeks in search of sperm whales off the south-west of Tasmania; but not meeting with any, we steered for Royal Company Islands. On October 18 we had snow on board for the first time. It came in heavy squalls, bringing a large specimen of the *Diomeda exulans* albatross on board for refuge. At night it was moonlight, and at twelve o'clock the Aurora Australis was visible for the first time, with white shining clouds, rolling from west to east, at an altitude above the southern horizon of thirty-five degrees. The *Antarctic* was at the time in the vicinity of Macquarie Island, in latitude about 50° south. The aurora seemed to be constantly reinforced from the west, the intensity of the light culminating every five minutes, dying out suddenly, and regaining its former brilliancy during the succeeding five minutes. The phenomenon lasted until two o'clock, when it was gradually lost in an increasing mist. As the snow was heavy, and there was little probability of any material benefit from landing, we set out for Campbell Island on the 22nd, and dropped anchor in North Harbour on the eve of October 25, drifting the following day down to Perseverance Bay, a much safer harbour, where we filled our water-tanks and made final preparations before proceeding south. Campbell Island shows from a great distance its volcanic origin and character, undulating ridges rising in numberless conical peaks to from 300 to 2000 feet above sea level. The land around the bay is rich in vegetation, and most of the island is covered with grass, on which a few sheep seem to live in luxury. Numerous fur seals were basking on the rocks, and we also found many sea-leopards (*Stenorhynchus leptonyx*). They seemed to thrive well, their skins being without scar or cut, and, except human beings, they appear to have no enemies in these waters.

While duck-shooting on the Campbell, I came on three graceful waders of the snipe type (*Novæ Zealandiæ*). In the interior of the island grass was everywhere to be seen except where stunted brushwood covered the ground. I have no doubt that some of the hardy species of Scandinavian trees would do well on this island.

We weighed anchor on October 31. During the next few days, proceeding further into the fifties, the air and water remained at an equal temperature of 44° F. A large number of crested penguins were seen jumping about like small porpoises. We met with several icebergs from 100 feet to 150 feet in height. These bergs were solid masses of floating ice, with perpendicular walls and an unbroken plateau on the top.

On the 6th of the following month, in lat. 58° 14′ and long. 162° 35′, we sighted an immense barrier of ice, or chain of icebergs, extending for about forty to sixty miles from east to north-west, in fact as far as the eye could reach, the top being quite level and absolutely white, and the greatest height 600 feet. The perpendicular sides were dark ashy grey, with large worn green caves. Several icebergs, similar to those we had encountered before, were floating in all directions, and were undoubtedly children of this enormous monster.

By the time we had reached 55° the albatross had left us, as likewise the Cape pigeon (*Daption capensis*); but the white-bellied storm petrel still followed in our track. A lestris, with dark brown head and white bordered wings, and a small blue petrel put in an appearance. On December 7 we sighted the edge of the pack ice and shot our first seal, which was of the white kind (*Stenorhynchus carcinophaga*), its skin being injured by several deep scratches. We had also a very heavy snowfall, the vessel being covered on deck and rigging for the first time.

On December 8, in lat. 68° 45′, long. 171° 30′, large streams of ice drifting around us, a strong ice blink appearing towards the south, and the presence of the elegant white petrel (*Procellari Nivea*) gave us unmistakable evidence that we had now before us those vast ice-fields into which Sir James Ross successfully entered with his famous ships *Erebus* and *Terror*, on January 5, 1841. In the evening we slowly worked our way in

[1] Abstract of a paper read by Mr. C. E. Borchgrevink at the Sixth International Geographical Congress on August 1

through the outer edge of the ice-pack, which consisted of large and heavy hummocky ice. I saw multitudes of the *Argonauta Antarctica* everywhere in the pack, usually swimming in cavities in the ice-floes to escape their enemies the whales. The large-finned whale (*Physalus Australis*) was spouting about in all directions. The white petrels were numerous here, and I secured more of them. The white-bellied petrel departed at the edge of the pack, leaving the icy regions to its darker, hardier brethren (*Thalassidroma Wilsonii*). We shot several seals, but they were scattered about sparsely, most having scars and scratches in the skin. Sir James Ross noticed similar wounds on the seals, and it has been supposed that they are inflicted by the large tusks in battle between themselves. My opinion, however, is that these scars must be ascribed to the action of a different species. The wounds are not like those inflicted by a tusk, being from two to twenty inches in length, and straight and narrow in shape, and where several are met with on the same animal, they are too far apart to have been produced by the numerous sharp teeth of the seal. Nor do I consider that they are due to the sword-fish, though that is doubtless doing mischief there. If my opinion, that these wounds are inflicted by an at present unknown enemy of the seal, proves correct, it may serve to explain the strange scarcity of these animals in regions where one would expect to find them almost everywhere.

When we entered the ice-pack the temperature of the air was 25° F., that of the water 28° F., which latter temperature was maintained all through the pack. Penguins were about in great numbers.

On the 14th we sighted Balleny Island, finding it in lat. 66° 44', long. 164°; this agreeing with Ross. The ice-floes became gradually larger as we approached land, and it was evident that the ice-pack then around us was in great part discharged from the glaciers of Balleny, some of it carrying stone and earth. Although the higher part of the island was lost in mist, we got a good view of its lofty peak, which rises to a height of 12,000 feet above the sea level. The size and shape of the ice about Balleny was a source of considerable danger to our vessel, covered as it is with snow to a depth of several yards, and running out under water in long sharp points. It is not likely that a vessel depending entirely on sails would long survive in such ice. The air temperature at Balleny was found to be 34° F., that of the water 28° F.

Finding the pack so impenetrable in this locality we resolved to work eastwards, in the track which the *Erebus* and *Terror* had followed. On December 22, in lat. 66° 3', long. 167° 37' E., I shot a seal of ordinary size and colour, but with a very thick neck, and no sign of scars, a kind which none of our old sealers on board had ever seen before.

On Wednesday, the 26th, we crossed the Antarctic circle, and on New Year's Eve were in lat. 66° 47', long. 174 8' E. at twelve o'clock. In lat. 67° 5', long. 175° 45' E., I secured a specimen of *Appenodytes Forsterii*—a large penguin. I only secured four of these birds altogether, and never saw it in company with others of its kind. On the 14th, in lat. 69° 55' and 157° 30' E., we came again into open water, having spent 38 days in working our passage through the ice-pack. A clear open space of water was now before us. We steered straight for Cape Adare on Victoria Land, and sighted it on the 16th of January. On the 18th, in lat. 71° 45', long. 176° 3' E., the temperature of the air was 32°, and of the water 30°. The cape, which is in 71° 23' and 169° 56' E., rises to a height of 3779 feet, and consists of a large square basaltic rock with perpendicular sides. From there we saw the coast of Victoria Land to the west and south as far as the eye could reach, rising from dark bare rocks into peaks of perpetual ice and snow 12,000 feet above the sea level, with Mount Sabine standing out above the rest. I counted as many as twenty glaciers in the immediate vicinity of the bay, one of which seemed covered with lava, while below a layer of snow appeared another layer of lava, resting on the surface of the glacier. A volcanic peak about 8000 feet in height had undoubtedly been in activity a short time before. On the 18th we sighted Possession Island, and effected a successful landing on the North Island, being the second to set foot on this island, Sir James Ross having preceded us fifty-four years before. The island consists of vesicular lava, rising in the south-west into two pointed peaks 300 feet high. I scaled the highest of these, and called it Peak Archer, after A. Archer, of Rockhampton, Queensland. To the west the island rises gently upward, forming a bold and conspicuous cape, to which, not having been christened by Ross, I gave the name of Sir Ferdinand von Mueller. I quite unexpectedly found vegetation on the rocks about 30 feet above the sea level, vegetation having never been discovered in so southerly a latitude before. We gave to this island, which I judged to be about 300 to 350 acres in extent, the name of Sir James Ross Island. Possession Island is situated in lat. 71° 56', long. 171° 10' E.

On January 20 we steamed southwards, and on the 21st sighted Colman Island at midnight. Finding the eastern cape of this island unnamed, we called it Cape Oscar, in honour of his Majesty our King. I noticed great irregularities in our compass at Colman Island, and undoubtedly it contains secrets of scientific value. On the 22nd, being in lat. 74° S., and no whales appearing, it was decided to head northwards again, although all regretted that circumstances did not permit of our proceeding further south.

On the 23rd we were again at Cape Adare. Icebergs of large size were everywhere to be seen, and showed distinctly whether they were broken from the big barrier or discharged from the glaciers on Victoria Land. We landed at Cape Adare that night, being the first human beings to put foot on the mainland. Our landing-place was a kind of peninsula or landslip, gently sloping down from the steep rocks of Cape Adare until it ran into the bay as a long flat pebbly beach. The peninsula formed a complete breakwater for the inner bay. The penguins were, if possible, even more numerous here than on Possession Island, and were found in the cape as far up as 1000 feet. Having collected specimens of the rocks, and found the same cryptogamic vegetation as on Possession Island, we again pulled on board. We now stood northward, and in lat. 69° 52', long. 169° 6' E., again ran into the ice-pack. On February 1, in lat. 66°, long. 179° 31' E., we reached open water, having this time spent only six days in the ice-pack. On the 17th the Aurora appeared stronger than I ever saw the Aurora Borealis. It rose from south-west in a broad stream towards the zenith, and down again towards the eastern horizon, being quite different in appearance from when we last saw it on October 20. It presented long shining curtains rising and falling in wonderful shapes and shades, sometimes seemingly quite close to our mastheads, and it evidently exerted considerable influence upon our compass-needle. In lat. 44° 35' and long. 147° 34' we met with a great number of sperm whales. After struggling for several days with a furious storm of distinctly cyclonic character, we sighted the coast of Tasmania on March 4, and entered Port Philip on the 12th, five months and a half after our departure from Melbourne.

As my report shows, we had comparatively high temperatures during our voyage, higher than Sir James Ross experienced, and higher than those observed last year by the whaling fleet south of Cape Horn. The minimum temperature we experienced within the Antarctic circle was 25° F., the maximum 46°. The average temperature from 200 readings each month was 32°·5 for January, 30° for February. The temperature of the water remained at 28° F. all through the ice-pack, rising 1° wherever a larger sheet of water broke the ice-fields. In the large bay in South Victoria Land the temperature remained nearly constantly about freezing-point. The question naturally arises—Has the average temperature at the shore of Victoria Land risen during the last fifty-four years, and has vegetation for the first time developed in those southern latitudes since Ross was there? It does not seem probable that the appearance of vegetation on Possession Island would have escaped the observation of the naturalists who accompanied that expedition. It is evident that a warm current with a constant direction northwards breaks the ice-fields at the very place where Sir James Ross and we penetrated to the open bay of Victoria Land. Within the Antarctic circle the barometer at 29 inches always indicated calm, clear weather, and even at 28 inches it remained fine. This low barometric reading is remarkable considering the dryness of the air. The prevailing wind in the bay seemed to be from the east, but at Cape Adare a change appeared to take place, and westerly winds are there, to all appearance, predominant. The direction of the movement of the ice is distinctly north-easterly, and the scarcity of ice in the bay of Victoria Land is undoubtedly not alone due to warm currents, but also to the protection from drift ice afforded by the shore from Cape Adare down to the volcanoes Erebus and Terror.

The rocks on Possession Island seem all to be of volcanic origin, and represent basaltic lava flows which have taken place during late geological epochs. The specimens I brought from South Victoria Continent differ but little from those I found on Possession Island. One peculiar rock I collected has an indistinct granular structure, and resembles much the garnet sand-stone of Broken Hill; it seems to bear some close relation to granilite. The specimen is composed of quartz, garnet, and felspar fragments. This rock holds out hopes that minerals of economic value may occur in these regions.

The peninsula on which we landed at Cape Adare must be some seventy acres in extent; on the top of the guano were lying the primitive nests of the penguins, composed of pebbles. Some hundreds of yards up these landslips I came upon two dead seals, which from their appearance must have lain there several years. I made a thorough investigation of the landing-place, because I believe it to be a place where a future scientific expedition might safely stop even during the winter months. Several accessible spurs lead up from the place where we were to the top of the cape, and from there a gentle slope leads on to the great plateau of South Victoria Continent. The presence of the penguin colony, their undisturbed old nests, the appearance of the dead seals, the vegetation on the rocks, and, lastly, the flat table of the cape above, all indicated that here the unbound forces of the Antarctic circle do not display the whole severity of their powers. Neither ice nor volcanoes seemed to have raged at the peninsula at Cape Adare, and I strongly recommend a future scientific expedition to choose this spot as a centre for operations. At this place there is a safe situation for houses, tents, and provisions. I myself am willing to be the leader of a party, to be landed either on the pack or on the mainland near Colman Island, with Ski, Canadian shoes, sledges, and dogs. From there it is my scheme to work towards the south magnetic pole, calculated by Ross to be in 75° 5′ and 150° E., Colman Island lying in 73° 36′ S. and 170° 2′ E. I should have to travel about 160 miles to reach the south magnetic pole. Should the party succeed in penetrating so far into the continent, the course should be laid, if possible, for Cape Adare, in order to join the main body of the expedition there.

As to the zoological results of future researches, I expect great discoveries. I base my expectations on one point—on the scars found on the seals, which in my opinion point to the existence of a large unknown mammal within the Antarctic circle. Although the white polar bear of the Arctic has never been found in the south, I should not be surprised to discover similar species there. It would indeed be remarkable if, on the unexplored Victoria Continent—which probably extends over an area of 8,000,000 square miles, or about twice the size of Europe—animal life hitherto unknown on the southern hemisphere should not be found.

It is of course possible that the unknown land around the axis of rotation may consist of islands, only joined by perpetual ice and snow; but the appearance of the land, and the colour of the water with its soundings, in addition to the movements of the Antarctic ice, point to the existence of a mass of land much more extensive than a mere island.

It is true that the scientific results of this expedition have been few, but my little work gives me at least the satisfaction of feeling that it will fill a useful, if molecular, place among those strong arguments which for years have accumulated, and which prove that further delay of a scientific expedition to South Victoria Continent can scarcely be justified.

WEATHER FALLACIES.[1]

IN the long and patient pursuit which the attainment of all accurate knowledge exacts from man, it may sometimes be instructive to turn one's gaze backward and contemplate the errors which have been corrected, the fallacies which have been demolished, and the superstitions which have been lived down; and this consideration has prompted me to take for the subject of this year's address that wide range of human opinions which may fitly be classed under the head of "Weather Fallacies."

Nothing could have been more in accordance with the law of growth in other branches of knowledge than that Meteorology should, in its earliest dawn, have been with difficulty able to emerge from the mists and darkness of guesses and surmises such as have surrounded the transfer of any truth from the barbaric to the philosophic stage.

It is to the Greeks that we must look for the first real weather observations after the matter had passed through what may be called the mere savage phase; and we find Hesiod, Theophrastus, and Aratus presenting us with an early code of rules, which serve at least to show us how little we have ourselves advanced in some matters since their time.

[1] An address delivered to the Royal Meteorological Society, by Mr. Richard Inwards, President. (Reprinted from the *Quarterly Journal* of the Society.)

One of our Fellows, Mr. J. G. Wood, has just given to the world an excellent and scholarly translation of the work of Theophrastus, which has not previously been put in an English garb, and Mr. Wood has done the whole country a great service in giving us this translation of the "Winds and Weather Signs," a book which contains a host of rules and observations about the weather, and which, as might have been expected from the production of the favourite pupil of Plato and Aristotle, is singularly free from errors of the grosser and more superstitious kind, such as were plentifully produced in Western Europe many centuries later.

But long before the time of Theophrastus, and probably very soon after the invention of agriculture itself, there were weather gods and weather fallacies; for we find that Jupiter Tonans and Pluvius—the thunderer and the rain-maker—were set by men on the highest pedestals. And centuries after this, Lucian tell us that it was usual in his time to offer prayers for suitable weather, and he recounts in his "Dialogues" how two countrymen were at the same time offering up contrary petitions—one that not a drop of rain might fall until he had completed his harvest, while the other prayed for immediate rain, in order to bring on his backward crop of cabbages—both suppliants only too sure to find that the ears of the image were deaf as the stone of which they were made, and that the wheels of the universe would not wander or turn back for any selfish ends of man.

In considering these early times, when the weather had to be studied from cloud, sky and sea, and from the behaviour of the animals and plants, we must be ready to excuse men for doing that which is still too frequently a cause of error, viz. foretelling what they most wished for, and putting down as universal law that which was only a coincidence of totally independent events. In considering weather fallacies it will be impossible to follow a chronological order, so I shall treat them, or rather a small portion of them, under the heads of saints' day fallacies, sun and moon fallacies, and those concerning animals and plants, while finally I shall consider the almanack makers, weather prophets and impostors who have from time to time furnished the world with materials for its credulity or its ridicule.

The first class of weather fallacies which I shall scarcely more than mention, are those which refer to the supposed connection between the weather of any day in the week or year, and that of any other period, and it may be as well to state at the outset that there is no kind of foundation in fact for any of these so-called rules. They are for the most part born of the wish to see certain kinds of weather at certain times of year, and, like all these predictions, were faithfully remembered when they came true, and promptly forgotten when they failed. One has often heard—

"Fine on Friday, fine on Sunday."

Or that "Friday is the best and worst day of the week," and the superstition even extends to hours of the day, for we have—

"Rain at seven, fine at eleven,"

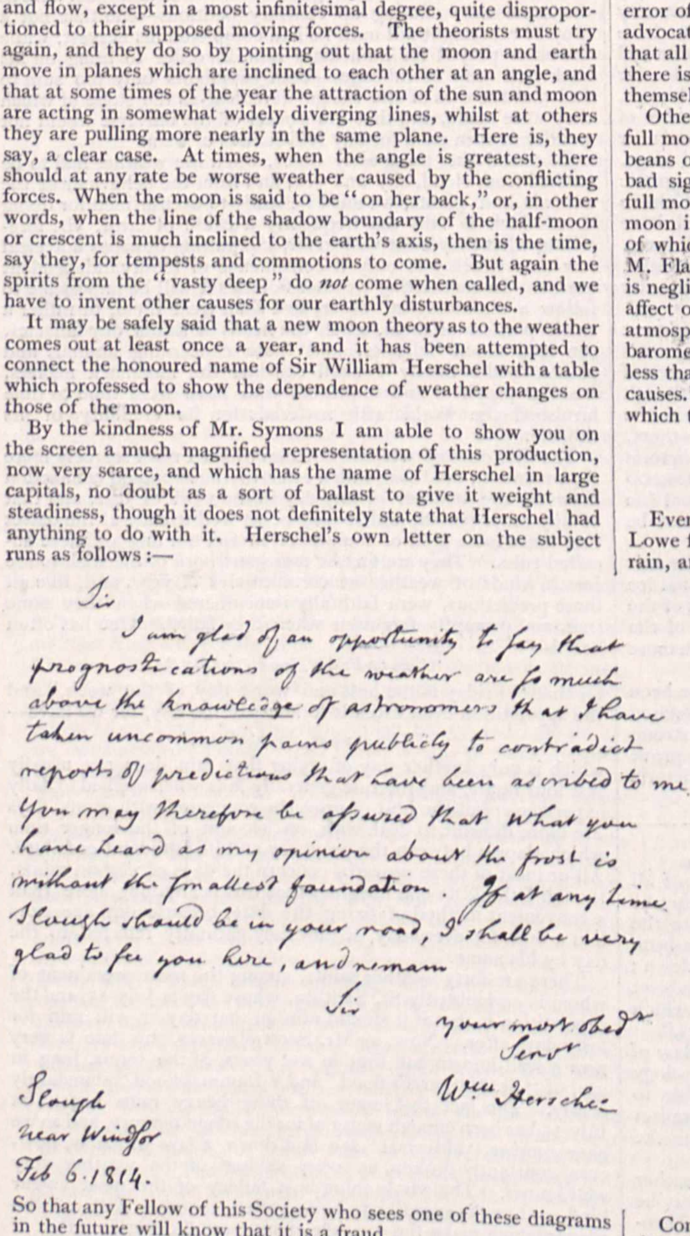
which is only another way of saying that rain does not usually last four hours, and the rule generally fails when applied to daily experience; but the host of proverbs connected with saints' days are more difficult to deal with, on account of the longer time which elapses between the prophecy and its fulfilment or failure. All or most of these proverbs concern the days of certain saints, though I think no one imagines that this is anything more than a convenient method of fixing the date, because our ancestors had a saint for every day, so that they naturally referred to the day by his name.

There are forty weather saints, among the most prominent of whom is undoubtedly St. Swithin, whose day is July 15, and the superstition is that if it should rain on that day it will rain for forty days after. Now, as Mr. Scott observes, this date is very near a well-known bad time in wet years, as the terms, long in use, of "St. Margaret's flood" and "Lammas flood" abundantly testify. The fact that some of these heavy rains began on July 15 has been enough material for the adage-monger, and so we have another "universal" law laid down, a law which is, however, constantly broken, as every student of the weather very well knows. The whole thing is a fallacy of the most vulgar kind, and ought speedily to be forgotten, together with all the adages which make the weather of any period depend on that of a distant day.

Turning in weariness from this class of superstitions, which may be said to belong to the self-exploding order, we are next met by an extensive array of authorities who, under the protecting shield of astronomy, profess to have framed infallible rules for the weather as judged from the ever-varying relative positions of the sun, moon, and planets. They attack us systematically and persistently, appealing to analogy, to reason, and to common sense. But it is sometimes necessary to be on our guard, even against common sense, in considering problems to which uncommon sense has for centuries been devoted without avail. The well-known action of the sun and moon upon the ocean tides is generally the starting point of these theorists, and it is soon shown to common sense that when the earth is nearer the sun, or the moon is nearer to the earth (it being remembered that they move in elliptic orbits), or when both sun and moon are, as it were, pulling together, as at new moon, there ought to be a tide of atmosphere caused by their influence similar to the tides of the ocean, which such agencies undoubtedly produce. But we find that whatever so-called reason, analogy, and common sense may seem to dictate, the facts will not follow in the path marked out for them; and the atmospheric tides refuse to ebb and flow, except in a most infinitesimal degree, quite disproportioned to their supposed moving forces. The theorists must try again, and they do so by pointing out that the moon and earth move in planes which are inclined to each other at an angle, and that at some times of the year the attraction of the sun and moon are acting in somewhat widely diverging lines, whilst at others they are pulling more nearly in the same plane. Here is, they say, a clear case. At times, when the angle is greatest, there should at any rate be worse weather caused by the conflicting forces. When the moon is said to be "on her back," or, in other words, when the line of the shadow boundary of the half-moon or crescent is much inclined to the earth's axis, then is the time, say they, for tempests and commotions to come. But again the spirits from the "vasty deep" do *not* come when called, and we have to invent other causes for our earthly disturbances.

It may be safely said that a new moon theory as to the weather comes out at least once a year, and it has been attempted to connect the honoured name of Sir William Herschel with a table which professed to show the dependence of weather changes on those of the moon.

By the kindness of Mr. Symons I am able to show you on the screen a much magnified representation of this production, now very scarce, and which has the name of Herschel in large capitals, no doubt as a sort of ballast to give it weight and steadiness, though it does not definitely state that Herschel had anything to do with it. Herschel's own letter on the subject runs as follows:—


Sir

I am glad of an opportunity to say that prognostications of the weather are so much above the knowledge of astronomers that I have taken uncommon pains publicly to contradict reports of predictions that have been ascribed to me. You may therefore be assured that what you have heard as my opinion about the frost is without the smallest foundation. If at any time Slough should be in your road, I shall be very glad to see you here, and remain

Sir

your most obedt

Servt

Wm Herschel

Slough
near Windsor
Feb 6. 1814.

So that any Fellow of this Society who sees one of these diagrams in the future will know that it is a fraud.

Of course it is in the power of every one to check the predictions which are so often issued with respect to the changes of the weather taking place at the change of the moon; but many eminent men have occupied themselves with the subject, and the result is that no correspondence between the two classes of phenomena has been established.

Dr. Horsley examined the weather tables of 1774, as published by the Royal Society, and out of 46 changes of weather in that year only ten occurred on the days of lunar influence, only two of them being at the new moon, and none at all at the full. M. Flarguergues, of Viviers, found also as the result of twenty years' observations, that the barometer readings taken when the moon was furthest from the earth averaged 755 millimetres, and when nearest, 754 millimetres, showing a difference of 1 millimetre or about ·04 inch, and this in a direction against the theory, the pressure being greater by that amount when the moon was farthest from the earth.

Various other weather seers have pinned their faith on lunar cycles, and have predicted that weather changes would repeat themselves, as soon as the sun and moon got back into the same relative positions, which they do in nineteen years, with only an error of an hour and a half. Others, such as Mr. G. Mackenzie, advocated a cycle of 54 years, but it may be summarily stated that all the cycles have broken down, and that, as far as we know, there is no definite period after which the weather changes repeat themselves.

Other fallacies about the moon are numerous, such as that the full moon clears away the clouds; that you should only sow beans or cut down trees in the wane of the moon; that it is a bad sign if she changes on a Saturday or Sunday; that two full moons in a month will cause a flood; that to see the old moon in the arms of the new brings on rain, and many others, of which a catalogue alone would take up a good deal of space. M. Flammarion says that "the moon's influence on the weather is negligible. The heat reaching us from the moon would only affect our temperature by 12 millionths of a degree; and the atmospheric tides caused by the moon would only affect the barometric pressure a few hundredths of an inch—a quantity far less than the changes which are always taking place from other causes." On the whole we are disposed to agree with the rhyme which thus sums up the subject:

The moon and the weather
May change together;
But change of the moon
Does not change the weather.

Even the halo round the moon has been discredited, for Mr. Lowe found that it was as often followed by fine weather as by rain, and Messrs. Marriott and Abercromby found that the lunar halo immediately preceded rain in 34 cases out of 61. We always have a lingering hope that some future meteorologist will disentangle the overlapping influences, and arrive some day at a definite proof that our satellite after all has something to do with our weather.

About the sun, also, there are many fallacies, and ever since the discovery that the spots which appear on his surface have a period of greatest and less frequency, there have been theorists in shoals who have sought to prove that this fact rules our weather. It has undoubtedly been found that the frequency of sun-spots and the variations of the magnetic needle are intimately connected; and it is almost equally well established that the aurora appears and disappears in some sort of sympathy with the sun-spot variations. But this, up to the present, is as far as we can get in this direction, for our weather seems to have no definite relation to these changes.

The more recent discoveries of prominences visible round the disc of the sun during an eclipse, and of the light clouds only seen in M. Deslandres' spectro-photographs, will no doubt call out new weather theories on the subject. And I must confess to a wish that those mysterious flame-like bodies rushing from the sun millions of miles into space, will be found to have some influence on the upper layers of our earth's atmosphere; but I also hope that we may be saved from a theory on the subject until more facts are before us.

Coming down to earth again, we are met by a long array of fallacies connected with the behaviour of animals and plants, and which have a supposed connection with weather changes. Few of these are so well grounded that they may be considered as proved, and as nothing is sacred to a meteorologist, our veteran

Fellow, Mr. E. J. Lowe, F.R.S., has endeavoured to put some of the rules from this source to the test of definite observation. He took a number of well-known signs said to indicate change, and carefully noted what happened after each sign, and although he does not say that all indications from animals, birds and plants are useless, yet certainly those he did investigate seemed utterly to break down.

He took the well-known signs of bats flying about in the evening, many toads appearing at sunset, many snails about, fish rising much in lake, bees busy, many locusts, cattle restless, land-rails clamorous, flies and gnats troublesome, many insects, crows congregating and clamorous, spider-webs thickly woven on the grass, spiders hanging on their webs in the evening, and ducks and geese making more than usual noise. Mr. Lowe found that in 361 observations of the above signs, they were followed 213 times by fine, and only 148 times by wet weather; so that even after the prognostications for rain, there was a greater preponderance of fine weather. He called a day fine when no rain was measurable in the rain gauge. Mr. Lowe says that even swallows flying low cannot be depended on, as, especially at the close of summer and autumn, they almost invariably skim the surface of the ground, and Mr. Charles Waterton, the naturalist, decided, after careful observation, that the unusual clamour of rooks forms no trustworthy sign of rain. These must, therefore, swell the list of fallacies, although there are many other rules which have not been so carefully examined, but which may still be true. My own impression is that although it is painful to dismiss the animals from their ancient position as weather prophets, we may consider them as indicating what they feel, rather than as predicting what is to come, and that their actions before rain simply rise from the dampness, darkness or chilliness preceding wet weather, and which render these creatures uneasy, but not more so than they affect man himself. The sheep turning its back to the wind (one of the best known signs of rain) is probably only that it may shelter its least protected part from the effects of the weather; and many of you must have observed sheep sheltering their heads from the heat by getting them into the shade of each other's bodies in a similar way.

As to cows scratching their ears, and goats uttering cries, and many other signs of bad weather, they are at least very doubtful; whilst the adage about the pig which credits him with seeing the wind, carries with it its own condemnation.

The medicinal leech is still left on the list of weather prophets, though he has no doubt had his powers exaggerated; and two books have been written about his behaviour during changes of weather. One is by Mrs. Woollams, who, during a long illness, watched a leech in a bottle, and carefully noted what it did; and the other is by a gentleman at Whitby, who came to the conclusion that the leeches could be made to give audible and useful storm warnings. So he contrived the instrument, of which I now show you a drawing taken from his book. No one would imagine from its appearance what its use could be. It consisted of twelve glass bottles each containing a leech in water, and so arranged in a circle, in order, as the humane inventor states, that the leeches may see each other and not endure the affliction of quite solitary confinement—this rather reminds us of Isaac Walton, who told his pupil to put the hook into the worm "tenderly, as if he loved it"—in each bottle was a metal tube of a particular form, and which was made somewhat difficult for a leech to enter, but into which it would endeavour somehow to creep before a thunderstorm, according to its nature. In each tube was a small piece of whalebone, to which a gilt chain was attached, and so arranged, on the mouse-trap principle, that when the whalebone was moved the bell at the top of the apparatus was rung by means of the chain. There were twelve leeches, so that every chance was given that one at least would sound a storm signal. The author called this apparatus the "Tempest Prognosticator," a name which he preferred—and I think we shall agree with him—to that of atmospheric electric telegraph conducted by animal instinct. He went on to state in his little book that he could, if required, make a small leech ring the great bell of St. Paul in London as a signal of an approaching storm. The book is written in all seriousness, and a number of letters are appended from gentlemen who certify that correct atmospheric indications were at various times given by the leeches. The name of the inventor of this ingenious contrivance was Dr. Merryweather—himself a learned leech.

Plants have also their advocates as weather indicators; and there is no doubt that in most cases they act in sympathy with changes in the dampness, gloominess, or chilliness of the air, and as these conditions generally precede rain, one cannot term the indications altogether fallacious. The pimpernel and the marigold close their petals before rain, because the air is getting damper, while the poplar and maple show the under surface of their leaves for a similar reason. Indeed, an artificial leaf of paper may may be made to do the same thing, if constructed on the same principle as the natural one—a hard thin paper to represent the upper side of the leaf, and a thicker unsized paper for the lower side; these will, if stuck together, curl up or bend down in sympathy with the hygroscopic condition of the air. A slip of ordinary photographic paper will do the same, and will curl up at once when placed on the hand.

The same slackness which moisture produces in plants applies in some degree also to insects, some of which can only fly in sunshine, so that there is a chain of weather signs all following from a little dampness in the air. The flowers close their petals and shut in their honey, the insects cannot fly so high, and the swallows seeking them skim the surface of the earth, and even then the threatened shower may not come.

In 1892 attention was directed to a plant, the *Abrus precatorius*, a beautiful shrub of the mimosa kind, which has the property of being sensitive in a high degree, so that its pinnate leaflets go through many curious movements, and it was claimed that these form a guide of unerring certainty to foreshow the coming weather. Even earthquakes were said to be predicted by this wonderful plant. If it closed its leaflets upward, after the manner of a butterfly about to settle, fair weather was shown; when the leaflets remained flat, changeable and gloomy weather was indicated; while thunder at various distances was to be foretold by the curling of the leaflets, and the nearer the thunder the greater the curl, until when the points of the leaflets crossed, the thunderstorm was indicated as being overhead. Changes of wind, hurricanes, and other phenomena were to be shown by the various curious and beautiful movements of the leaflets and stalks. These movements undoubtedly took place, but when the plant was submitted to the unprejudiced observation of Dr. F. W. Oliver and Mr. F. E. Weiss, at Kew Gardens, those gentleman failed to find any connection between these movements and the weather, and Dr. Oliver made a report on the matter, which hits the heart of the whole subject of plant movements, by ascribing them for the most part to the agency of light and moisture. Mr. Scott, of the Meteorological Office, gave the finishing stroke to the theory by proving that the movements had no connection with either cyclones or with earthquakes, so that the sensitive plant may be considered as out of the list of weather guides, in spite of having been made the subject of an English patent.

It is a most common observation in the country that a large crop of hips, haws, and holly-berries indicates a severe winter to follow, and it is generally pointed out that nature thus provides winter food for the birds. This, too, is a fallacy.

Another weather fallacy, for which artists are responsible, is that flashes of lightning take the form of long angular lines of a zigzag shape, and of which I show you an example, taken from a work on the subject. This, when compared with the next view, which is a photograph taken direct from nature, shows that the artist had very little understood the true form of the lightning flash, which consists of numbers of short curves joining each other, something like the course of a river depicted on a map, or in some degree like the outline of a clump of leafy trees seen against the sky. But, as far as I know, there were only two artists whose acute vision saw lightning in anything like its true form. One was Turner, who long before the time of photography, scratched his lightning flashes with a penknife, making short curved dashes across the picture; and the other was Nasmyth, the astronomer and engineer, who also saw the lightning in its true form, and duly noted the same, only to be confirmed years afterwards, when it became easy to photograph the lightning flash itself. While on the subject of lightning, I may mention that it is recorded that in one case at least a rheumatic man who had been confined to bed six weeks, received a shock from a stroke of lightning, jumped from his bed, and ran down stairs completely cured. This is related in the *Gentleman's Magazine* for June 1820.

It has been often stated that the noise of cannon will produce rain, and it is not unusual in the Austrian Tyrol to hear the church bells ringing to avert thunder. These are fallacies. The experiments in America made recently to test whether rain could be produced by exploding a large quantity of gunpowder in the air, resulted in nothing except noise and smoke, though the thing was well worth trying.

Empedocles of old is credited with the invention for chasing away the Etesian winds by placing bottles made of the skins of asses on the hills to receive them. Timæus relates this. After hearing this about Empedocles, one is not surprised to learn that he thought there were two suns, that the moon was shaped like a dish, and that the sea was the sweat of the earth burnt by the sun. All this will be found in Stanley's "Lives of the Philosophers."

Almost in our own time, too, a "pluvifuge," or machine for blowing away rain, was proposed in Paris. This, too, was a fallacy.

To give an account of all the various ceremonies in savage and civilised countries which have been resorted to for the purpose of changing the course of the weather, would be here impossible; but such rites have a common origin and a common result. They begin in error, and end in failure. In India, the rain-god is imagined to pour down showers through a sieve; in Peru there was supposed to be a celestial princess, who held a vase of rain, and when her brother struck the pitcher, men heard the shocks in thunder. In Polynesia rain comes from the angry stars, stoning the sun; while in Burmah it is still the custom to haul down rain by pulling at a rope. New Caledonia has its regular rain-making class of priests, and in Moffatt's time the rain-makers of South Africa were held in even higher estimation than the kings; and on the other side of the world the Alaskan propitiates the spirit of the storm by leaving tobacco for him in a cave. In our own country, too, there have been weather witches of various grades, and one described in Drayton's "Moon Calf"—

"Could sell winds to any one that would
Buy them for money, forcing them to hold
What time she listed, tie them in a thread
Which, ever as the seafarer undid
They rose or scantled as his sails would drive
To the same port whereat he would arrive."

The Finlanders at one time drove a profitable trade by the sale of winds. *After* being paid, they knitted three magical knots, and told the buyer that when he untied the first he would have a good gale; when the second, a strong wind; and when the third, a severe tempest.[1] Sir Walter Scott also mentions that King Eric, also called "Windy Cap," could change the direction of the wind by merely turning his cap round upon his head; and old Scotch women are mentioned who, for a consideration, would bring the wind from any desired quarter.[2] The Mandan Indian rain-maker had a rattle by the noise of which he called down rain from heaven by the simple process of keeping on long enough. It is safe to say that these are all fallacies.

From the rain-makers we may now turn for a moment to the almanack makers, and any one who will look up an old almanack of the early part of the last century, will find the greater part of it filled with lucubrations on the influence of the stars and constellations; he will also find a column giving for every day the parts of the body which are particularly under the celestial influences on the given dates, and when one sees for the first time this column reading—head, chest, legs, knees, feet, &c., one wonders what it can mean; but it was then so well understood, as not even to require explanation, and there was generally too a rude woodcut of a hideous human figure, tattooed with the various signs of the zodiac to show the same thing. The sort of knowledge that passed for meteorology in 1703 may be learned from the following extract from "Meteorologiæ" by Mr. Cock, Philomathemat. 1703—a rare book in the possession of Mr. Symons.

"The twelve signs are divided into four sorts, for some be earthy, others watery, a third sort aery, and the fourth sort is fiery." The author then goes on to state that "Jupiter in the Skinker (whatever that may be) opposed by Saturn in the Lion did raise mighty South-west winds. . . . Observe when a planet is in an earthy sign he was lately dried up by perambulating a fiery sign, and after that, immediately having made his progress in an earthy sign, is quite bound up from moisture."

It seems incredible that our ancestors, only a few generations back, could have bought, paid for, and believed, such stuff as this. The early almanacks boldly gave a prediction for the weather for every day in the year; but after a time confined themselves to a general statement of the weather, for instance "Partridge's Almanack" for 1835 has the following prophecy for June: "Fertilising showers attended with thunder and lightning"—this does for the first ten days. "Fair and at times hot" for the middle of the month, and "refreshing rain for the grass and corn" for any time between the 21st and the end of the month.

[1] Olaus Magnus, "His. of the Goths," 1638.
[2] Notes to "The Pirate."

Authors of weather almanacks had already begun to seek safety in vagueness. Some of these almanacks rose to a great popularity on the strength of one lucky guess; and I think it is told of this same Partridge's almanack, or some other of the class, that it owed its reputation to a curious prophecy of extraordinary weather for July 31, when hail, rain, snow, thunder, &c., were freely indicated. Forgetting that the month had 31 days the almanack maker had omitted to insert the weather prediction for the last day, and a boy was sent from the printing office to know how the space was to be filled up. The weather prophet was too busy to attend to him, but at last in a passion, said: "Put down hail, rain, snow, thunder, anything"; and the boy taking it literally told the compositor, who duly set into type the extraordinary prediction, and which by a freak of nature came true, and made the fame and fortune of the almanack maker. This story, if not true, is at least *ben trovato*, and shows the force of the bard's statement—

"Our indiscretion sometimes serves us well
When our deep plots do pall."

The *British Almanack* for 1831, published by the Useful Knowledge Society, had no weather predictions.

Patrick Murphy published a popular weather almanack, and his fame is said to have commenced by a lucky hit in one of the earlier issues by which he indicated which would be the coldest day of the year. There is a copy of this almanack for 1838 in the library of the Society, and some former owner has evidently taken the trouble to pencil in the actual weather opposite to that predicted. There were, according to this annotation, 89 incorrect forecasts, 91 doubtful, and the rest correct.

This Patrick Murphy was not a mere charlatan. He had a system, and though he differed from Sir Isaac Newton and the Royal Astronomical Society, he gave much study and research to the subject of meteorology—as shown by his various books. There was an Astro-Meteorological Society as late as 1861, and we have some numbers of its *Records* in our library.

Next comes the subject of weather prophets as distinguished from mere almanack makers; and who profess, sometimes for pelf, at other times for honour and glory, to predict the weather for any future date. These are always arising, and they do not lack a certain number of followers, who, possessing a large angle of credence, duly trumpet forth the successes of their chiefs, when they are so fortunate as to make any. The stock-in-trade of a prophet is of a slender and cheap description. He must have an inventive mind, a store of self-confidence, an insensibility to ridicule, and, above all, a keen memory for his successes, and a prompt forgetfulness of his failures. He should by choice have a theory, and this should be of the elastic order, so that if a predicted event does not punctually occur, he will be ready with a sort of codicil to amend it. Hence we find that the firing of guns has been cited as a sufficient reason for falsifying a weather prediction; and railways, too, are said to have an adverse influence, one author (not a prophet) telling us that they may be considered as "large winnowing machines, perpetually fanning and agitating the air with prodigious power, ploughing the air, as it were, and causing waves of vast extent, which, invisibly enlarging like the waves of the ocean, probably meet each other, clash, and produce modified effects, as resultants from adverse motions."

One of the first weather prophets mentioned in that delightful old book, Stanley's "Lives of the Philosophers," was Democritus, the Milesian, known as the "laughing philosopher," who foresaw a dearth of olives, and by buying up all he could get might have made a fortune, but gave it back to the bargainers with the remark, "You can see now that a philosopher can get rich when he pleases." Then there was Pherecydes, of whom Pythagoras was a favourite pupil, who predicted an earthquake three days in advance by the taste of the water from a certain well. Perhaps the earliest of all was Elijah, who from the top of Carmel pointed out the coming squall cloud, and predicted a great rain. He forms a good model for imitation to the modern weather prophets, for he did not prophesy until he saw the storm coming, and he made no secret of his method. We have still amongst us in our country, mostly without honour, seers who supply us with weather predictions in various forms, from the modest duodecimo almanack to the flaring broadsheet which compels attention; but it would be a task too long to enter on a systematic refutation of their contradictory guesses at the weather. The last of these broadsheets that caught my eye had for the days of the gale of December 1894, which Mr. C. Harding has described to us, the tame announcement of "generally overcast." This did not err on the side of boldness when considered with reference to one of the severest gales of the century.

A Spanish peasant whom I heard of in Andalucia, and who had the reputation of a weather prophet, wisely said, if you want to know the weather for to-morrow, ask me early in the morning. The Indian weather prophets who made a failure had to be silent altogether for the rest of their lives; and this causes us to regret that some of our own seers were not born in that distant land.

As to the so-called weather forecasts, they only come under the title of this paper when they fail, and as eight out of ten are said to be correct, I shall only say that they are honest attempts on the part of civilised governments to warn their people as far as possible against the march of known disturbances. I could wish that the term "weather indications" or "indicated weather" had been adopted, so as to make this plain to all, and that oftener, when the signs were vague, we had the simple announcement of no change indicated.

The director of this system so well known to us, and who is playfully called the "Clerk of the Weather," sometimes receives valuable hints, even from children; and I must quote one such communication.

"Please, Mr. Clerk of the Weather, tell the rain, snow, and hail to stop for the afternoon, and rain in the night."

I may conclude this section by saying that it is a great fallacy to suppose that there is such a thing as a weather prophet. All the great authorities agree that in the present state of our knowledge no human being can correctly predict the weather, even for a week to come.

And now we must consider a class of weather fallacies of which the victims can only excite in a well-regulated mind feelings of sadness and compassion, rather than the ridicule to which at first sight they seem more naturally entitled. I mean those weather prophets in whom the delicate mechanism of the mind is touched by disorder or decay, even if it has not already fallen under the stroke of complete dementia, and who believe that they can not only foresee the weather, but, by an effort of their own minds, control the elements and compel the clouds.

These patients I had hoped only existed in small numbers; but, on perusing the correspondence of a prominent meteorologist, kindly lent me for the purpose, I find that there are many of this class whose name, like that of the ancient wanderer among the tombs, is "Legion," and who still come on, each prepared to drive the chariot of the sun, or by an exertion of his own will, odylize (the word I suppose will come) all the powers of nature.

Dr. Johnson's Astronomer says in "Rasselas":—"Hear me, therefore, with attention. I have diligently considered the position of the earth and sun, and formed innumerable schemes, in which I changed their situations. I have sometimes turned aside the axis of the earth, and sometimes varied the ecliptic of the sun, but I have found it impossible to make a disposition by which the world may be advantaged. What one region gains another loses. Never rob other countries of rain to pour it on thine own."

This type of patient, as well as those who would use their supposed power for the purpose of creating fine weather during the holidays of the people, belong to the more noble sort, but there have been others, like the notorious Friar Bungay, who for sordid reasons have professed to exert a similar power. The only wonder is that anybody ever believed them.

Now, as this malady of the mind is not incurable, I will venture to offer a practical suggestion, and would recommend these patients who have nursed themselves into the belief that they possess the keys of the weather, to seek the hill-top on a summer afternoon—the air and exercise will do them good—and watch the fine fleeces of cumulus cloud as they sail majestically across the sky, each with its attendant shadow below. Let the patient concentrate his attention upon one single feathery cloud, and try by the exertion of his utmost force of will to make it pause for a moment in its career; and, if he fails—"as fail full well he may"—then let him banish from his mind for ever the idea that he can by his own will dominate the whole firmament. And if he has ever gone into print upon the subject, let him go home, and, like Prospero, his prototype, say—

> "Deeper than ever plummet sounded,
> I'll drown my book,"

and so save the world from the trouble of investigating much pure nonsense. To these sufferers I can only repeat the words of one of our own kings to the last man he touched for the evil—"I wish you better health and more sense."

I must be forgiven for having only made a selection from the vast catalogue of fallacies which have accumulated about the subject, and I must continue to regret that there are still people who are ready to believe that the saints' days rule the weather, that the sun puts out the fire, that warm water freezes sooner than cold, or that a man is a prophet because he says so himself.

This Society is clearing the ground of many weeds, and already the fallacy of the "equinoctial" gales has been exploded (by Mr. Scott), while the churchyard ghost of the supposed fatal "green Christmas" has been most effectually laid by a recent statistical paper by Mr. Dines.

Some one may ask, after all this clearing away of fallacies—What have we left? and I would venture to refer him to all the patient work which is being done in various countries, and by which a real Science of Meteorology is being slowly built up, while to the outdoor weather student I would offer this consoling reflection—There is still the sky.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

PROF. A. H. CHURCH AND DR. FREAM have been offered and have accepted Honorary Professorships at the Royal Agricultural College, Cirencester. These gentlemen were both formerly professors at the College, and both took part in the recent jubilee celebrations.

IT would be a great advantage to the numerous students of science and technology if the scientific works in all public libraries were arranged in a separate class, and catalogued separately. This has been done for the Central Free Public Lending Library of Nottingham, by Mr. J. P. Briscoe, the librarian, and Mr. T. Dent. All the scientific books in the library have been arranged according to the science to which they refer, and indexed according to subjects and authors. The list will thus be of great assistance to students.

NEW technical schools, presented to Winsford, in the salt district of Cheshire, by Mr. Joseph Verdin, at a cost of £8000, were opened by the Duke and Duchess of Westminster last week. The money is part of a fund of £26,000, originally intended to compensate property owners from subsidences brought about by brine-pumping. As he was unable to transfer the fund, the Charity Commissioners were applied to, and it was decided that £12,000 should be used in the erection and endowment of technical schools at Winsford and Northwich.

PRECEDING a historical account of the Owens College, Manchester, contributed by Mr. P. J. Hartog to the current *Record* of Technical and Secondary Education, the function of university colleges in technical education is discussed. Mr. Hartog points to a fundamental distinction established by the Royal Commission on Technical Instruction between (1) institutions for the instruction of manufacturers and higher managers, and (2) institutions for the instruction of foremen and workmen engaged in industrial pursuits. He rightly remarks, however, that the distinction is still vague in the mind of the public, and even in that of many educationalists. It has become more vague through the use of the words "polytechnic" and "technical school" to render the German *polytechnicum* and *technische hochschule*, to which they are not at all equivalent. The *polytechnicum* and *technische hochschule* educate managers and manufacturers; our polytechnics and technical schools, with their day-schools for lads and their night-schools for adults occupied during the day, educate foremen and workmen. It is not necesssary to insist on the inestimable value of the latter class of school; but it is of the first importance that the public should perceive the distinction referred to by Mr. Hartog, and that they should not think that they are following the example of a country like Switzerland, which eleven years ago was spending over £14,000 a year on the Zürich Polytechnic, when they vote a large sum to one of the many English polytechnics and technical schools, now springing up so rapidly with the help of funds derived from the Customs and Excise duties, while but meagre support is given to the institutions for the training of managers and manufacturers. As Mr. Hartog remarks, the university colleges combine the faculties of a German or Swiss university with those of a *polytechnicum*, but the existence of the technical part of the instruction given is often ignored because it is called university teaching, and not technical instruction, and because side by side with the teaching of science there is the teaching of the "humanities." The remarks conclude with a statement of the amount allotted from the public funds to university colleges. Out of the sum available under the Local Taxation Act about £600,000 a year is devoted to technical education, but only £23,854 was given to fourteen university colleges in England and Wales in 1892-3 by twenty local authorities, in addition to a sum of £29,550 provided by the Treasury, of which nearly half (£13,306) went to the three Welsh colleges alone. The support certainly seems insufficient for the great services rendered by the colleges to the nation.

THE third Report of Mr. J. A. Bennion, the Director of Technical Instruction in the County Palatine of Lancaster, was presented to the County Council a few days ago. It is clear from the report that every effort is being made by the Committee to expend judiciously the funds at their disposal. A sum of £28,500 was distributed among the urban and rural districts of the county last year. The following amounts were voted for work in special subjects:—Navigation, £250; Sea Fisheries, £300; University Extension Lectures, £500; Horology, £250; Mining, £500; Silk Industry, £500; Plumbing and Sanitary Science, £750; Horticulture and Bee-keeping, £500; Practical Agriculture (including Veterinary Science, Poultry-keeping, and allied subjects), £1000. In addition to the ordinary sums allotted to each district, special grants, amounting to nearly £1000, were made for the purpose of purchasing apparatus and appliances. University College, Liverpool, and the Owens College, Manchester, each received a grant of £400 for the same purpose. Classes in horology are held at Prescot, but they are quite inadequate for the whole county; and do not impart the thorough teaching, either theoretical or practical, that is given on the continent. A deputation from the Committee visited some of the Continental Schools of Horology, and as a result of their inspection they strongly recommended the establishment of a County School of Horology, similar to the school at Geneva. It was afterwards resolved at a large and representative conference that "it is desirable to establish a Technical School of Horology and Scientific Instrument-making, including electrical, optical, and mechanical instruments, both practical and theoretical, for the County of Lancaster." Efforts are now being made to put this resolution into effect. The establishment of a school to afford effective teaching in subjects relating to the silk industry is also under consideration. It is proposed to found the school upon the model of the Seidenweb Schule of Wipkingen, in Zürich. For the purpose of providing instruction in practical agriculture, a farm and farm buildings, covering nearly 150 acres, has been acquired at Hulton, near Preston. A vote of £650 was made to the Harris Institute for special courses to agricultural students; and a number of lectures on subjects relating to agriculture were delivered in various parts of the county, while agricultural experiments were carried on in several districts.

SCIENTIFIC SERIALS.

Wiedemann's Annalen der Physik und Chemie, No. 7.—Absorption spectrum of pure water for red and infra-red rays, by E. Aschkinass. The "extinction coefficients" of water for the various wave-lengths at the red end of the spectrum were determined by the bolometer, and calculated by the formula

$$J' = Je^{-\epsilon d},$$

where J is the intensity of the incident, and J′ that of the transmitted light, d the thickness of the layer in *cm*, e the basis of the Napierian logarithms, and ϵ the "extinction coefficient," which therefore means the reciprocal of the thickness which a ray must traverse in order to be reduced to $1/e$ of its original intensity. Of these extinction coefficients 200 are given, for wave-lengths extending from 0·4500 μ to 8·49 μ. The minimum is at $\lambda = 0·5375$, being 0·00005, and the maximum of 2733 is attained at $\lambda = 3·02\ \mu$. A second maximum occurs at 6·09 μ, but between 6·7 and 8·5 the values of the extinction coefficients vary only between 700 and 900.—Absorption of radiant heat by liquids, by Charles Friedel. The liquids investigated were carbon compounds contained in cells between an iron block and a thermopile. Among the results obtained are the following:—Whenever, in a chemical compound, H, O, HO, or N are replaced by S or halogens, the transmittance of the solution is considerably increased. In homologous series the transmittance is regularly changed by every addition of CH_2, but the direction of this change depends upon the nature of the other atoms contained in the molecule. The absorptive power of a compound does not essentially depend upon the size of the molecule, but seems to be a property of the constituent atoms. The greatest influence is always due to H, N, and also O. In isomeric compounds the diathermancy is different, and the difference is not only connected with the difference of atomic volume of the elementary atoms, but also with the difference of linkage of the atoms amongst each other; in saturated compounds the diathermancy (transmittance) always increases with the atomic volume. The determination of the diathermancy is the most delicate test available for the purity of organic liquids or salts which are soluble in highly diathermanous liquids.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Horticultural Society, June 25.—Mr. McLachlan in the chair.—Mr. Wilson exhibited a pot containing some seedling plants, in blossom, of the North British species *Primula scotica*, which is found in pastures of Orkney, Caithness, and Sutherland. The flowers are homomorphic, not having the stamens and pistils of different lengths as in most other Primulas.—Mr. Jackman exhibited small trees of *Fagus sylvatica*, with the leaves small, entire, and round. As the trees exhibited an erect form, with short branches, it would seem to be the result of some check to growth, the form of the leaf representing a less developed state than that of the ordinary type of tree.—Mr. Colinette, of Guernsey, forwarded some hazel wood found in peat near the coast of Guernsey, containing flint implements, stone rings, and pottery, presumably neolithic. No hazel is now known to be indigenous to Guernsey.—Mr. McLachlan exhibited specimens of *Melanostoma scalare* attached to flowering stems of a grass, *Glyceria fluitans*.

July 23.—Dr. M. T. Masters described a curious case of *Cypripedium* malformed, received from Messrs. Sander and Co., in which the sepals were normal, but the two petals and lip were absent.—Dr. Masters also drew attention to a peculiarity in the venation of the lobed leaves of *Lavandula dentata*.—Dr. Ch. B. Plowright forwarded specimens of the parasitical fungus *Æcidium nymphæoidis*, with the following observations:—"This Æcidium has been stated by Chodat to be connected with the Puccinia on *Scirpus lacustris*. In November 1877, *Puccinia scirpi* was found floating in the river Ouse at King's Lynn. During the past winter I found it on the bulrushes (*S. lacustris*) in the 'Old Bedford' at Earith, Huntingdonshire. On revisiting the spot this July the Æcidium on Villarsia was met with in great abundance." Dr. Plowright also sent specimens of the fungus *Æcidium chenopodii*, with some remarks upon them.—With reference to the specimens of flies attacked by a fungus, brought before the last meeting by Mr. McLachlan, it was reported from an examination made at Kew that "the fungus is *Empusa conglomerata*, Thaxter (a somewhat rare species), parasitic on Diptera, especially the larvæ and imagines of Tipulæ. Distrib.—Europe and United States. This is the first record for Britain."—MM. Letellier et Fils forwarded from Caen some growing plants of thornless gooseberry, from which they have issued four kinds, raised by M. Ed. Lefort, of Meaux, France. The usual triple spines were either quite absent, or represented by mere rudiments only.—Mr. Cannell sent some trusses, with small jagged-edged petals of a crimson colour, approximating the original wild form. They appeared among his long-selected beds of sweet williams, the margins of the petals being rounded and smooth.

PARIS.

Academy of Sciences, August 5.—M. Marey in the chair.—Experimental study of the transverse vibrations of cords, by M. A. Cornu. The complex vibrations of strings produced as in actual musical instruments have been studied. The transverse vibrations of a string, excited in any way whatever, are always accompanied by torsional vibrations, the torsional elasticity of the cord taking effect in the same way as the transverse component of the tension. Not only is the actual vibration complicated by these torsional vibrations, but, in many cases, the transverse vibrations are themselves rendered more complex by the fact that strings are seldom or never symmetrical about their axes. The vibrations have been studied by means of very light mirrors attached preferably to the portion of the string near one of its points of attachment or a node. Light figures similar to Lissajous' figures have been obtained. With the mirror attached parallel to the axis, all the components of the vibration are effective; when its plane is perpendicular to the axis, the torsional vibrations are eliminated.—Some considerations on the construction of great dams, by M. Maurice Lévy.—The international committee on glaciers. A note by M. F. A. Forel. From the observed facts it is deduced that the general behaviour of glaciers is individual and special to themselves. There are some traits, however, which appear in certain cases in connection with the whole of the glaciers of a country. The duration of the oscillations of glaciers is measured in years by tens, the mean being at least thirty or forty years. The same variations are met with in other glacier regions as well as in the Alps. The committee ask the co-operation of scientific observers to ascertain whether there is coincidence, alternation, or lack of agreement in glacial variations: (*a*) In the different glaciers of the same continent; (*b*) in the glaciers occurring in the same hemisphere; (*c*) in the glaciers of all parts of the earth. —On the Brownian movement, by M. C. Maltézos. The conclusion is drawn that the Brownian movement is a capillary phenomenon.—Lighting by luminescence, by M. A. Witz. Lighting by means of a vacuum tube in circuit with a Holtz machine or Ruhmkorff coil is proved to give a smaller proportion of heat in relation to the quantity of light developed than any other means of obtaining light, yet the light so obtained requires the expenditure of much more energy per candle-power than ordinary sources, and hence the disposition of apparatus will require to be very much modified before light can be produced commercially at a low temperature.—On the nuclei of the Urediniæ, by MM. G. Poirault and Raciborski.—On diphtheritic anti-toxin, by MM. Guérin and Macé. The active substance appears to be of the same nature as the soluble ferments classed under the name "diastase."—On a toxic substance extracted from the suprarenal capsules, by M. D. Gourfein.—Instantaneous hyperglobulia, by peripheric stimulation; consequences, by M. Jules Chéron. Hypodermic injection of artificial serum or stimulating actions on the sensitive skin surface (such as a cold douche, massage, &c.) cause an immediate loss of the anæmic symptoms in patients suffering from anæmia. The result is probably produced by a stimulation of the central nervous system, followed by a bracing up of the vascular system as evidenced by the increase in arterial pressure. The apparent increase in the numbers of red corpuscles is caused by the greater extravasation of serum brought about under the greater pressure.

NEW ZEALAND.

Philosophical Institute of Canterbury, May 1.—Mr. C. W. Purnell, on "true instincts of animals." The definition of the term "instinct" has been greatly narrowed of late years. Formerly every act of an animal betokening intelligence was ascribed to "instinct," but the term is now restricted to acts which are performed in an apparently mechanical manner by generation after generation, and seem to be prompted by some other faculty than intelligence. The author thought that the definition could be still further restricted. Writers upon the subject had not taken sufficiently into account how much the young animal might be taught by the old, and how much it might learn from imitation. The migratory habits of certain birds, for example, were always set down to instinct, but birds usually migrated in flocks, and, in any case, with the young bird it was "follow my leader." The same remark applied to the periodical migrations of the Norwegian lemming, the salmon, and other animals. The nest-building habits of birds could be similarly explained; and even such extraordinary habits as that of the Australian Megapodidæ, which formed immense mounds of vegetable and other matter, and deposited their eggs in the midst, leaving them to be hatched by the heat evolved from the fermentation of the decaying mass. The beaver's remarkable habit of constructing dams and canals, some of which are of great antiquity, and which, if constructed by human beings, would be deemed proofs of considerable engineering skill, illustrated the author's argument. The young beaver remained in the parental lodge until the summer of its third year, when it began housekeeping for itself, so that it had abundant opportunity, during its youth, of receiving instruction from its elders, in the peculiar ways of beaverdom, and when it did make a start in life upon its own account, it still enjoyed opportunities of receiving instruction and of gaining skill by experience. Cats, dogs, and monkeys instructed and corrected their young; and the adult carnivora taught their offspring how to capture and kill their prey. Some of the most remarkable so-called instincts displayed by animals could be accounted for in the same way, and when we came to analyse these instincts, we found them to be nothing more nor less than racial habits, transmitted from generation to generation, and acquired in a similar way to that in which the racial habits of mankind are acquired. Mr. Purnell then referred to the singular instinct of the huanaco, which, in the southern part of Patagonia, resorted to ancient dying places, whither all individuals inhabiting the surrounding plains repaired at the approach of death. Mr. Hudson, author of "The Naturalist in La Plata," attributes this practice to the possession by the huanaco of "a fixed immutable instinct, a hereditary knowledge, so that the young huanaco, untaught by the adults," goes alone and unerringly to the dying place. Mr. Purnell considered this an unwarranted assumption, and that it was a far more likely supposition that, if a young huanaco was *in extremis*, the older members of the herd expelled it from their ranks, as other sick or wounded animals are usually expelled by their fellows, and indicated to it whither it should go. Traditional and tribal memories, perpetuated by communication from old to young, would account for such habits as the hive-constructing habits of the bee and the domestic and military habits of the various species of ants, which were so commonly regarded as typical of the more wonderful development of instinct in the lower animals. The fact that many so-called instinctive acts were really the products of education and experience, did not clash with the view that animals might be and probably were born into the world with a hereditary predisposition to certain tribal habits which rendered instruction in those habits easier and more effective. The mental, like the bodily, structure of any individual animal was the sum and outcome of all its progenitors' faculties, and just as its bodily organisation was better fitted to perform certain acts than others, so its mental organisation was better fitted for certain mental operations than others. Body and mind were correlated and developed in unison. The web-building spiders secreted web-building material in their bodies, and possessed highly specialised organs enabling them to produce the material in such manner and quantity that it can be used in the construction of snares, and just as this specialised anatomical structure has gradually been evolved from simple beginnings, so the mental faculty required for the construction of snares has been evolved with it. The spider is, so to speak, endowed with mental as well as with anatomical spinnerets. If we eliminated all such habits as might have been acquired from teaching or observation, there were left comparatively few fixed habits of animals which, in the present state of our knowledge, could not be accounted for by the individual having received instruction from its fellows, or gained knowledge from its own observation, and it was to such habits that the author proposed to confine the term "instinct." For the purposes of this paper, he would call them "true instincts." These true instincts were found almost solely amongst insects. By way of illustration, he would take the case of the caterpillar of a butterfly (*Thekla*), which fed within the pomegranate, but when full-grown gnawed its way out, and then proceeded to attach with silk threads the point of the fruit to the branch of the tree, so that the fruit could not fall before the metamorphoses of the insect was complete. Here, there was apparently no means by which the caterpillar could receive instruction, since no visible intercourse took place between the butterfly whose offspring the caterpillar was and the caterpillar. In considering this problem, we must firmly grasp the fact that, although the caterpillar, the pupa, and the imago were, to outward seeming, three distinct animals, in reality they were but varying phases of the same animal. Therefore the insect possessed the power of inheriting memories We could understand how the memory of an inherited habit useful and common to one phase of the animal's existence, might readily be transmitted from the perfect insect to its offspring through the various stages of that offspring's existence. The order in which these memories were transmitted would be the order in which they would manifest themselves in the new life cycle. Did, then, the Thekla possess the power of transmitting the habit referred to? It appeared not unreasonable to suppose that such a habit might become (metaphorically speaking) so ingrained in the mental constitution of the animal as to be capable of transmission from parent to offspring. The life of an insect was short and monotonous, and its range of locomotion limited; its world was a small world; it enjoyed little scope for variation of habit, and its ways of life consequently tended to become stereotyped upon its mental system, and so transmitted from generation to generation. As the mental nature of the animal grew more complex, instincts became more rare, because the animal exercised more choice in its actions. The fact that the nervous system of the Invertebrata was materially different from that of the Vertebrata, was full of significance in this connection. Amongst true instincts he would class such acts of protective mimicry as those performed by the Phasmidæ; although their alleged practice of shamming death might possibly be constitutional lethargy, which had misled observers. The fear which young animals, including children, usually manifested towards what was really dangerous to them, might also be classed amongst true instincts; although recent experiments by Prof. Lloyd Morgan proved that the fear was not universal. Mr. Purnell next discussed Spalding's experiments with newly-born chickens, ducks, pigs, &c., which went to show that the young of these animals were capable of performing many acts, apparently intelligent, without instruction. It must be borne in mind that the young fowl, duck, or pig came into the world with its intelligence pretty fully developed, although it grew wiser as it grew older, and all the acts mentioned by Spalding were intelligent acts, not acts performed in an unvarying fashion, but acts varying with surrounding circumstances. He therefore concluded that these acts could not be attributed to instinct, but were directed by intelligence. What he had denominated "true instincts" suggested an analogy with reflex actions, but the analogy was fallacious. Singleness was of the very essence of a reflex action. The action might be complex in its manifestation, but it was essentially one act, of which active consciousness and reflex action were contradictory terms. A true instinct commonly involved a sequence of acts, directed towards a definite end, while the acts were consciously performed.

NEW SOUTH WALES.

Linnean Society, June 26.—Prof. T. W. E. David, Vice-President, in the chair.—(*a*) Notes on the Omeo Blacks; (*b*) on the Monaro Blacks, with a description of some of their stone implements; (*c*) a native burial-place, near Cobbin, Monaro, by R. Helms.—Descriptions of some new *Araneidæ* of New South Wales (No. 5), by W. J. Rainbow. Three new species of orb-weavers of the genus *Nephila* from New England and Sydney were described. The fact was recorded of a young bird (probably *Estrilda temporalis*) having been caught in a web of *N. ventricosa* in the vicinity of Sydney; also that Mr. A. J. Thorpe, of the Australian Museum, had seen an emu wren (*Stipiturus malachurus*) entangled in the web of one of the *Nephilæ* at Madden's, near Belle Plains (N.S.W.); also at Cape York, several of the blue warblers, notably *Malurus brownii* (Vig. et Hors.) and *M. amabilis* (Gould). It was pointed out that it is only young birds and those of weak wing-power that are arrested by such webs; and doubt was expressed as to the correctness of the assertion of some writers that birds so caught are devoured by the spiders. The author also pointed out that each web is placed in position by the unerring instincts of the spider, simply because the situation is such as will assure abundance of food in the shape of insects, and that it is merely an accident when a bird becomes entangled in the toil. The paper concluded with a description of the mode of coition in the *Nephilæ*, and a list of the previously described Australian species of the genus.—On the methods of fertilisation in the *Goodeniaceæ* (part ii.), by Alex. G. Hamilton. Eleven species of *Dampiera* were treated. Of these four are usually cross-fertilised by the aid of insects, but in the remaining seven while cross-fertilsation is possible by insect aid, yet self-fertilisation must occur more commonly.—On a new fossil mammal allied to *Hypsiprymnus*, but resembling in some points the *Plagiaulacidæ*, by Robert Broom. The remains described under the name of *Burramys parvus* are those of a small marsupial not larger than an ordinary mouse. The form is specially interesting in having but three true molars in each jaw; and a very large grooved premolar with serrate edge very similar to that found in the Eocene genus *Neoplagiaulax*. Its affinities were dealt with at some length, and an endeavour was made to trace its relationship phylogenetically.—On some new or hitherto little-known land shells from New Guinea or adjacent islands, by C. F. Ancey. Three new Papuan species, viz. *Hemiplecta granigera*, *Papuina tuomensis*, and *Pupina beddomei*, were described, and other known land shells from German New Guinea were discussed.—Plants of New South Wales illustrated. No. viii. *Acacia lanigera*, A. Cunn., by R. T. Baker. This is by no means a rare plant in New South Wales, and yet of the several descriptions that have been published from time to time, not one is sufficient in detail to accurately determine the species; in the specimens described in the Flora Australiensis the pod was incorrectly matched. The author gave the results of an examination of perfect material from many localities, and his paper should prove of assistance in the future in the elucidation of cognate species which at present are not easy of determination.—Description of a new species of *Acacia* from New South Wales, by J. H. Maiden and R. T. Baker.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten*, Part 2 for 1895, contains the following memoirs of scientific interest:—

February 9.—W. Voigt: Some applications of the thermodynamic potential. Franz Meyer: On the structure of discriminants and resultants of binary forms (second note).

February 23.—E. Ritter: On the representation of groups of functions by means of one base.

March 9.—J. Orth: On mucous tissue and myxomata, with special reference to the hydatidiform mole.

March 23.—A. von Koenen: On the relation of river-valleys to erosion and to the deposit of diluvial and alluvial formations. O. Mügge: On the plasticity of ice-crystals.

May 11.—O. Wallach: Researches from the University Laboratory of Göttingen. (1) On a method of preparing ketones; (2) on derivatives of piperonal (heliotropin); (3) the oxidation-products of terpinol; (4) the reduction-products of carbon. R. Dedekind: On an extension of the symbol $(\mathfrak{a}, \mathfrak{b})$ in the theory of moduli. E. Netto: On the structure of the resultants of binary forms.

BOOKS, PAMPHLET, and SERIALS RECEIVED.

BOOKS.—Traité de Mécanique Générale: H. Resal, Deux. Edtn. Tome 1 and 2 (Paris, Gauthier-Villars).—L'Arithmétique Amusante: E. Lucas (Paris, Gauthier-Villars).—Traité D'Arithmétique: C. A. Laisant et E. Lemoine (Paris, Gauthier-Villars).—Philip's Handy-Volume Atlas of the World: E. G. Ravenstein (Philip).—Philip's Systematic Atlas, School Edition: E. G. Ravenstein (Philip).—A Glossary of Greek Birds: Prof. D. W. Thompson (Oxford, Clarendon Press).—Descriptive Catalogue of the Spiders of Burma preserved in the British Museum: T. Thorell (London).

PAMPHLET.—Baby Buds: E. Ethelmer (Congleton, Mrs. W. Elmy).

SERIALS.—Engineering Magazine, August (Tucker).—Journal of the Anthropological Institute, August (K. Paul).—Strand Magazine, August (Newnes).—Himmel und Erde, August (Berlin, Paetel).—Sitzungsberichte der Physikalisch-Medicinischen Societät in Erlangen, 26 Heft, 1894 (Erlangen).—Journal of the Franklin Institute, August (Philadelphia).—American Journal of Science, August (New Haven).—American Naturalist, August (Philadelphia).

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