THURSDAY, JUNE 19, 1913.

MENDELISM AND STOCK-BREEDING.

The Principles of Stock-Breeding. By Prof. James Wilson. Pp. vii + 146. (London: Vinton and Co., Ltd., 1912.) Price 5*s.* net.

IN this volume Prof. Wilson claims "to deal with the problem of stock-breeding in the light of the Mendelian discovery." The book is addressed to breeders; for the sake of clearness it is shorn of many words common to the writings of the modern exponent of this branch of biological science, and it is clearly designed to stimulate the practical breeder to base the conduct of his business on Mendelian principles.

A book from the pen of Prof. Wilson is sure to command attention, and in this instance he brings abundant enthusiasm to help him in his task, and is full of hope for the future. We are not convinced, however, of the wisdom of the undertaking; neither scientific enthusiasm nor hope appeals forcibly to the practical man; he requires facts on which to base his work. The author himself demonstrates that very few facts applicable to the breeding of domesticated animals are yet to hand, and it seems to us that the time has not yet come when breeders as a whole can reap substantial benefit from the theory of Mendel.

The enthusiastic Mendelian may, perhaps, consider that he has effectively disposed of the opinion of many biologists that Mendelism has not yet been proved to be the main road, has merely been shown to be a side track alongside that road which leads to the solution of the mysteries of heredity and variation. But the practical breeder is aware of this scientific scepticism; he is even more difficult to convince than is the pure theorist, and we doubt if the examples of applied Mendelism which Prof. Wilson gives will serve to stimulate his belief in the practical value of that theory.

There are three main reasons why the application of Mendelism to stock-breeding is rendered difficult: time, cost, and trustworthy data. To-day we have a very meagre allowance of data, and the little we have is rarely trustworthy. In order to gain such data many years must pass, and many wealthy breeders must content themselves with the collection of facts which shall be recorded in great detail. This knowledge must be gained by exceedingly careful observation of the results obtained by breeding on a definite plan and on a large scale, and the records must be designed to embrace the conduct of a number of characters which may in themselves be exceedingly difficult to observe; and when the facts are known they must be applied.

The author gives an instance of such application. "Assume," he says lightly, "that sixty-four heifer calves are got, because this is the smallest number that will split into all the possible cases"; of these, only one can have the characters desired, and these characters can only be fully determined after the animal has grown up. But in order to get such a herd of heifer calves a much larger number must be bred; and suppose this heifer dies before she reaches maturity, or suppose she proves to be sterile! Is this a problem which is likely to attract any but a very rich and a very large breeder? One may grow wheat on an infinitely larger scale at a nominal cost, but the breeding of stock in sufficient numbers is a very different matter, as Raymond Pearl's experiments clearly show. It is true the author adds that "In practice such a number need not necessarily be bred, because from a smaller number the desired stock could eventually be raised." But he does not define what he means by "eventually," and it seems that the element of chance must have a large share in the calculation.

In the early part of the book, Prof. Wilson gives a lucid account of the old theories of stock-breeding. We scarcely think, however, that he does full justice to some of the experimental work done in those days, and cannot agree with some of the deductions he draws from his study of the subject; as, for instance, in the degree of attention paid by the old breeders to the part played by the sire, and, if we understand him aright, in the relation of artificial selection to evolution.

The chapter on the Mendelian theory and animals is another instance of the author's power of exposition. In spite of great difficulties, he has surely made this part of his subject clear to his readers. In doing so he has emphasised the fact that when you can apply Mendel's theory to observed phenomena you may thus obtain valuable knowledge of the forces which act in order to produce those phenomena, and he shows that to this extent you will gain a clearer view of their significance.

But if this is all the help Mendelism will give to breeders there will undoubtedly be much disappointment shown by those who have been led to expect that it will serve as a short cut to the production of improved breeds, and for the modification of special characters; that it will take the place of those laborious methods of selection hitherto practised by the few successful breeders—who are born with an eye for the detection of minute variations, and can afford to fail many times—and thus put success within the reach of all.

In our opinion, much more research and many practical experiments on a large scale are needed before a book on the practical advantages to be derived from Mendelian methods can, with advantage, be presented to breeders, since premature assertion of the utility of a theory tends to alienate the practical man, and to destroy his confidence in the value of science.

THE INDEXING OF CHEMICAL LITERATURE.

General Index to the Chemical News. Vols. i to c. Pp. 712. (London: *Chemical News* Office, 1913.) Price 2*l.*

IN compiling an index of chemical literature on anything like a large scale numberless difficult problems are encountered at the outset. The question as to whether authors and subjects should be divided or not is usually answered in the affirmative and with good reason. The inquirer generally knows whether he wishes to refer to an author's name or to some subject, and it is undoubtedly a help to be able to turn with certainty to one section or the other.

The mere alphabetical arrangement of authors' names would appear to be simple, but the greatest difficulty is often experienced if any effort is to be made to secure that individual authors are to be properly identified with their work.

An index of subjects offers even more problems to be considered. Over an extended period of years, changes of nomenclature are bound to occur, and the same compound is often described under two or even three synonyms. Is the indexer to record the names as they stand, or is he to use the modern name only, and index all older varieties or synonyms under that? In view of the fact that authors rarely know even the rudiments of nomenclature, and seldom consider whether it is correct to write, *e.g.*, caustic soda, sodium hydrate, or sodium hydroxide, it would appear that the only possible thing to do in such a case is to decide on "sodium hydroxide," and index all references to "caustic soda" or "sodium hydrate" under it. With organic compounds the case is much more difficult, but the point has, perhaps, been sufficiently illustrated.

The index under review is one that will be necessary to every reader of the *Chemical News*, and, indeed, will be useful to all chemists, giving, as it does, references to so many subjects, such as university intelligence, &c., which are found in perhaps no other chemical journal.

The advisability of putting authors and subjects together is a matter of opinion, but the searcher after names will turn over with some impatience the 35 pages which separate "Bonz" and "Booth."

The identification of certain authors—for example, "Mr. Brown" and "Dr. Schmidt"—must be difficult, as there are twenty-nine "Browns" and twenty "Schmidts." This, of course, illustrates a common failing of authors of not putting their full names to their papers.

The German "ü" is taken as "u" throughout. This, we believe, is the custom of the British Museum, but to mix up "Mullers" and "Müllers" is, in our opinion, obviously incorrect.

As regards the subjects the list of books reviewed, which occupies the thirty-five pages just mentioned, is very valuable, and so are the collected references to many other matters of general chemical interest, but it is really regrettable that some effort has not been made to avoid duplicate headings; this is the chief fault we have to find with the book. Under "acids" we have "chlorhydric" and "hydrochloric," "cyanhydric" and "hydrocyanic," "naphtholsulphonic" and "naptholic sulpho," "bioxybenzoic," "dioxybenzoic," and "dihydroxybenzoic," with no cross-references from one to the other. Entries are also to be found, again without cross-references, under acid, carbolic, and phenol, aldehyde, anisic, and anis-aldehyde, alizarin, nitro-, and nitralizarin, carbamide and urea, benzalacetophenone and benzylidene acetophenone, benzene, benzine, and benzol, carbon bisulphide, disulphide, and sulphide, and many others.

Cross-references there are indeed, but many are unnecessary; particularly "Amyl-diethacetate, cinn-. See Cinnamyldiethacetate."

In a work of this kind misprints are almost inevitable, but a little more care in the proof-reading might have avoided such mistakes as "alikali earth metals," "alsohols," "eperiments," "methylsalysilic," &c. J. C. C.

PETROLOGY AND BUILDING STONES.

(1) *The Petrology of the Sedimentary Rocks.* By Dr. F. H. Hatch and R. H. Rastall. With an Appendix on the Systematic Examination of Loose Detrital Sediments by T. Crook. Pp. xiii+425. (London: George Allen and Co., Ltd., 1913.) Price 7*s.* 6*d.* net.

(2) *Building Stones and Clay-Products: A Handbook for Architects.* By Prof. Heinrich Ries. Pp. xv+415+lix plates. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1912.) Price 12*s.* 6*d.* net.

(1) SINCE the days of Sorby much useful work has been done on the less-altered sedimentary rocks—by Hill, Jukes-Browne, and Hume,

for example, on the Cretaceous; Wethered on the Carboniferous; Hutchings on slates and other rocks, Millard Reade and Thomas on the Trias; Cayeaux on many formations, to mention a few only of the workers. Yet, on the whole, the petrological problems of sedimentary rocks have not attracted the attention of geologists with anything like the same force as those presented by the igneous rocks.

The reasons for this partial neglect are not far to seek. Most active, perhaps, has been the influence of the "path of least resistance." It has been much easier to make a brave show for a given expenditure of time and care on the petrology of igneous than on that of sedimentary rocks. Though many sediments, especially when much metamorphosed, may be studied in thin sections, the examination of less compact sediments requires the handling of a considerable bulk of material by somewhat tedious processes, as well as the application of a sound knowledge of the methods of mineral identification. Thus we find the fresher sediments passed over in favour of their most highly altered representatives, which have received a very large share of attention.

It is therefore a matter for congratulation that we have now, for the first time, a book (1) devoted to the petrology of the sedimentary rocks, and, further, that it is a companion to Hatch's "Text-book of Petrology," which has a well-earned reputation for lucidity of treatment.

The book is divided into two parts, the first dealing with the mode of formation and materials of raw sediments (employing this term in its widest sense, to include all but rocks of igneous origin), the second with their metamorphosed equivalents.

In the former the subject-matter is treated on familiar lines under the heads deposition in general, fragmental deposits, chemical deposits, organic deposits. The clastic sediments are graded according to the dimensions of their constituents, *e.g.* boulder and scree deposits, above 100 mm. diameter; gravel, between 2·5 and 100 mm.; sand, between 0·05 and 2·5 mm.; mud and dust, below 0·05 mm.

It seems a little unreasonable to describe the foraminiferal, pteropod, diatom, and radiolarian oozes with the fragmental deposits, while shell and coral formations appear in the organic deposits.

Here and there, as is usual in text-books, difficult ground is lightly tripped over; the explanation of the formation of "iron-pan" is not all that could be desired.

From fresh sediments the authors pass on to what they call the metamorphic derivatives, and follow Van Hise and many modern writers in the assumption that metamorphism must be taken to connote any change in the constitution of any kind of rock, through whatever agency. This is logical, no doubt, but "horse sense" is sometimes better than any amount of logic; by being so precise about the *literal* meaning of the word, its old-fashioned and quite useful significance has been destroyed. By their acceptance of this extended usage of "metamorphism," the authors stultify in a measure their own classification. Why should they trouble to separate the "sediments" from their "metamorphic derivatives" when they must be aware that the former are suffering, from the earliest moments of their formation, those very changes of constitution that produce the so-called metamorphism. There can be no unmetamorphosed rocks if metamorphism is what the authors say it is. However, coming to details, we find this subject treated under the heads contact metamorphism, regional metamorphism, cementation, metasomatism, and weathering. The "zone of cementation" is said to be permanently saturated with water-solutions, but we would point out that cementation may take place in the "zone of weathering," and, indeed, numerous examples are given in the book.

This volume contains little that cannot be obtained by the perusal of the larger general text-books; none the less, it will be a convenience to students to have the information in this handy form. In a new edition, which we hope will soon be required, we should like to see more illustrations of typical rocks as good as those in the present work; photomicrographs of metasomatic and other structures in limestones and series to illustrate progressive alteration in contact and regional metamorphism are specially to be desired. The value of this volume is greatly enhanced by the admirable appendix on the systematic examination of loose detrital sediments by Mr. Crook.

(2) Prof. Ries is as well known in this country as in the United States for his numerous and valuable works on clays. There is little that is new in his book on building stones and clay-products, but it is well produced, and compiled by an experienced hand; it will doubtless be appreciated by the United States architects, for whom it has been written. The viewpoint throughout is entirely American, as the following extract from the glossary will illustrate: "*Forest-marble*, an argillaceous limestone in which the colouring-matter is so disposed as to resemble forests."

OUR BOOKSHELF.

The Log of H.M.S. Encounter. Australian Station, 1910–1912. By Herbert Wilson. (London: The Westminster Press, 1912.)

IT may be more often than is generally known that a petty officer in his Majesty's Navy keeps a private log; it may be seldom that such a log sees daylight in the form of print; but it is approaching a unique occurrence when such a log is published in book form, and records in considerable detail a complete story of an eclipse expedition.

The particular log to which reference is here made is that of H.M.S. *Encounter,* covering the period 1910–12. In this period, which was her last commission on the Australian station, the total solar eclipse of April, 1911, occurred, and for that event she was placed on special service to assist the British and Australian expeditions; needless to say she did signal service on that occasion.

It may be remembered that Dr. W. J. S. Lockyer and the Rev. Father Cortie, S.J., were in charge of the British parties, while Mr. Baracchi was chief of the Australian contingent. All the parties went to Vavau, one of the islands of the Tonga group, but the British expeditions from England were conveyed from Sydney to their station by H.M.S. *Encounter.*

The author of this book is not only an excellent observer, but, further, he can commit his observations clearly to writing. The account of his experiences at the eclipse station is only one of many incidents which he records in an interesting manner in these pages. To take an example in other fields, he writes:—"We ran into a great storm area—great atmospheric disturbances. There were intermittent downpours of rain, accompanied by great rolls of thunder and most vivid lightning—in fact, a magnificent, typical tropical storm." Being a practical man, he further narrates: "We always take advantage of times like this to wash our dirty clothes in nice soft rain water." Halley's comet was first recorded by him in his entry of March 21 (1910), and he subsequently makes numerous remarks as to its appearance on different occasions.

This log is accompanied by numerous reproductions from photographs taken by his shipmates, and the volume forms not only a valuable memento to those who served through the commission with him, but an interesting survey of a petty officer's life on and off duty.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1913. Edited by Dr. J. Scott Keltie; assisted by Dr. M. Epstein. Pp. xcvi + 1452 + 10 plates. (London: Macmillan and Co., Ltd., 1913.) Price 10*s.* 6*d.* net.

"THE Statesman's Year-Book" with the present issue reaches its fiftieth year of publication, and by way of signalising this event certain new features are added which not only are appropriate to it, but also enhance the utility of the work. A number of statistics for the British Empire and for the other principal countries are furnished to afford comparison between the conditions of years about 1860 and of the present day. There is a semi-tabular retrospect of recent history. Certain comparisons covering the same period also appear under the individual headings of some of the countries. Map-work also plays an important part; there are maps, side by side, of each continent for the years 1863 and 1913; on some of these (*e.g.* Europe and America) the graphic representation of railway extension is perhaps the most noteworthy feature; from the maps of Africa we have evidence at a glance of the wonderful extension of exploration in the half-century. The year-book always deals exhaustively with the subject of defence, and we now have diagrams illustrating the "growth of displacement, horse-power, and speed of capital battleship types," and the "varying ratio between weight of heaviest gun, its penetrative power, and the protection afforded to ships," during the last fifty years.

It is scarcely necessary to say that the accustomed features of the book are maintained at their usual standard: the Franco-Spanish treaty is dealt with by means of both map and text, and in the same way the recent important extensions of Ontario, Quebec, and Manitoba are indicated. The introductory matter further includes a variety of valuable detail such as the substance of the treaty of Ouchy, a table of cases brought before the Hague tribunal, and material dealing with the naval and land defences of the British Empire. It is clear that in making up this book the problem of space is very carefully watched, and even the important additions mentioned here have not caused the volume to become unwieldy.

Cambridge County Geographies: Lincolnshire. By E. Mansel Sympson. Pp. viii + 193. (Cambridge University Press, 1913.) Price 1*s.* 6*d.*

DR. SYMPSON'S account of Lincolnshire is unusually interesting, and will appeal in many ways to scientific readers. The geology, natural history, climate, and peoples are all dealt with as fully as the limited space allowed. Honourable mention is made, among the distinguished men produced by the county, of Sir Isaac Newton, Sir Joseph Banks, and Sir John Franklin. Altogether the volume well maintains the high standard of the series.

Atlas Notes. By J. C. Chute. Pp. 82. (London: Humphrey Milford, Oxford University Press, n.d.) Price 1*s.*

"THESE notes are intended as a guide to a revision of the subject, for boys who have dabbled in its various departments and who now wish to make good their knowledge of the chief facts contained in a good political and physical atlas," says the author in his preface. If boys are set to study geography in school they should not be allowed "to dabble," but should be encouraged to work methodically and with all the thoroughness the time available permits. In that case the boys would themselves make the notes required for any future revision, which is better than having them already made.

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.]*

Pianoforte Touch.

I HAVE read Prof. Bryan's piano-player article in NATURE, and wish to congratulate him on seeing so early the wonderful capacity of the pneumatic player. I entirely agree with him. Long ago I have done work like his, though very crudely. Thus I always played with the *feet*, sitting on a pivoted swinging chair, and I constructed an arrangement in which, by means of two strings, I had some control of the touch. It was a partially successful attempt at most. I also fixed up a "dead stop" string operating a brake on the engine, by which pauses could be made at the proper places. I am sure Prof. Bryan's way is immensely superior.

It is very singular that some of the compound touch problems are of a transcendental nature. They cannot be solved by common, rigorous mathematics, but only by my new mathematics. At Prof. Perry's suggestion I made this a feature of one of my books. It was full of compound touch problems insoluble (so I was told) by rigorous mathematics, though the rigorous mathematicians cannot deny the results. It is because their ideas concerning functions are not broad enough. I have also been thinking about the theory, and think it will be more difficult than appears in Prof. Bryan's paper, because his touch variations are secondary to those of the player itself, due to the way the holes are cut and their overlap in the music-rolls. The results are sometimes not good. Another thing, I have considered the piano itself to be a rather imperfect instrument. We get used to its faults; is that any reason they should be made virtues?

I consider the piano-player does for music what the printing press did for books. But while, after reading a book once, you generally never wish to read it again, it is impossible to appreciate elaborate technical compositions without playing them over and over again. So there is something to be said for the playing by children and men even in the most mechanical and unintelligent way.

OLIVER HEAVISIDE.

A Peripheral Effect with X-Radiation.

WHILST repeating the now well-known experiments of Barkla, Laue, and others we have accidentally met with some remarkable effects upon which we should like to invite judgment. By inadvertence the edge of a piece of mica intercepted a direct beam of X-rays, and the recording photographic plate shows pronounced black and white bands along the X-ray shadow of the edge of mica. Further experiments with mica, glass, and metals also gave the effect, the edge of the shadow being bounded by a well-defined black band in the dark portion of the field with a light band in the lighter half.

An extended series of experiments was then made using lead foil cut into thin strips from one to five layers in thickness, mounted on glass, and placed in the direct beam of X-rays; no screen of any kind being employed, as was the case in the preliminary experiments. The distance of the photographic plate, placed behind and parallel to the mounted pieces of lead, was varied from 3 mm. to 5 cm., and that of the anti-kathode to the obstacle from 26 to 450 cm. Under these varied conditions of distance dark and light bands along the edges were obtained on the negative. The X-ray bulb had a fine focus, and exceedingly sharp X-ray shadows were obtained, especially at distances between 200 and 450 cm., a fact to which the observance of these bands is greatly due.

The width of the bands in these lead strip experiments is roughly 0·1 to 0·2 mm., but in the preliminary mica and glass experiments they were much broader, being about 0·5 mm. in width. These bands are distinctly visible under a low-power microscope, whilst under favourable conditions of illumination they are plain without artificial aid, and the same remarks apply to their prints. They are seen also when thrown upon a screen, and these facts seem to preclude the suggestion of their being contrast or optical effects, as was supposed by Haga and Wind in their well-known attempts to demonstrate diffraction. That they are not diffraction effects comparable with those of light is shown by their not varying appreciably in width as the photographic plate is varied behind the mounted strips of lead foil. Nor should these bands be confounded with those which appear upon the portion of the beam reflected from crystalline surfaces (which we also obtained), and have been described by de Broglie and Lindemann; although we are disposed to admit a possible physical connection.

Bands of similar width and appearance have been obtained with other metals, such as iron, zinc, copper, and aluminium, and in one case where an attempt was made to obtain direct refraction the white band appears between the transmitted and the direct beam. The apparent constancy of width and appearance under widely different conditions is a baffling point, arguing *prima facie* an optical or photographic effect. Yet against this is to be set the fact that so far mica and glass have given bands several times as wide as those from metals.

Attempts to vary the bands from metals by passing electric currents through them, and by high temperatures, have given so far negative results, though it may be desirable to mention the fact that in the latter case images of cold wires appear distinctly brighter in the negative. In one experiment, in addition to bands, a remarkable halo appears at a distance of 1·9 cm. from the image of the circular orifice in a metal screen. In another case a black band of approximately equal intensity to the image given by the direct beam appears surrounded by a white area, and in the same position, *i.e.* between the direct and reflected images. The fact that this band is black in the negative shows that the effect cannot be due to absence, in this position, of the generally scattered radiation which may have fogged the plate.

An explanation of grounds of halation, or reflection from the back of the plate, is, we need scarcely say, inconsistent with the accepted theory of X-radiation. The solution to which we may be reduced is that the bands are due to some edge or peripheral condition of the substance depending upon abrupt discontinuity of the media (mica, air), since a mere scratch or break in the surface does not produce the bands. Increase of density along the edges due to surface tension would appear to be of too small an order to account for the phenomenon. A subjective appearance of bands may invalidate some of the cases with metals, but in others (especially that with a halo suggestive of an X-ray spectrum) actuality is beyond doubt.

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Radium and the Evolution of the Earth's Crust.

IT is now well known that if the proportion of radium in the interior of the earth is the same as that in the surface rocks, the earth ought to be growing hotter, and the temperature gradient of the crust ought to be much higher than we find it. A simple calculation shows that a distribution of radium averaging 2×10^{-14} grams in each gram of rock throughout the earth would suffice to preserve thermal equilibrium. The amounts of radium actually found in the surface rocks are approximately as follows:—

Acid	3×10^{-12}	grams per gram
Intermediate ...	2	„ „ „
Basic	1	„ „ „
Ultrabasic ...	0·5	„ „ „

In addition to the elements of the uranium family, those of the thorium family must also be considered, for they afford an equally important supply of heat.

Prof. Strutt was the first to indicate the way in which the obvious dilemma might be escaped. In order that the earth should be nearly in thermal equilibrium (*i.e.* not growing hotter, but cooling at the very slow rate allowed by the radio-active elements as they decrease in quantity in accordance with their progressive disintegration), it is necessary to assume that the earth's store of radium is concentrated near the surface. As the following arguments indicate, this conception is less arbitrary than would appear at first sight. The radio-active elements are found most abundantly in the acid rocks, their more basic associates being less embarrassingly rich. The more acid rocks are characteristic of only the outermost zones of the crust, and there are many reasons for believing that with depth the more basic rocks largely predominate. Seismic and other terrestrial phenomena have now provided us with data from which the condition of the earth's interior may be deduced with some confidence. First, there is the crustal zone, rapidly becoming less silicic with depth, having a mean density of 2·8, and an approximate thickness of thirty miles. Within a fairly sharp surface of discontinuity comes what may be called the stony zone. The density is 3·4, and judging from the close analogy presented by meteorites, the material would be of ultra-basic composition. This zone dies out at a depth variously estimated at from 600 to 900 miles. The internal core of the earth is probably largely composed of iron, its density being about 8.

In a number of meteorites, the radium content has been determined by Prof. Strutt and the present writer, and if it may be assumed that they afford a clue to the problem, the heavy metallic core should be completely destitute of radium, and the stony zone should contain only a small proportion, very much less than that of the ultra-basic rocks of the crust.

On the planetesimal hypothesis, the two internal zones find a ready explanation. It is supposed that the earth began as a nebulous knot, and that it has grown up to its present mass by the capture of associated planetesimals. It is very unlikely that as a whole it was ever in a molten condition. Internal heat probably arose largely from the condensation of the mass during the period of its growth. The temperature would slowly rise until the fusion point of certain of the constituents was reached, and the liquid tongues and pockets thus formed would tend to move away from the centre, the lighter and less viscous stony material being squeezed outwards relatively to a network of the heavier and more rigid metallic materials. Once vulcanism had been initiated in this way, the process would continue until a highly metallic nucleus had collected. Surrounding it there would gradually form a thick zone of silicate rocks, the differentiation from the original heterogeneous mixture of stony and metallic constituents being due to the selective fusion of the former. There seems to be little doubt that the radio-active elements would be concentrated in the stony zone. With the establishment of ocean and atmosphere, a new factor in surface differentiation arose, and sedimentary rocks were deposited for the first time. In some way which, as yet, we understand but vaguely, both igneous and denudational differentiation then combined in developing the earth's crust. We now find in the latter all those rocks which hold a maximum content both of silica and of the radio-active elements. The relative concentration of these constituents having taken place at the expense of the zone below, the conjectural paucity of the latter in radium finds a suggestive explanation.

Before the advent of radium, geologists had not recognised the difficulties presented by the peculiar chemical constitution of the earth's crust. Radium did not create this difficulty, but has merely directed attention towards it. Any explanation of the high percentage of silica in the surface rocks will explain equally well their richness in radium.

It can scarcely be said now that radium has given us "a blank cheque on the bank of time." Not only did the discovery of radium destroy the validity of the older thermal arguments, but also it led directly to the elaboration of a new and more refined method. Every radio-active mineral may be regarded as a self-contained hourglass, the radio-active end-products, helium and lead, slowly accumulating at the expense of their ultimate parent, uranium. In the few cases which up to the present have been investigated, periods of enormous duration have been revealed, and the geologist who ten years ago was embarrassed by the shortness of the time allowed to him for the evolution of the earth's crust is now still more embarrassed by the superabundance with which he is confronted. The time scale up to date, as determined by the lead ratio, is as follows:—

Carboniferous	340	million years
Devonian	370	„
Ordovician	430	„
Algonkian	1000	„
Archæan	1300 to 1600	„

We must not moan over the apparent difficulties with which the geologist has been faced since the advent of radium. Rather should they be welcomed in that they open the way for further advances. If at present some of our ideas are mutually incompatible, the discrepancies do not demand a wholesale rejection of the facts, but simply a re-interpretation of the fundamental hypotheses on which so many of our doctrines seem to hang.

ARTHUR HOLMES.
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An Amphipod Invasion.

MANY specimens of a small amphipod crustacean, *Euthemisto compressa*, Goës, have been forwarded to me by Mr. T. H. Nelson, of Redcar. On May 23 and 24 these were washed ashore in incredible numbers on the coast of Yorkshire, where they lay from Saltburn to Teesmouth—a distance of ten miles—in drifts several inches deep. The pools were alive with the crustaceans, and to the east of Redcar a fisherman was seen raking them into heaps, and wheeling away barrow-loads to put on his garden as manure. In the sea hundreds at a time could be scooped up in one's hands.

Euthemisto compressa is an uncommon British

species recorded sparingly from a few localities, but off Redcar it occasionally appears in extraordinary shoals in springtime. Such visitations have occurred previously in the second week of February, 1892, April, 1907, and April 2, 1908. In general the creatures come ashore after a N. or N.E. wind, but on the present occasion a gentle westerly wind had prevailed for a few days. I should be glad to receive information from naturalists or fishermen who may have observed these minute "shrimps" about the same date, on other parts of the coast or in the open sea, so that knowledge may be gained of the full extent and of the provenance of the shoal.

JAMES RITCHIE.

Royal Scottish Museum, Edinburgh.

New Zealand Vegetation.

IN NATURE for April 10 (p. 147), under the title "New Zealand Vegetation," I notice the following sentence:—"The northern rivers and estuaries display a mangrove vegetation—a unique and unexpected occurrence outside of the tropics."

The writer of the article is evidently not aware that mangrove formations are found at intervals all round the coasts of Australia. The species which forms them is *Avicennia officinalis*, L., which occurs in all the Australian States, but not in Tasmania. It reaches its southerly limit in Western Australia in the neighbourhood of Bunbury (33½° S.), where the trees reach a height of about 12 ft. On the east coast it is most familiar on the shores of the Parramatta River in Sydney Harbour, which is a little further south than Bunbury, but it occurs so far south as Corner Inlet, on the east side of Wilson's Promontory (39° S.). This southernmost point of the Australian continent is one degree further south than any point on the north coast of the North Island of New Zealand.

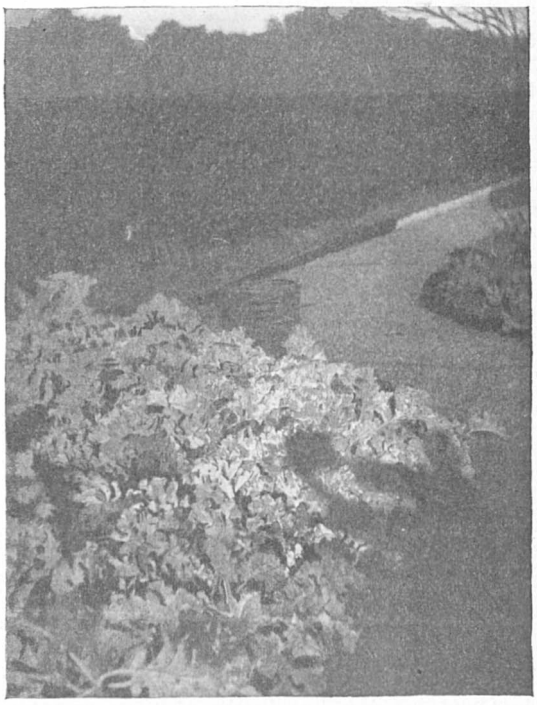
W. B. ALEXANDER.

The Western Australian Museum and Art Gallery, Perth, Western Australia, May 10.

I FEAR that in attempting to compress into a few paragraphs a general sketch of the plant communities of New Zealand I inadvertently conveyed the erroneous impression concerning the distribution of the mangrove vegetation in Australasia which Mr. W. B. Alexander has corrected in his interesting note. The sentence which he quotes is perhaps less misleading if read in connection with that immediately preceding it, and containing the statement upon which I wished to lay chief stress in enumerating the main types of New Zealand vegetation—"to find an equal variety a continent extending to the tropics would have to be visited." I was quite aware of the well-known fact that the eastern or Indo-Malayan mangrove flora, well developed on the northern littoral of Australia, extends in an impoverished form along the eastern and western coasts southwards, though it is interesting to note that it actually reaches the most southerly point of the Australian continent. It may be added that Prof. Bews (Annals Natal Museum, ii., 1912, p. 297) has recently described what appears to be the most southerly extension of the mangrove vegetation on the opposite side of the Indian Ocean, in Durban Bay; here, as in the subtropical and warm temperate parts of Australasia, the rich eastern mangrove flora is represented by an interesting though poorly developed outlier consisting of *Avicennia officinalis*, *Bruguiera gymnorhiza*, and *Rhizophora mucronata*. F. C.

Anthelia.

IN connection with the correspondence in NATURE on the bright light on dew round the shadow of one's head, the accompanying photograph, which shows the phenomenon on dew on seakale, may be of interest. It was taken here on October 7, 1899, at 8.35 a.m. It shows the shadow of the camera, so that in spite of the irregularity of the leaves the radius of the



bright light is easily measured as nearly 8°. The scale of the photograph is 8·5° to the inch.

T. W. BACKHOUSE.

West Hendon House, Sunderland, June 10.

Antennæ for Wireless Telegraphy.

I WAS interested to see Mr. Campbell Swinton's letter on wireless receiving with his bedstead as an aërial. Many of the more powerful stations are, however, much easier to receive than is generally supposed; for instance, I have been able to read the Eiffel Tower nine o'clock news message with only 12 ft. of No. 18 S.W.G. copper wire stretched across my attic (second floor, about 25 ft. from the ground) using good earth to waterpipes, with usual tuning coils and condensers, bornite-zincite detector, and very sensitive 4000 ohm telephone (H. W. Sullivan), without any relay. Even when the aërial was reduced to 6 ft. of wire the signals were just audible, but very faint. ARNOLD G. HANSARD.

Limpsfield, Surrey, June 10.

SOME months ago, in endeavouring to reduce the antenna to the smallest possible dimensions, such as by placing a series of wires just over the instruments, I found that by using a bedstead (without wire mattress) signals of "strength 8"—*i.e.* moderately loud—could easily be obtained from Paris *without the aid of a Brown relay*—a costly instrument, reputed to increase the strength of signals five times. The apparatus used was simply the orthodox loose coupling with crystal detector. The bed used is on the second floor of my house, about 20 ft. from the ground, and the gas-pipe below the same floor served as an earth connection.

Under the same conditions Norddeich is usually readable, and sometimes Poldhu and Nauen. That nearer stations are also heard is obvious.

I should be pleased to give a demonstration of

reception by means of this same bedstead as the antenna to anyone interested.

BENJAMIN S. T. WALLACE.
113 St. James Road, Upper Tooting,
London, S.W., June 16.

Sub-Red Crag Flint Implements and the Ipswich Skeleton.

I WOULD like Mr. Sutcliffe to read p. 199 of vol. i., part ii., Proceedings East Anglian Prehistoric Society, which contains the original description of the discovery of the Ipswich man. I think it would have been better if he had done this before publicly accusing me of inconsistency in regard to this matter.

J. REID MOIR.

THE OXYGEN CONTENT OF THE ATMOSPHERE.[1]

THIS memoir, published under the auspices of the Carnegie Institution of Washington, is of a type with which we are becoming increasingly familiar—a publication, in fact, which, it may be argued, the institution was created largely to undertake. None of the regularly constituted scientific societies would probably charge themselves with the issue of such a work, and it is very unlikely that it would see the light if left to private enterprise. Nevertheless, it is an eminently useful work, and will be welcomed by chemists, meteorologists, and physiologists alike.

The work is divided into two parts. Part i. is wholly concerned with an historical account of the development of the methods for determining oxygen, in which practically everything contained in the literature has been put together and collated, from the days of Scheele and Priestley to those of Regnault and Bunsen, von Jolly and Morley, down to the methods of our own time depending upon purely absorptiometric processes. Naturally there is nothing very original in this section, and it is well-trodden ground to all who are familiar with the development of eudiometry. It is, however, an interesting and useful compilation, and will be of service to those who are concerned with accurate gasometric analysis, especially in relation to the atmosphere, or who desire to know all there is to know relating to its history.

The second and more immediately important part deals with the experimental work of the nutrition laboratory of the Carnegie Institution, Washington, of which Prof. Benedict is the director.

For some time past the nutrition laboratory has been engaged, among other things, in an elaborate inquiry into the nature of respiratory exchange in relation to metabolic processes, and the necessary instrumental equipment has now been brought to a very high degree of precision. After a careful investigation into the merits of the various types of modern absorptiometric apparatus, it was decided that the arrangement devised by Dr. Klas Sondén, of Stockholm, a development of the apparatus originally contrived some years ago by Prof. Pettersson, more fully fulfilled the essential conditions of expedition, convenience and accuracy than any other existing form; and part ii. is practically made up of a description of the Sondén air-analysis apparatus, illustrated by photographs and woodcuts, together with an account of the plan and methods of research to be undertaken by it, with the results which have been obtained up to the date of publication of the report.

The principle of the apparatus is essentially that of the original Pettersson instrument, in which the absorption and determination of the carbon dioxide and oxygen are made, as in the Hempel, Orsat, and Haldane arrangments, by means of caustic potash and alkaline pyrogallate, but with the use of water-jackets and compensating pipettes so as to ensure much greater accuracy of reading.

The plan of the research involved (1) the estimation of the comparative oxygen-content of uncontaminated outdoor air under all conditions as to wind direction and strength, temperature, cloud formation, barometer and weather, including rain, snow, fog and mist; (2) a study of the influence of the temperature of the reagent upon its absorptive power; (3) an examination of the air over the North Atlantic Ocean; (4) on the summit of Pike's Peak; (5) in the crowded streets of Boston and in the subways of New York and Boston.

Such a programme necessitated a very large amount of experimental work and the analysis of many hundred samples of air. In addition, a large volume of work was needed in control and verification, and especially in tracking down and eliminating sources of possible error. Eventually a routine method was established, and from a long series of determinations it would appear that, as regards oxygen content of outdoor air, no material fluctuation could be detected over a period extending from April, 1911, to January, 1912. This constancy was maintained in spite of all possible alteration in weather conditions, barometric or thermometric changes, or changes in humidity, wind direction, and strength; furthermore, the experiments were made before, during, and after the vegetative season. The average result of 212 analyses showed 0·031 per cent. of carbon dioxide and 20·952 per cent (corrected) of oxygen. Hence Dr. Benedict concludes "that air is a physical mixture with the definiteness of composition of a chemical compound." We have, in fact, got back to the position maintained by Cavendish in 1783 and by de Marli in 1787, that is, of the uniform constancy of the composition of normal atmospheric air, so far as regards its oxygen content.

Prof. Benedict further concludes that—

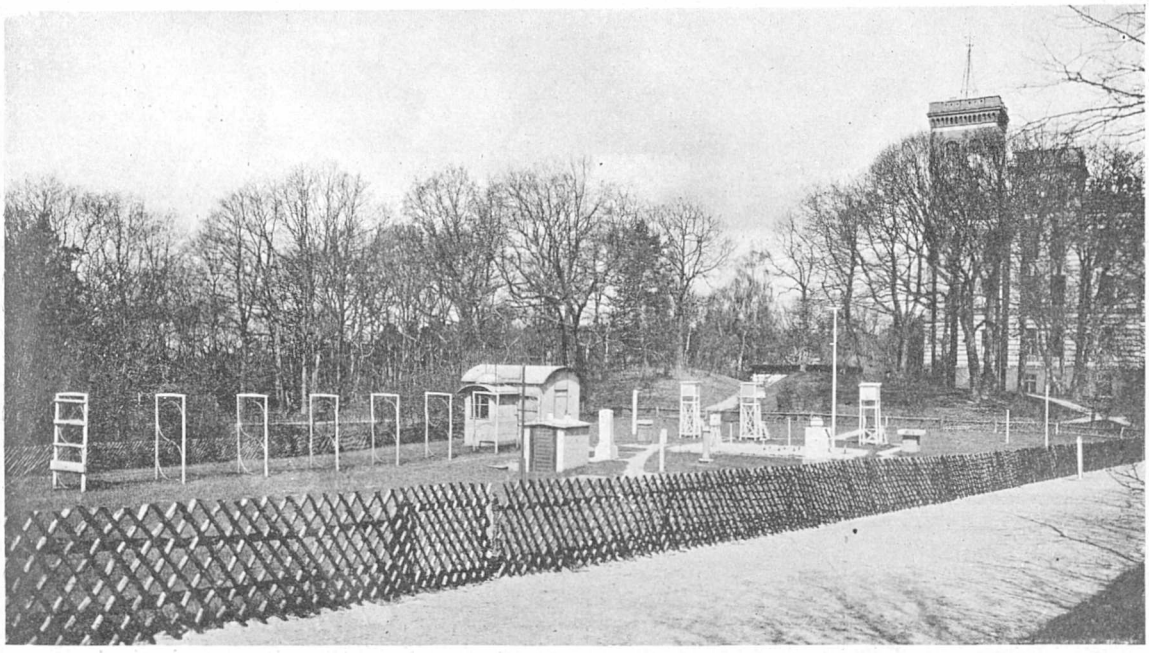
While the combustion of fuel and the vital processes of men and animals result in a local increase in carbon dioxide and decrease in oxygen on the one hand, and vegetable growth results in a decrease in carbon dioxide and increase in oxygen on the other, the extraordinary rapidity with which the local variations in the composition of the air are equalised is accentuated by the observations on street air, which show but the slightest trace of an oxygen deficit.

[1] "The Composition of the Atmosphere, with Special Reference to its Oxygen Content." By F. G. Benedict. Pp. iii+115. (Washington, D.C.: arnegie Institution of Washington, 1912.)

The interdependence between the amounts of carbon dioxide and oxygen is so constant that carbon dioxide estimations made in the Sondén apparatus may be taken as an accurate indication of oxygen content. For every 0·01 per cent. increase in atmospheric carbon dioxide, a corresponding decrease in the percentage amount of oxygen may be safely assumed. T. E. T.

THE POTSDAM METEOROLOGICAL AND MAGNETIC OBSERVATORIES.[1]

THE volume referred to below gives a lucid description of the observatories at Potsdam, compiled by Profs. Suring and Schmidt, who are in charge respectively of the meteorological and magnetic departments. A preface by Prof. Hellmann, the director of the Royal Prussian Meteorological Institute, to which the observatories belong, states that the book is primarily intended for the benefit of those studying at or visiting the observatories, the number of visitors being now large. The text describes the buildings and instruments, while reference is made in footnotes to many researches associated with the place. Thirty-one figures supplement the descriptions of buildings and instruments in the text, and a plate gives a ground-plan of the whole site.



Observation enclosure of the meteorological and magnetic observatories at Potsdam.

The construction of the magnetic observatory began in 1888, and that of the meteorological observatory in 1890, so that the buildings are all modern. The equipment is also modern and exceedingly complete. The site on the Telegraphenberg, a wooded hill on the outskirts of Potsdam, might be criticised by some meteorologists, but it possesses much natural beauty, and the proximity of the astrophysical and geodetic observatories—also situated on the Telegraphenberg—admits of the ready exchange of ideas amongst a number of men of science, each an expert in his own subject. The figure reproduced shows the enclosure devoted to meteorological instruments, especially those recording air and earth temperatures and rainfall. The small building in the corner is devoted to atmospheric electricity. In the background is the main meteorological building, a very large and handsome structure. Its basement contains *inter alia* a physical and chemical laboratory, a photographic dark-room, a workshop, electrical generating apparatus and storage batteries.

On the ground-floor are various rooms for meteorological work, including a large room containing the barographs and other recording instruments. Most of the remaining space under the roof serves to provide accommodation for the resident staff and the director of the Meteorological Institute, but it includes a library and a conference chamber. The roof is flat and surmounted by a low and a high tower, the former devoted to optical and cloud-measuring apparatus. The large tower rises to a height of 32 metres above ground-level. A staging on the top of it carries various wind-measuring apparatus, including a Robinson anemometer, the cups of which are 40·8 metres above the ground and surmount all other objects on the Telegraphenberg.

There are two chief magnetic buildings, the larger about 100, the smaller about 150 metres from the meteorological building. The former contains two sets of magnetographs, in a basement maintained at a nearly constant temperature throughout the year; the latter is devoted to absolute observations. In view of electric-tram disturbances in Potsdam—though these are still exceedingly small—a new magnetic observatory

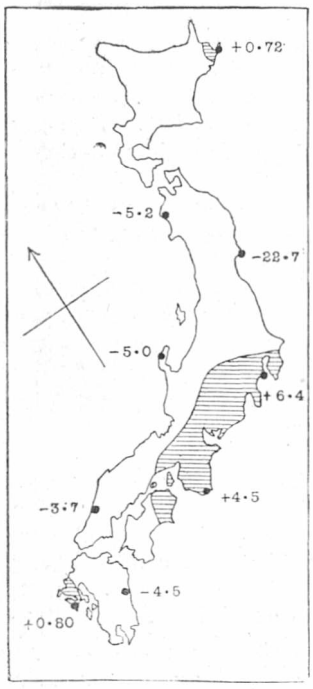
[1] "Meteorologisch-magnetisches Observatorium bei Potsdam." Pp. 67+ plates. (Berlin: Behrend and Co., 1912.) Price 3 marks.

was built in 1906 at Seddin, about 12 kilometres south-west of Potsdam. Magnetographs are now in operation there as well as at Potsdam under the Potsdam staff. A description of the Seddin buildings and instruments is thus included.

The volume contains much of interest to all meteorologists and magneticians, and is admirably suited for the purpose for which it was primarily intended. A previous study of it will double the advantages of a visit, while subsequent consultation will recall memories of a most pleasant and profitable experience. C. CHREE.

RECENT SEA-LEVEL VARIATIONS IN JAPAN AND ITALY.[1]

IN a valuable memoir, Prof. Omori deals with the variations in the height of the sea-level at nine mareograph stations in Japan from 1898 (in a few cases from 1894) to 1910, referred to in a note in NATURE of December 26, 1912 (vol. xc., p. 471). They are greatly in excess of any changes that might be due to variations of barometric pressure or air-temperature, and the effects of wind are probably negligible. These variations being allowed for, there remain considerable changes in the mean annual height of the sea-level at all nine stations, the greatest being a decrease in height of 22·7 mm. per year at Ayukama. In the accompanying sketch-map, the shaded areas represent the parts of Japan which are now subsiding, the boundaries inland being determined by interpolation. The figures at the different stations denote the mean annual rise or fall of the sea-level in millimetres per year. It is on the east side, to which the present depressions are chiefly confined, that the greatest depths of ocean lie and the most violent earthquakes originate.



Prof. Omori also compares the variations in the average height of the sea-level in the whole of Japan (the barometric and temperature corrections being made) with the variations in the latitude of Tokyo and Mizusawa for each year from 1895 to 1910. The curves representing both variations show a remarkable correspondence. The average height of the sea-level was greatest in 1899 and 1905–06, and least in 1897 and 1902; the latitude was a maximum about 1899–1900 and in 1906, and a minimum in 1897 and 1902. Corresponding to a variation of 0·1″ in the latitude, there was a change of 40 mm. in the height of the sea-level.

The examination of the records at seventeen mareograph stations in Italy and Austria from 1900–08 shows that in all parts of Italy the height of the sea-level was decreasing by amounts ranging from 10·5 mm. per year in the neighbourhood of Pola and Ancona, to between 4 and 5 mm. per year at Naples and Messina and less than 2 mm. per year at Palermo. In 1908 the mean sea-level reached a well-defined minimum, and Prof. Omori suggests that this may have been a secondary cause of the Messina earthquake at the close of that year.

C. D.

[1] F. Omori: (1) "On the Recent Sea-level Variation at the Different Japanese Mareograph Stations" (Bull. Imp. Earthq. Inv. Com., vol. v., 1913, pp. 39–86). (2) "Note on the Recent Sea-level Variation at the Italian and Austrian Mareograph Stations, and on the Cause of the Messina-Reggio Earthquake of 1908" (*ibid.*, pp. 87–100).

NOTES.

A STATUE of Lord Kelvin, which has been subscribed for mainly by the public of Belfast, is to be unveiled to-day (Thursday) in the Botanic Gardens, Belfast. The Chancellor of the Queen's University, Belfast (the Earl of Shaftesbury, K.P.), will preside, and Sir Joseph Larmor, M.P., F.R.S., will perform the unveiling ceremony, and deliver an address. The statue is the work of Mr. Bruce Joy. Invitations to the ceremony have been issued to the Lord Mayor and Corporation of Belfast, to the Senate and professors of the Queen's University, Belfast, and to a number of leading men of science.—The statue of Lord Kelvin erected by the contributions of his fellow-citizens in Glasgow and the west of Scotland has been placed in position by the side of the new Kelvin Avenue, which traverses the Kelvingrove Park beneath Gilmorehill, close to the University of Glasgow. The statue will be unveiled on October 8 next, by the Right Hon. A. Birrell, Lord Rector of the University, and an address on Kelvin will be subsequently delivered by the Right Hon. A. J. Balfour, Gifford lecturer in the University.—The Kelvin memorial window in Westminster Abbey will be unveiled on July 15.

IT is with deep regret that we have to announce the death, from spleno-medullary leucæmia, of Prof. N. H. Alcock, Joseph Morley Drake professor of physiology in McGill University, Montreal. Prof. Alcock was born in 1871, and received his medical education at Trinity College, Dublin, and Sir Patrick Dun's Hospital. He graduated as B.A. and M.D. in Dublin University in 1896, taking senior moderatorship and gold medal in natural science. He was shortly afterwards appointed demonstrator of anatomy at Victoria University, Manchester. In the following year he was appointed assistant professor of physiology in Dublin University. In 1903 he became demonstrator of physiology at London University, and in the following year he succeeded Dr. Waller as lecturer in physiology in St. Mary's Hospital Medical School, Paddington. In 1909 he obtained the degree of D.Sc. of London University in consideration of his researches

on the influence of anæsthetics on nervous phenomena. In 1911 he was appointed to the chair of physiology at McGill University, Montreal. By his early death British science has lost a valuable worker. His experimental work was always most scrupulously verified by every possible control, and he took extraordinary care to reduce experimental error to a minimum. Among his numerous scientific publications were papers concerning "Irish Bats," "The E.M.F. of the Negative Variation of Various Nerves, especially the Vagus," "The Velocity of the Nervous Impulse in Tall and Short Individuals," "The Relations between the Physical, Chemical, and Electrical Properties of the Nerves," "A Text-book of Experimental Physiology" (conjointly with Dr. F. O'B. Ellison), "Accurate Dosage of Chloroform by Means of a Regulating Inhaler," and many others. Prof. Alcock married, in 1905, Norah Lilian Lepard, daughter of Sir John Scott, K.C.M.G., and leaves his widow, one son, and three daughters to mourn his loss.

MR. A. R. HINKS, F.R.S., chief assistant at the Cambridge Observatory, and University lecturer in surveying and cartography, has been appointed assistant secretary of the Royal Geographical Society.

THE new wing of the laboratories of the Rothamsted Experiment Station, Harpenden, will be opened by the Right Hon. W. Runciman, President of the Board of Agriculture, on Friday, June 27, at 3.30 p.m.

THE death is announced, in his sixty-fifth year, of Mr. F. A. Ober, one of the best known of American ornithologists. In the interests of his favourite pursuit he had travelled extensively in South America, Mexico, and the West Indies. In the Lesser Antilles, in particular, he discovered twenty-two new species of birds, and added many types to the collections of the Smithsonian Institution. Mr. Ober wrote largely for the newspaper press, and was the author of forty books.

ON June 5 the faculty of science of the University of Geneva erected a bust to the memory of Pierre Prevost (1751–1839), the Geneva man of science whose name is remembered by Prevost's theory of exchanges. Prof. C. E. Guye presided at the ceremony, and most of the learned societies with which Prevost was associated sent delegates, or addresses of congratulation. M. G. Lippmann represented the Paris Academy of Sciences, and delivered an oration. The Royal Society and the Royal Society of Edinburgh were represented by Dr. W. H. Young, F.R.S., and Mr. Mitchell respectively, who presented addresses in English. The Berlin Royal Academy of Sciences sent a letter of congratulation signed by Prof. Planck.

A TIDAL observatory has recently been constructed by the Ordnance Survey at the foot of the Castle Rock at Dunbar, and is now fitted with a self-recording gauge and other instruments. The main object is to obtain an accurate value for a mean sea-level datum on the open North Sea coast to which the network of geodetic levelling in Great Britain can be very precisely connected. Such an accurate determination is required for the measurement of relative movements of land and sea along our coasts, an object recommended some years ago by the Tidal Commission on Coast Erosion. Incidentally light may be thrown upon slow vertical movements of the earth's crust, periodic coastal movements due to tidal load, and upon the tidal phenomena of the North Sea generally, with their relations to hydrological and meteorological changes taking place in and over the neighbouring oceans. In this country the existing tide-gauges fulfil comparatively rough requirements in harbours not truly representative of open ocean conditions, and there can be no doubt of the importance for scientific purposes of having well-placed observatories on open coasts and capable of being rigorously connected with the network of geodetic levelling.

The Cape Times of May 7 contains an interesting article strongly advocating the founding of a national botanic garden at the Cape. Matters have already gone some distance in this direction, and the Kirstenbosch estate, which is Government property, has been mentioned as an appropriate site. In the interest of South Africa, no less than of scientific botany, it is sincerely to be hoped that this project may be successfully carried through. A view which has been put forward by certain influential people in South Africa is that the garden should be placed under the control of the Agricultural Department rather than that it should be more directly attached to the South African College, and through it to the scientific botanical staff. This view, however, is one which demands, and doubtless will receive, very careful consideration. A botanic garden which is not under scientific direction can have very little value, and it is to be hoped that, in the interests of South Africa generally, this principle will not be lost sight of in determining the nature of the body which is to be responsible for its proper administration. The problems to be solved are mainly scientific, but from their successful solution there may be expected to accrue results of value not only to science but also of great economic importance to the community at large.

A LARGE number of distinguished physiologists, biologists, and medical men have signed a letter addressed to the Home Secretary directing attention to the scientific aspects of the administration of the Mental Deficiency Bill. The signatories desire to secure the continuous prosecution of research into the conditions on which mental deficiency depends, and into the means by which it might be remedied or prevented. They point out that it may be said, in a general way, that the conditions in question must be due either to defective formation and development of the active structures of some portion or portions of the brain, or to defective formation or supply of the fluids by which these structures are surrounded, and by which they are stimulated to activity. For example, one common form of idiocy is consequent upon the absence from the blood of the secretion which should be furnished by the thyroid gland, and may be remedied by the administration of thyroid extract derived from lower animals. The Mental Deficiency Bill will probably bring together many of its subjects into institutions controlled by the State, and supported by

the public. It is therefore urged that the facilities for scientific study which such institutions would afford should be fully utilised for the general benefit of the community, and that the duty of so utilising them should be committed to men of science, fully conversant with all that is already known in relation to the subject, and able to point out the directions in which further inquiry should be pursued. It is suggested that the objects in view could scarcely be obtained except by an adequate representation of biological science upon any Commission to which the administration of the law may be entrusted.

IN an interesting paper published in the *Biologische Centralblatt* (vol. xxxiii., No. 3), under the title "The Occurrence of Dextro-rotatory Albumins in Organic Nature," Dr. John Beard has developed the idea, published in 1907, that the albumins of cancer and of malignant tumours in general must be dextro-bodies because of the destructive action, ending in liquefaction, of active pancreatic ferments, especially trypsin, upon them. He now shows that asexual generations of animals such as Hydra, Cordylophora, Trichodina, Vorticella, Carchesium, Amœba, Actinosphærium, and Stentor are rapidly killed and digested by pancreatic ferments (trypsin and amylopsin), and hence concludes that such asexual forms are built up of dextro-proteins; on the other hand, sexual generations such as Daphnia, Nauplii, Planaria, Nais, and Melicerta are not in the least affected by these enzymes, and are therefore probably built up of lævo-albumins. In a striking generalisation, Dr. Beard contends that "the micro-organisms, bacilli, &c., of disease are of necessity composed of compounds which are stereochemical antitheses of those making up the normal human body, and that when compared similarly with the pancreatic ferments, the like is true of the ferments by means of which they effect their ends. Only by means of such antithetic or opposite characters of compounds and of ferments produced by them could such disease-inducing organisms bring about their ravages." The natural method of treatment is therefore to employ against them the ferments produced by the organisms, such as mankind, which are their victims, and of these by far the most potent are the pancreatic enzymes, trypsin and amylopsin.

THE transference of the Northern Territory of Australia from South Australia to the Commonwealth has been followed by the more active investigation of the country and its resources. Fresh effort is recognised as necessary, for the total population, exclusive of aborigines, has fallen from 4788 in 1891 to 3005 in 1910. An expedition, consisting of Prof. Spencer, Prof. Gilruth (who has since been appointed Administrator of the territory), Prof. Woolnough, and Dr. Breinl (director of the Australian Institute of Tropical Medicine), visited the country in 1911, and their preliminary reports have been published as Nos. 1 and 1*a* of the Bulletin of the Northern Territory. Prof. Woolnough reports that he was much impressed with the mineral wealth of the country, but as the deepest mine is under 400 ft. in depth he recommends that a shaft should be sunk further in order to determine the extension of the deposits in depth. Prof. Gilruth reports on the domestic animals in the territory, and discusses the source of the two prevalent cattle diseases, red water or tick fever, and worm nodules. He concludes that they were introduced from Java in 1872. The red-water fever has spread from the Northern Territory to Queensland. He concludes that under the conditions that have hitherto prevailed the satisfactory development of the country could not be expected, but with a better system of administration and more reasonable land tenure the country possesses unlimited possibilities. Dr. Breinl describes the diseases prevalent amongst both the Europeans and aborigines. He gives full tables of the health statistics available. Malaria is widely spread, and was probably introduced from New Guinea; it is distributed by a mosquito, *Nyssorhynchus annulipes*. Dr. Breinl believes that malaria could be controlled by proper methods. He finds that the white people living under active conditions have good health, and the hæmoglobin content of the blood in children is normal. The population is, however, too small for its evidence to show whether the country can be developed by white labour.

The Museum Journal, of Philadelphia, in its last issue, records the purchase from members of the punitive expedition to Benin of a fine series of brasses and ivory carvings. Of the former class the more important specimens are two bronze heads, said to be portraits, with remarkable head-dresses and a high neck ornament, in one case rising as high as the lower lip. On heads like these the carved ivory tusks, which were apparently objects of veneration, are said to have been placed. A large bronze plaque represents a high official, wearing the same type of necklet, and standing surrounded by his attendants and slaves. Another fine exhibit is a pair of bronze cocks, about life-size, with chiselled feathers and the eyes inlaid with iron.

WE have to acknowledge the receipt of No. vi. of Dr. Koningsberger's "Java," which is chiefly devoted to the fauna of the Bouwland.

TO the author, Mr. H. Schmidt-Jensen, we are indebted for a copy of a paper, from *Vidensk. Meddel. fra Dansk. naturh. Foren*, vol. lxv., on regeneration in the antennæ in larvæ of a phasmid insect, *Carausius* (*Dixippus*) *morosus*, as the result of both natural and artificial injuries.

NO. 2 of the tenth volume of the University of Colorado Studies is devoted to an illustrated synopsis, by Messrs. M. M. Ellis and J. Henderson, of the amphibians and reptiles of Colorado. Despite the varied physical conditions of the country, which in several other groups of animals is correlated with a large and diversified fauna, the species of the groups under review are not remarkably numerous. No new species are recorded.

THE existence of a close relationship between the faunas of India and Africa, which was so strongly urged by the late Dr. W. T. Blanford and subsequently by Mr. Lydekker, is emphasised in an article by Mr. Ernst Schwarz on Indian Viverridæ, published in vol. lxxviii., part 11, of *Archiv für Naturgeschichte*.

It is there pointed out that the true civets (Viverra) have closely allied representatives in the two continents, and that the same holds good for several groups of mongooses (Mungos or Herpestes), while the Indo-Malay linsangs (Prionodon) are near relatives of the African Poiana. It is also pointed out in this paper, and in a second by the same author (*op. cit.*, part 12) on the extinct viverroid genera Palhyæna and Ictitherium, that although the Viverridæ are the most primitive type of cat-like Carnivora, and have some representatives (Poiana and Prionodon) approximating to the feline type, while the above-mentioned extinct genera show an equally marked step in the direction of the Hyænidæ, yet that in both instances these resemblances should be regarded in the light rather of convergence than of direct ancestry, the Felidæ having in all probability originated independently from a still earlier stock.

A RECENT number of *Science* (May 2) contains an account by Dr. C. Gordon Hewitt, entomologist to the Dominion of Canada, of the Imperial Bureau of Entomology. This organisation has grown out of the Entomological Research Committee appointed in 1909 by Lord Crewe, then Secretary of State for the Colonies. The functions of the bureau, which is supplementary to the existing research committee, are to collect and coordinate information relating to the noxious insects of the world, to undertake the authoritative identification of insects of economic importance submitted by the Departments of Agriculture and Public Health throughout the Empire, and to publish a monthly journal giving summaries of all current literature which has a practical bearing on the investigation and control of noxious insects. Mr. Guy A. K. Marshall, the scientific secretary of the research committee, has been constituted director of the bureau and editor of the journal, the first issue of which, under the name of *The Review of Applied Entomology*, appeared in January of this year. It is being published in two parts, devoted respectively to agricultural and to medical and veterinary entomology. Dr. Gordon Hewitt points out that there are no fewer than 1700 periodicals which may contain articles dealing with the subjects of which the bureau takes cognisance, and that entomologists in many remote districts have neither the opportunity of seeing nor the time to consult more than a small proportion of this literature. Hence the establishment of a central organisation for the collection and dissemination of important economic data is likely to be of the highest practical value.

THE results of a comprehensive series of trials with varieties of oats are published as Report 29 of the Edinburgh and East of Scotland Agricultural College. The observations extend over the years 1909–12, and indicate marked differences between the varieties, according to weather conditions, altitude, and character of the soil. Of the twenty-six varieties grown at fifty-two centres, eight surpassed the standard potato oat by from 20 to almost 40 per cent. in yield of grain; five others were from 15 to 16 per cent. better, but none of these improved varieties showed itself equal to the standard oat in respect of straw production. On account of early ripening certain varieties are specially suited to late districts, while others failed to ripen at all at the higher centres in the wet season of 1912.

THE Bulletin of the Department of Agriculture of Jamaica (vol. ii., No. 6) contains a number of articles on the fungoid diseases of the banana. Amongst these is an account of the Surinam Panama disease (*Leptospora musae*) of the Gros Michel banana. Investigation has shown the fungus to be a parasite on several varieties of Musa, although the plantain is immune against it. Soil disinfection experiments with carbolineum, copper sulphate, and gas water have been made with negative results. Greater success is anticipated from flooding the infected areas, since the fungus is adversely affected by humid conditions. The introduction of immune varieties, such as the Congo and other bananas, is recommended.

THE Meteorological Charts of the North Atlantic Ocean for May and June, issued by the U.S. Weather Bureau, contain interesting articles by Mr. R. E. Harris, illustrated by synoptic weather charts and barograms, relating to the unusually heavy storms in that ocean during January last (possibly the stormiest month on record there), and supported by extracts from log-books of a considerable number of vessels. The most severe storm was that of January 7 to 11 inclusive. This depression had two centres at Greenwich noon, January 8, one over New York, while a storm was central near latitude 49° N., longitude 25° W., and was causing winds of force 8 to 12 (Beaufort scale) between the fifteenth and forty-fifth meridians. By noon of January 9 a rapid development in the western storm had occurred, and it was central near latitude 45° N., longitude 48° W. During the night of January 9–10 some remarkably low barometer readings were recorded, the lowest, 26·96 in., being registered by an aneroid at 52° N., 25° 30′ W. This (if really correct) is probably the lowest reading ever made on the North Atlantic. By noon of January 10 the storm was central near 51° 30′ N., 27° W., the lowest barometer being 27·76 in. The log of the ss. *Cedric* showed a continuous rise of 2·8 in. in twenty-five hours and forty minutes (from 27·49 in. to 30·29 in.), which, Mr. Harris observes, probably marks a record north of the thirty-fifth parallel.

MR. G. H. KNIBBS, of the Australian Bureau of Census and Statistics, recently contributed a paper to the *Philosophical Magazine* on climatological physiology. His view is that in "the mechanical and chemico-physical arrangements of the human thermostat actions supervene after about 30° C. is reached which disturb those conditions of thermogenesis and thermolysis which are necessary for the thermostasis of the organism." He analyses a number of experimental results obtained by Prof. W. A. Osborn for losses from the human body by evaporation, and discusses them from the theoretical side. The problem in its simplest form is the same as the problem of the wet-bulb thermometer, and Mr. Knibbs uses the results of Regnault, Stefan, Marvin, and others on the relation of evaporation to temperature, relative

humidity, and wind in his discussion. He finds that the change in the loss by evaporation under different conditions is proportional to the product of the absolute temperature and the absolute dryness or saturation deficit, and he makes the interesting suggestion that sufficient observational results should be obtained to give normal values for the constants for different sexes, races, &c. Incidentally the paper emphasises the importance of the wet-bulb temperatures as a climatic factor, especially in tropical or semi-tropical regions. It may be noted that experiments on the effect of different meteorological conditions on the human body are being conducted by Dr. J. R. Milne at Edinburgh, a preliminary account being given in the recently issued Journal of the Scottish Meteorological Society.

THE Meteorological Institute of the Netherlands has issued copies of thirteen of the principal magnetic disturbances of the year 1911, as recorded at de Bilt, and the director of the institute, Prof. van Everdingen, intimates that in future it is intended to publish each year copies of the chief disturbances, as indicated on the international lists compiled under his auspices. The time scale adopted is 15 mm. to the hour, and the curves—declination, horizontal force, and vertical force—are very clearly reproduced.

WE have received a copy of an address delivered by Dr. Wolfgang Ostwald before the eighty-fourth Versammlung Deutscher Naturforscher on "Die neuere Entwicklung der Kolloidchemie" (pp. 23, T. Steinkopf, Dresden, price 1 mark). Colloid-chemistry is a branch of science which has made striking progress during the past few years, and has now not only a distinct terminology of its own, but a journal, the *Kolloid-Zeitschrift*, to chronicle its advances. The brief review given by Dr. Ostwald of recent development of the science should prove of interest to many workers in the numerous fields of science and industry in which a knowledge of colloids is of importance.

WE have received a copy of the *Compte Rendu* of the Geneva Physical and Natural History Society for the year 1912. The society has sixty-eight ordinary and forty-two honorary members, and admits twenty-eight associates free. The *Compte Rendu* extends to more than eighty pages, and contains articles on physics, chemistry, botany, geology, and zoology of considerable interest. Amongst the most important of these articles are Prof. Guye's on the internal friction of metals at high and at low temperatures, and M. Tommasina's surveys of Ritz's theories of the æther and of gravitation.

THE June number of *Terrestrial Magnetism and Atmospheric Electricity* contains a list of the determinations of declination made on the magnetic survey ship *Carnegie* during its voyage across the Pacific from Tahiti, Society Islands, to Chile, and thence *viâ* Cape Horn to the Falkland Islands. Comparisons are made between the values obtained and those given on the United States, the German, and the British charts. So far as the latter is concerned, the corrections to be applied to the charted values are in most cases less than one degree, but exceed that amount at nine points off the coast of Chile and Patagonia, where the chart shows the easterly declination too small.

IN a paper recently published in the Bulletin of the Imperial Academy of Sciences of St. Petersburg, Prof. P. Walden brings forward additional evidence in favour of the view that the degree of dissociation of a given solute is independent of the nature of the solvent if each solution is at the saturation point. This was demonstrated previously for tetramethylammonium iodide, $N(C_2H_5)_4I$, in fourteen solvents, but is now shown to be true for tetramethylammonium iodide, $N(CH_3)_4I$, in ten solvents ($\alpha=0{\cdot}666$), for tetrapropylammonium iodide, $N(C_3H_7)_4I$, in five solvents ($\alpha=0{\cdot}26$), and, finally, for potassium iodide, KI, in three solvents ($\alpha=0{\cdot}423$).

IN the May issue of the Chemical Society's Journal Dr. Scott describes some new methods for the preparation of pure bromine. The first method depends on getting rid of iodate and iodide by boiling potassium bromide with a little potassium metabisulphite and sulphuric acid, then twice adding saturated bromine water and distilling off the bromine, and finally neutralising with potassium carbonate and evaporating to dryness. The bromide was then fused with potassium dichromate in quantity insufficient to decompose any chloride that might be present; the fused mass was decomposed by sulphuric acid with the addition of a little permanganate to decompose organic matter. A quantity of 3250 grams of pure bromine was prepared in this way, together with an additional 185 grams, which should contain all the chlorine, but this was found to amount only to 4 or 5 milligrams. The halogen impurities were separated by extracting the bromine with caustic soda; this appears to provide a very simple and a most effective way of purifying bromine, the chlorine being removed as chloride, and the iodine as iodate. By this method the whole of these halogens can be removed from 10 c.c. of bromine by extracting once with 5 c.c. of normal sodium hydroxide.

OUR ASTRONOMICAL COLUMN.

OBSERVATORIES AND CITIES.—Modern astronomical research work, which necessitates the long exposure of photographic plates and the observation of faint stars, is gradually separating old observatories from their historic surroundings and creating new buildings in more favourable situations. The Hamburg Observatory is now settled in its new site in Bergedorf, some distance away from the city, and the new ground is bristling with domes of the latest construction. Berlin Observatory is now on the move, taking up its new position in Neu Babelsberg, not very far from its astrophysical *confrère* at Potsdam. At the present time the question is being considered as to the removal or part removal of the Paris Observatory, as the conditions on the site now occupied are not conducive to the best observational work. Those unfamiliar with the present locality can obtain a good idea of it in relation to Paris from the excellent reproduction of a photograph by M. Baillaud which is given in the current number of *The Observatory* (June, No. 462).

NEPTUNE'S FAINT EQUATORIAL BELTS.—Dr. T. J. J. See publishes in the *Astronomische Nachrichten*, No. 4656, a paper describing some observations he made on the planet Neptune in 1899 and 1900, with the 26-in. refractor of the Naval Observatory at Washington. On some days in those years the air was particularly steady and the mottled appearance of the disc of the planet accidentally attracted his attention. This led him more closely to scrutinise the disc, and he noticed that beaded bands or belts were faintly visible against the brighter body of the planet. The seeing on these occasions was such that 95 Ceti, the most difficult of known double stars, was resolved, and other difficult pairs, such as 85 Pegasi and T Cygni, measured. The bands, he says, were found to be extremely faint, but on a few occasions they came out with more distinctness, and he attaches drawings from which their general character can be inferred. Dr. See refers to Prof. Asaph Hall's observations with the same instrument, which gave the suggestion of suspected mottlings on the planet's surface, and to Prof. S. J. Brown, who noticed an unsymmetrical appearance on the disc. As Dr. See points out, the chief interest attaching to the discovery of these equatorial belts arises from the circumstance that phenomena depending on planetary rotation first noticed on Jupiter, and then on Saturn, and finally on Uranus, are now seen to be common to the most remote member of the solar system. The paper concludes with a brief notice of the discovery of belts on the other major planets.

VARIABLE STARS.—Numerous recent papers deal with the subject of variable stars. Prof. A. A. Nijland, of Utrecht, sends a pamphlet on the light curves of twenty-three Algol stars, and the classification of variables. Two papers in the *Astronomische Nachrichten* (No. 4653, vol. cxciv.) deal respectively with the ellipsoidal variables SI Tauri and S Antliæ, by Harlow Shapley, and the variability of the pole star by Ant. Pannekoek.

Photometric observations of variables is the subject of Padova's communication to the *Mem. della Soc. dei Spettroscopisti Italiani* (April, disp 4*a*, vol. ii., ser. 2*a*), and he deals with two Algol variables, U Ophiuchi and RZ Cassiopeiæ; two variables of short period, Y Ophiuchi and β Lyræ; five long-period variables, and two irregular variables, RS Cygni and R Scuti. Light curves accompany the observations in most cases. Harlow Shapley contributes a paper on the visual and photographic ranges and the provisional orbits of Y Piscium and RR Draconis to the April number of *The Astrophysical Journal*, while the same journal also contains a second paper by Frederick H. Seares on the Algol variable RR Draconis. Prof. E. C. Pickering refers in Circular 177 of the Harvard College Observatory to the maximum brightness of Algol variables.

KODAIKANAL SOLAR PROMINENCES DURING 1912.—Bulletins Nos. 29 and 30 of the Kodaikanal Observatory contain a summary of prominence observations made at that observatory during the past year. Previously it was customary to publish detailed lists of prominences, such as those which appeared in the series of bulletins ending with No. 28, but these will now be discontinued and replaced by a *résumé* of the observations issued half-yearly. This *résumé* will include full descriptions of any remarkable phenomena observed or photographed, and, in addition to the summary of the observations at the sun's limb, there will be given the results of a study of the prominences projected on the disc as hydrogen absorption markings. The present two bulletins are written on these lines, and they contain the summarised material for 1912.

THE ALLOTROPY OF IRON.

TWO papers read before the recent meeting of the Iron and Steel Institute, one by Dr. Carpenter on the critical ranges of pure iron, and the other by Dr. Rosenhain and Mr. Humfrey on the tenacity, deformation, and fracture of soft steel at high temperatures, were responsible for a renewal of the discussion upon the allotropic modifications of iron. The present discussion may be regarded as a further contribution to an old controversy, and in order to appreciate its true significance it is necessary to review, somewhat in the manner of a serial story, the incidents of the preceding chapters.

In 1890 Osmond showed that when a piece of steel was allowed to cool from a bright red heat the rate of cooling was not uniform, but that at three points there was an evolution of heat in the steel itself which had the effect of retarding the fall in temperature of the mass. These three arrests Osmond designated as A1, A2, and A3, A1 representing the change taking place at the lowest temperature. In order to distinguish between the evolutions of heat during cooling and the corresponding absorptions of heat during heating, the letters *r* (*refroidissement*) and *c* (*chauffage*) were added, and this nomenclature has been retained, the irregularities in the cooling curve being described as Ar1, Ar2, and Ar3, and those in the heating curve Ac1, Ac2, and Ac3.

It was clearly shown by Osmond that the A1 change was dependent upon the carbon in the steel, whereas the points A2 and A3 were independent of the carbon and equally prominent in the purest steel obtainable. Osmond therefore argued that the thermal changes at A2 and A3 must be due to molecular rearrangement or allotropy in the iron. Iron above the A3 point he described as γ iron, that between the A3 and A2 points β iron, and below the A2 point α iron.

Roberts Austen repeated and confirmed Osmond's experimental work, and accepted his theory of allotropy as being the most probable explanation of the facts. Prof. Arnold, on the other hand, rejected the allotropic theory on the ground that "steel research was, in his opinion, a field of too national an importance to be used lightly as a cantering ground for the hobbies of periodicity and allotropy." After repeating and confirming the work of Osmond and Roberts Austen, Prof. Arnold suggested that the A3 point was due to the influence of hydrogen, and the A2 point to a change from a plastic to a crystalline condition. He contended that these changes had little connection with the phenomena underlying the hardening of steel, but that these were due solely to the carbon, and at a later date he developed a subcarbide theory to explain the changes brought about by hardening, &c. Further investigations, however, by independent metallurgists, tended to confirm Osmond's original views, and within the last few years little has been heard of the controversy between the "carbonists" and the "allotropists."

The two papers which have been responsible for the reopening of the discussion may be briefly summarised as follows:—Prof. Carpenter, following a hypothesis of Benedicks, endeavours to prove that the change at Ar2 is not an independent change, but merely the tail end, or limit of supercooling due to impurities, of Ar3. It may be mentioned that this was Osmond's original explanation, which he abandoned when it was proved that the appearance of magnetism coincided exactly with the point Ar2. Prof. Carpenter argues that if Benedicks's theory is correct pure iron should show the Ar2 change but not the Ac2 change, and he gives a number of heating and cooling curves of the purest iron obtainable in

support of his view. Unfortunately, as Prof. Arnold has pointed out, the heating curves actually show the Ac2 change. It is true that they are less strongly marked than the Ar2 changes, but this is only what would be expected.

The changes during heating, as shown by inverse rate curves, extend over a greater range and are therefore less strongly marked than in the cooling curves. This is well shown in the A3 change shown in the curves, and in view of the fact that the Ar2 change is itself very small, it was scarcely to be expected that the Ac2 change would be very easily detected. Moreover, Prof. Carpenter has shown that if the iron, after cooling just below Ar3, is held at that temperature for two and a half hours in order to allow the change from γ to α iron to become complete, and then slowly cooled, the Ar2 change is shown as decidedly as before. He attempts to explain this by assuming that the impurities present are sufficient to prevent actual contact of the γ and α molecules, but the explanation is unsatisfactory, and his results must be regarded rather as proving than disproving the independence of the A2 critical point.

The paper by Dr. Rosenhain and Mr. Humfrey describes a series of experiments admirably conducted with the aid of an ingeniously constructed testing machine, in order to investigate the physical properties of mild steel at high temperatures. It is impossible to describe the experiments in detail, but the results show that the curve representing the tenacity at high temperatures consists of three branches corresponding to the γ, β, and α ranges of iron. Starting at 1100° C., the tenacity increases as the temperature falls, until the Ar3 point is reached, when there is a rapid decrease in tenacity. This is followed by a further increase until Ar2 is reached, when there is another falling off in tenacity. The influence of the rate of strain is discussed, also the influence of varying size of crystals; and photographs are given to illustrate the types of fracture at different temperatures. The authors conclude that they find it difficult to reconcile their results with Benedicks's theory by which β iron is regarded as a solution of γ iron and α iron.

Prof. Arnold's contribution to the discussion when separated from side issues resolves itself into little more than a reassertion of his own theories, which he claims are supported by the two papers in question. The one useful criticism which Prof. Arnold makes has already been referred to, in which he points out that the Ac2 change is observable in Prof. Carpenter's curves.

The criticism of Dr. Rosenhain and Mr. Humfrey's paper is even less helpful. It is claimed that the authors' conclusions are of no value owing to their "erroneously presupposing that they are discussing results obtained from chemically pure iron rather than from their dead mild commercial steel." It is possible that the authors have underestimated the importance of the impurities in their steel and have pushed their conclusions a little too far, but they give full details of the material upon which their experiments have been carried out, and they make no claim that their conclusions are final. Nevertheless, the authors have laid themselves open to some criticism inasmuch as they have chosen for their experiments a steel which, even from a commercial point of view, is of very poor quality.

As a matter of fact, the importance of the discussion has been exaggerated, and the two papers leave the β iron theory very much where it was before. The somewhat ill-defined A2 change and its relation to the physical properties of steel will still attract the attention of men of science who are anxious to discover the truth. Other papers will be read and further discussions will take place, but in the meantime, and until further evidence is forthcoming, those who are wise will refrain from a too dogmatic insistence upon their own particular views.

THE ROYAL SOCIETY CONVERSAZIONE.

THE annual June conversazione of the Royal Society was held in the rooms of the society at Burlington House on June 11. As is usual upon such an occasion, various instruments and objects of scientific interest were exhibited. Most of these have been described already in the account of the May conversazione given in NATURE of May 15 (p. 273). Other exhibits are mentioned below:—

Dr. E. C. Pickering: Colour-blindness, if any, of eminent astronomers. The sensitiveness of the eye to rays of different colours has been tested for numerous astronomers by grouping their estimates of the light of the stars according to their colour, as shown by the class of spectrum. The earliest estimates, those of Ptolemy and Sûfi, show results agreeing closely with those of recent times. Peirce shows a marked sensitiveness to the red, and Seidel to the blue, rays. The latter effect is still more marked in photographic plates.

Prof. Silvanus P. Thompson: Poulsen's telegraphon. The telegraphon of Dr. V. Poulsen, of Copenhagen, is an apparatus which records speech or sound transmitted by telephone, and reproduces it, at any subsequent time, in another telephone. The recording is effected magnetically. In this newest pattern, a thin wire of tungsten steel is caused to run rapidly between the poles of a small electromagnet in the receiving circuit of the telephone; and this electromagnet impresses the corresponding vibrations on the wire by magnetising it in an immense series of minute local spots. The record on the wire is absolutely invisible. On passing the wire again between the poles of a small electromagnet in the circuit of a receiving telephone, the series of minute magnetic spots on the wire sets up, by magneto-electric induction, a corresponding series of electric undulations, causing the telephone to emit a corresponding sound. The sounds so reproduced are faint unless a Brown telephone relay is employed to magnify them.

Mr. R. Inwards: Spiraloid curve apparatus. This is an instrument consisting of a revolving table carrying the paper, and over which a pen is caused by gear-wheels and adjustable cranks to describe an undulating line, and to produce figures resembling the structure of the Diatomaceæ, Radiolaria, and other natural forms.

Mr. C. R. Darling: Experiments with liquid drops and skins. (1) Large drops of liquids may be formed in media of slightly less density, *e.g.* orthotoluidine in water at 18° C. The formation is gradual, and all the stages may be observed by the unaided eye. If two drops of different diameters be made to communicate through a tube, the lesser passes into the greater when both are at the same level; if, however, the lesser drop be lowered, the movement is reversed. A position of equilibrium may be found in which both drops are stationary. (2) Skins of aniline may be formed on suitable frames under water, and made into bubbles filled with water. (3) Skins of various liquids on the surface of water exhibit characteristic movements, depending upon the liquid used.

Dr. T. K. Rose: Recrystallisation of gold on annealing. The specimens exhibited of incompletely annealed gold show that the new crystals make their appearance singly when annealing begins, and that as the temperature is raised or the time prolonged, other

crystals are produced round those first formed. Some of the original crystals, which have been distorted by rolling, are completely broken up into the new smaller crystals before recrystallisation begins in other laminæ. The new crystals are soft, and the unaltered laminæ remain hard. Incompletely annealed metal thus consists of alternate strips of hard and soft material.

Prof. C. J. Patten: (1) Model illustrating the topography of the Tuskar Rock and Lighthouse relative to some features in the diurnal migration of certain birds. (2) Studies in the migratory movements of birds at the Tuskar Light-station, illustrated by a series of photographs.

The John Innes Horticultural Institution: Phenomena of plant-breeding. (1) "Maternal" hybrids and actual hybrids in Primula and Nicotiana. (2) Inheritance of double flowers and sex in Tropœolum. (3) Inheritance in *Campanula persicifolia*. (4) Double flowers of various types in Begonia.

Dr. G. D. H. Carpenter: A synepigonic series of *Papilio dardanus* from the parent form *planemoides*. This exhibit represented the first proof by breeding that the form *planemoides* is definitely of the species *Papilio dardanus*.

Dr. H. F. Standing: Photographs of the skeletons of extinct giant lemurs from Madagascar, also casts of skulls of the same. This exhibit showed casts of the skulls and photographs of the mounted skeletons of two species of giant lemur recently exhumed in a subfossil condition at Ampàsambazimba, in the centre of the Island of Madagascar. The smaller animal (*Palaeopropithecus maximus*) shows curious specialisation for an amphibious mode of life. It probably burrowed in the banks of lakes and streams; the peculiar roughened upward extension of the nasal bones no doubt carried some kind of epidermal excrescence, presumably used in burrowing. The larger animal (*Megaladapis grandidieri*) was arboreal in its habits, and its mode of life probably resembled that of the chimpanzee.

Prof. W. M. Flinders Petrie: Egyptian jewellery, 3400 B.C. The pectoral exhibited is of soldered gold inlaid with cut turquoise, lazuli, and carnelian, like the celebrated pectorals of Dahshur, and probably by the same artist. Found with it was a piece of inlaid open work of Senusert II., and a gold shell with soldered wire work of Senusert III. None of this fabric has reached England before. These were found at Gerzeh, forty miles south of Cairo, in a grave in which a plunderer had been killed by a fall of the roof.

REMARKABLE DROUGHT IN THE PHILIPPINES.

THE drought experienced during the eight months, October, 1911–May, 1912, probably the most severe ever observed in the archipelago, has been discussed by the assistant director of the Weather Bureau. At Manila the total rainfall recorded during the period was only 3·73 in., or a monthly average of less than half-an-inch; the driest month was April, with only 0·03 in. The following rainless periods are especially noteworthy: October 24–November 16 (24 days); November 20–December 11 (22 days); March 19–April 12 (25 days); April 14–May 7 (24 days). Deducting the insignificant amount of 0·004 in. (0·1 mm.) on May 8, there would result a rainless period from April 14–May 20 (37 days).

Sr. Coronas shows that, so far as Manila is concerned, the drought was the worst experienced since the establishment of the observatory in 1865. From a cursory inspection of his tables it is seen that for the months October–December, 1911, the rainfall was 14·05 in. below the normal; for the months January–May, 1912, 5·10 in. below, and that the total rainfall for the eight months was 5·56 in. below the absolute minimum recorded for those months during the entire period. In other regions of the archipelago the results cannot be so convincing as those for Manila, as the statistics for the secondary stations cover only a relatively short period. A table of the rainfall at twenty-six selected stations shows that it was without exception less than the normal at every station. The longest dry periods occurred in western Luzon, and the shortest on the eastern coasts of Samar and Mindanao; this was to be expected, as in the former case the dry season is most pronounced, especially from December to March, and in the latter case during the same months the most persistent rains of the whole year occur. An extraordinary period of 165 days without rain occurred at Vigan (western Luzon) between December and May.

Some very high temperatures were recorded in April and May. At Manila a maximum of 100·9° (38·3° C.) occurred on May 19; so high a temperature had not been recorded since May, 1889. It may not be without interest to recall the fact that the drought of the summer of 1911 in this country was followed by a remarkable period of excessive rainfall during the winter six months of 1911–12. This period has been specially discussed by Dr. Mill, and referred to in our columns.

WORK OF THE ROTHAMSTED EXPERIMENTAL STATION.

THE annual report for 1912 of the Rothamsted Experimental Station, which has lately been issued, includes an introduction, the annual report proper, and a supplement giving the year's yields of the various series of plots. The report deals first with the season 1912, its peculiarities, and their effect on the crops, and proceeds to give short abstracts of the work of the various members of the staff.

The central idea of the work of the Rothamsted Experimental Station is the investigation of the relation between plants and the soil in which they grow. Dr. Russell, who has during the year succeeded Mr. Hall as director, is engaged, in conjunction with Messrs. Hutchinson, Golding, Petherbridge, and Goodey, in investigating the effects of partial sterilisation of the soil. His results have now got beyond the theoretical stage. Partial sterilisation is now practised largely in the glasshouses of the Lea valley with good results, and has so impressed the tomato and cucumber growers of that district that they are endeavouring to get established an institute for the investigation of the problems of glasshouse culture—a most encouraging instance of the readiness of practical men to adopt any really sound innovation put before them in a feasible form.

Dr. Miller continues his investigations of the nitrogen content of rainfall and drainage. Dr. Brenchley is studying the possible stimulating effects of poisons on plant growth, and has extended her survey of the weeds of arable land to the eastern counties. Mr. Davis has published the results of a careful series of comparative determinations of potassium by the perchlorate method, which he recommends as accurate and trustworthy. The method is well worth the attention of analysts in these days of dear platinum.

The report on the whole is of great interest as showing the varied methods of attack which are being applied with success to the central problem of the relation of plants to the soil in which they grow. References are given to the original publications,

which are for the most part contained in *The Journal of Agricultural Science*.

The report is accompanied by a circular of the society for extending the Rothamsted experiments, which gives details of the financial position of the trust. Subscriptions are invited for the rebuilding of the old laboratory, which must shortly be undertaken, and for the maintenance of the permanent plots, which entails very considerable annual expenditure.

DESIGN AND USE OF SCIENTIFIC INSTRUMENTS IN AERONAUTICS.[1]

AFTER expressing his admiration for the character of Wilbur Wright, his brilliant engineering work, and the scientific method by which he obtained his results, the lecturer considered the resemblance and differences of the manufactured aëroplane and the living bird. The resemblance may be simply the result of copying the bird, or it may be that similar designs have been arrived at independently by birds and men. The wings of both are roughly the same shape: of wide span, and narrow in the direction in which the bird flies; both have concave wings with thick leading edges. In many aëroplanes hollow spars are used like bones and like the quills of the feathers of birds. We copy plants also in this respect, for they too have learnt the economy of material in the use of hollow spars.

These resemblances are remarkable, but there are great differences. The Wright brothers found no biplane bird to copy and did not flap their wings. No flying animal uses a continuously rotating propeller to drive him forward on soaring wings, and it is perhaps scarcely too much to say that if birds only knew how, they would now copy the Wright brothers. Muscular action and the circulation of the blood, however, put supreme difficulties in the way of the development of the continuous rotation of a part of an animal.

Instruments Used in Aëroplanes.

It is important to realise beforehand the difficulties of using instruments on aëroplanes during flight and the errors that may be introduced in the readings. The aëroplane shakes, it does not remain level, and is subject to acceleration in all directions. The instrument should be so designed as not to be affected by any of these disturbances. A vertical acceleration has the same effect as a change in the amount of the downward pull due to gravity; the tilting of the aëroplane changes the direction of the downward pull with regard to the instrument. A lateral or longitudinal acceleration has the effect of altering both the direction and the amount of gravity. But vibration is a greater difficulty still. The hand of an instrument may move so much and so rapidly that it is difficult to estimate the mean reading on the scale, and sometimes it is quite impossible to do so. And this may happen when the quantity which is indicated by the position of the hand only varies slowly and by small amounts. The moving part of an instrument should be well balanced. This reduces the vibration from the shaking of the aëroplane as well as the error caused by its tilting or want of level.

In a compass as ordinarily made, the condition of balance cannot be fulfilled. The magnet rests on a steel point and is horizontal, and its centre of gravity is below the steel point. The force on the north pole acts in a downward direction towards the north, and the force on the south pole in an upward direction towards the south, and the magnet is made to rest in a horizontal position by arranging that the centre of gravity of the magnet is between its south end and its centre. It is below and to one side of the point about which rotation takes place. Hence a sideways movement must start it swinging. The magnet and card in aëroplane and ship compasses are usually surrounded by a liquid, so that any vibration which may be caused by its want of balance is rapidly reduced.

Instruments on aëroplanes should be damped, using the word to damp in the sense of "to dull" or "to abate the motion of." This damping is specially important if it should happen that the rate of vibration of the whole instrument should agree with the natural rate of vibration of the moving part. When this happens with an undamped instrument, the vibration is excessive. Damping is also required in cases where the fluctuations in the quantity to be measured are rapid; it may then be difficult to read the instrument, and the excursions of the hand may indicate a much greater amount of variation of the quantity than really takes place. If the mean reading is required the instrument must be damped, and the damping should be of a particular kind.

The essential features of satisfactory damping are that no force should be applied to the moving part whilst it is at rest, but that as soon as it moves a force should act opposing the movement. Friction at the joint does damp the instrument, but does not fulfil these conditions, and is bad. The force should be small when the movement is slow, and it should increase when the movement becomes more rapid. The most usual method is to immerse the moving part, or a paddle fixed to it, in a liquid more or less viscous, or the paddle can be replaced by a fan in the air. Another method is to damp by the movement of a copper plate between the poles of a magnet. If a Pitot tube is used, the flow of air through the connecting tubes damps the instrument.

Mr. A. Mallock has pointed out that in order to obtain a true mean reading with an instrument the damping force should be proportional to the velocity of movement of its index. When the damping force varies as the square of the velocity there may be no error or there may be a considerable error. Suppose that the quantity to be measured remains at 80 for 2/10 second, and then suddenly increases to 140 and remains at that amount for 1/10 second, and then it goes back to 80 and remains at that amount for 2/10 second, and that this rapid oscillation goes on indefinitely. Suppose also that the instrument is damped by a force which varies as the square of the velocity of the index, and that it is so much damped that the hand appears to remain at rest. The reading of the instrument will be 92 and the true mean in reality is 100, so that we have an error amounting to 8 per cent., by no means a small error. The diagram (Fig. 1) gives the supposed variations of the quantity as it would be recorded on a moving sheet of paper, and gives the true mean and the instrument reading.

In the magnetic method of damping, the force varies as the velocity and the true mean is obtained. With liquid and air damping the force varies as the square of the velocity, unless the movement is extremely slow, when it varies nearly as the velocity.

Speed of Aëroplanes.

The speed of the aëroplane through the air is often measured by a Pitot tube and a manometer.

The principle of the Pitot tube is very simple. If the open end of a tube faces the wind, the air wants to pass down the tube; if the tube is closed at

[1] From the first Wilbur Wright memorial lecture delivered before the Aëronautical Society of Great Britain on May 21, by Mr. Horace Darwin, F.R.S.

the other end the air pressure is increased in the tube, and this increase of pressure is a remarkably accurate means of measuring the velocity of the wind. This method is used in Dines's anemometer, and for measuring the velocity of the air in the wind channel at the National Physical Laboratory. In 1903 Dr. Stanton read a paper before the Institution of Civil Engineers (Proc. Inst. C.E., vol. clvi., p. 78) proving the accuracy of this method of measuring air velocity, and improvements have recently been made which give even more satisfactory results. The delicate measurement of the air pressure necessary for the most refined work is made by the tilting water gauge designed by Prof. A. P. Chattock and Mr. J. D. Fry. This is a laboratory instrument of the highest order of precision, and is far too delicate and accurate to be used on a flying machine. It is a difference of pressure that has to be measured—the increase of pressure in the tube, above the air pressure outside—and a second tube transmits this pressure (the static pressure) to the manometer. It is found by experiment that changes in the size of the opening of the Pitot tube, or the thickness of the tube, or the bevelling of its edge, make little or no difference in the pressure. With the opening of

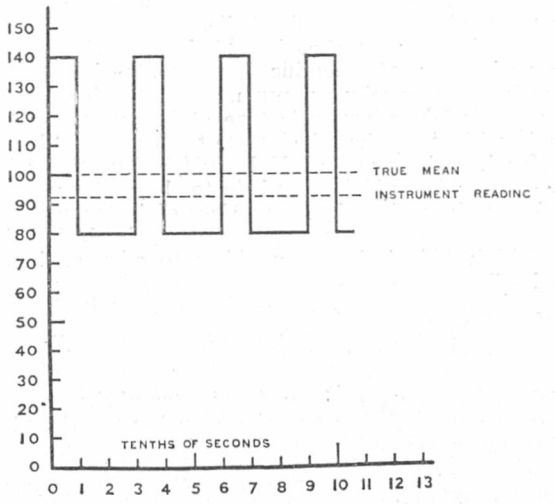


FIG. 1.

the static tube it is different, and its design is important. In the design now adopted at the National Physical Laboratory the pressure obtained is almost exactly what we should expect from theoretical considerations. This is an advantageous simplification, and this form of Pitot tube should be used for all the most refined measurements. But the static tube can be so made that it will give a pressure below the true static pressure, and the Royal Aircraft Factory has made use of this and has increased the manometer readings by 20 per cent. in order to give a more open scale.

The tubes transmitting the pressure can be carried a considerable distance to allow the manometer to be placed in a convenient position for reading; this is often of great importance. If it is found advisable to have a large amount of damping in the manometer it is best to have long tubes of large diameter. This gives the correct form of damping. Short tubes of small diameter will also give a large amount of damping, but in this case the damping force will vary as the square of the velocity of the air in the tube, and the reading will not necessarily be the true mean. For the same reason it is inadvisable to cause damping by throttling the passage of the air by closing a valve, or by means of letting it pass through a small hole in a plate.

If a Pitot tube speed-meter gives the correct speed when flying near the ground level, it will not be correct when flying at a great altitude. The error is caused by the change in the density of the air. As you mount the air becomes less dense because the atmospheric pressure is reduced, and more dense because the temperature falls, and an error of 7 per cent. may be expected at an altitude of 5000 ft.

The simplest form of manometer is a U-tube containing a liquid. The difference of the level of the liquid is then a measure of the difference of the air pressure in the two tubes. For use on an aëroplane this has two drawbacks: the scale is not open enough to read the speed easily and accurately, and tilting of the aëroplane causes an error. Mr. Short, of the Royal Aircraft Factory, has designed a manometer which overcomes both these objections. It is in effect a U-tube manometer; he uses two liquids of different densities, which do not mix, and thus obtains a more open scale. One tube is placed inside the other, and this overcomes the chief error due to the tilting of the aëroplane, leaving only a small secondary error amounting to $1\frac{1}{2}$ per cent. for a displacement of 10° out of the vertical.

If the aëroplane has an upward or downward acceleration or is changing its direction there is an error.

If a Pitot tube is fixed to the tips of the wings of an aëroplane and it is flying in a circle, the speed of the outer wing tip is greater than the speed of the inner wing tip. If these Pitot tubes are joined together by a tube there will be a greater pressure at one end of the tube than at the other, and at first sight we should expect that there would be a flow of air through the tube from the outer to the inner wing tip. But this is not the case, because the aëroplane is moving in a circle and there will be centrifugal force acting on the air in the tube. This will tend to make it flow outwards, and will exactly balance the tendency of the air to flow inwards due to the excess pressure in the Pitot tube on the outer wing tip, and there will be no flow through the tube. If there is a side-slip this statement is only approximately true. For accurate speed measurements at the Royal Aircraft Factory two Pitot tubes are used, one at each wing tip; both are connected to the manometer and the mean speed is given.

An instrument called a yaw-meter was described. It measures the direction in which the air is moving relatively to an aëroplane, and its action depends on the fact that the pressure in a Pitot tube becomes less if it does not directly face the wind. Two Pitot tubes are used, and the indication is independent of the speed of flight.

A method of indicating the speed of ascent or descent was also described.

The Principle of Geometrical Design.

Clerk Maxwell writes:—

"Each solid piece of an instrument is intended to be either fixed or movable, and to have a certain definite shape. It is acted on by its own weight, and other forces, but it ought not to be subjected to unnecessary stresses, for these not only diminish its strength, but (what for scientific purposes may be much more injurious) they alter its figure, and may, by their unexpected changes during the course of an experiment, produce disturbance or confusion in the observations we have to make.

"We have, therefore, to consider the methods of relieving the pieces of an instrument from unnecessary strain, of securing for the fixed parts a determinate

position, and of ensuring that the movable parts shall move freely, yet without shake.

"This we may do by attending to the well-known fact in kinematics—'*A rigid body has six degrees of freedom.*'"

Designs in which this principle is carried out may be called geometrical designs. A three-legged table is a geometrical design, and a four-legged table is not. A four-legged table either rocks on two legs, or bends so that all legs touch the floor, and the amount of bending and the pressure of each foot on the floor depends on the stiffness of the table and the evenness of the floor. Every time an ordinary chair is placed in a new position, it takes a new shape. A surface plate is a familiar example of the importance of three supports, and nearly all scientific instruments rest on three feet. Other examples of geometric design were also given.

Good Design and Bad Workmanship.

A most important consideration in a good design is that the instrument shall still work well when the rubbing surfaces get worn or parts get bent, or if the workmanship is not good. With perfect workmanship and a bad design, you may get jamming in the moving pieces and bending of parts which should not bend, and the results obtained will be liable to error and the working unsatisfactory. This consideration brings out most forcibly the advantage of geometrical designs, but also it is a valuable test to all designs. It is a long way from being the only test, but it is always well worth while to consider separately the effects of imperfect workmanship, or the bending of each part and wearing of the rubbing surfaces. Take the case of wear in a wheelbarrow. The axle of the wheel usually consists of two round iron pins running in holes in wooden rails forming the frame of the wheelbarrow. Both the wood and the pins wear; the pin gets smaller but keeps circular, and wears its way into the wood and always fits it properly on the side where pressure is taken. The wheel will work perfectly until either the holes break out of the wood or the pin wears down very small and itself gives way. But sometimes the axle is made differently; an iron rod is fixed to the two wooden rails and passes through a hole bored along the centre of the wheel. With use the iron rod wears on the under side and does not remain circular, the hole in the wheel gets larger; the result is increased friction and a loose and shaky bearing.

The following test was applied to the Rocking Microtome, which has been designed so far as possible on the geometrical method. The iron castings of which it is chiefly made were taken as they left the foundry, were put together with as little work as possible, and it at once cut good sections. This was a severe ordeal, but sections as thin as 0·003 mm. were cut, proving that the instrument still worked with considerable precision.

This test for good design is not the only test, and it may fail. Ball bearings are much used, and when once used for any purpose they continue to be used more and more; this is the best test of a really good mechanical device. All must admire their design, but first-rate workmanship is essential; in this must be included the composition of the steel, the skill in hardening, as well as the accuracy of the figure of the working parts. A ball bearing, however, would be a better thing even than it is at present if it did not require such fine workmanship. It also requires careful mounting, and it is interesting to notice that the recent improvements in ball-bearing design are in the direction of allowing it to work satisfactorily on shafting which may be considerably bent.

The Advantage of Reversing the Parts of a Machine.

An improvement in the design of a machine can often be made by reversing the relative position of two parts of it, or the part that moved can be fixed and the part that was fixed can be made to move. This reversal makes it possible to compare two or more methods, and it is then easy to see which is best. It is advantageous that "the survival of the fittest" should take place early in the life of the machine, and by this means, in fact, it takes place before the design is completed.

In the before-mentioned wheelbarrow it is easy to see which is the best design, and if the designer had deliberately considered whether the iron pins should turn in the wooden rails or whether the iron bar should be fixed, the bad design would never have been made. It is surprising how often this reversal is possible and advantageous, and how difficult it is to realise that it is possible. We are so familiar with a clock in which the frame remains at rest and the hands move that it requires a considerable mental wrench to realise that it is possible and in some cases better that the clock itself should revolve and the hour hand remain at rest. But in recording apparatus it is usual to fix the clockwork in the rotating drum carrying the paper, and to prevent rotation of the hour-hand spindle.

The lecturer concluded:—"I have spoken as a manufacturer of scientific instruments, but my remarks apply equally or even more to the home-made or rather laboratory-made type of instruments. And it is with these that the greatest advances in knowledge have been made. If I could believe that what I have said would be any help to the makers of the wire, cork, and sealing-wax class of instruments, or to the orthodox instrument-maker, I should be glad to think I had done something to advance knowledge."

THE STANDARDISATION OF HYDROMETERS.

WE have received from the director of the National Physical Laboratory the following memorandum for publication in NATURE:—

At the present time there appears to be considerable ambiguity as to the bases of standardisation of hydrometers graduated to read directly in specific gravity.

Three different methods have been brought to the notice of the National Physical Laboratory, and it seems desirable to determine which of these three should be considered as standard.

The instruments are in all cases graduated for use in a liquid at a definite temperature—we call this the standard temperature of the instrument—and give the specific gravity of this liquid at some definite temperature, which may or may not be the standard temperature of the instrument, referred to water at the same or at some other temperature.

The following cases have arisen in practice:—

I. (α) The liquid to be tested must be at the standard temperature of the instrument.

(β) The water to which the specific gravity is referred must also be at the standard temperature of the instrument. Thus, if 85° F. be the standard temperature of the instrument[1] the liquid must be at 85° F. when tested, and its specific gravity is referred to water also at 85° F.

II. (α) The liquid to be tested must be at the standard temperature of the instrument.

[1] A more usual value for this temperature of the instrument would be 60° F. or 62° F. The temperature 85° F. is chosen here as an example so as to bring out the differences arising from the various methods of standardisation.

(β) The water to which the specific gravity is referred must be at some other definite temperature, *e.g.* 60° F., or possibly 4° C., the temperature of maximum density. Thus, if 85° F. as before be the standard temperature of the instrument and 60° F. that of the water, the specific gravity of the liquid at 85° F. is referred to water at 60° F.

III. (α) The liquid to be tested must be at the standard temperature of the instrument.

(β) The graduations are such that they give the value which would be found for the specific gravity of the liquid if it were cooled or heated to some other temperature and referred to water at that[2] temperature. Thus the standard temperature of the instrument might be 85° F. The instrument would then be used at 85° F., but the graduations on the instrument would be such as to give the specific gravity which would be found for the liquid if it were cooled to 60° F., and referred to water at 60° F.

The following table gives the specific gravities of certain sugar solutions, as determined in accordance with these various methods, assuming coefficients of expansion as given in tables issued by the Kaiserliche Normal Eichungs-Kommission of Berlin :—

Solution	I. Specific gravity at 85° F. in terms of water at 85°	II. Specific gravity at 85° F. in terms of water at 60°	III. Specific gravity at 60° F. in terms of water at 60°*
Water ...	1·0000	0·9968	1·0000
Solution A...	1·0496	1·0462	1·0500
,, B...	1·0989	1·0954	1·1000
,, C...	1·1484	1·1447	1·1500

* In this case the liquid to be at 85° when tested, but the instrument is to give its specific gravity when cooled to 60° in terms of water at 60°.

Thus, taking solution C, and supposing in each case the liquid is at 85° F., the instrument will float immersed up to a definite division on the stem. In method I. this division would be marked 1·1484, in method II., 1·1447, and in method III., 1·1500.

Thus there would be a difference of 1·6 degrees of specific gravity between I. and III., and of 5·3 degrees between II. and III., and it is clearly necessary to specify the method of graduation.

There is one obvious objection to the use of method III. In order to graduate an instrument correctly it is necessary to observe its immersion in a liquid at the standard temperature, and then calculate from a knowledge of the coefficient of thermal expansion of the liquid and of its density at some given temperature what its specific gravity at some other temperature will be, and what mark therefore should be put on the stem. No doubt tables could be made up to do this for various liquids and temperatures, but from the point of view of a standardising institution it is preferable that the errors of graduation which have to be determined in the case of instruments sent for test should rest only on observations made during the test and not on a knowledge of the coefficient of expansion of the liquid in which the instrument is to be used.

The instrument is correctly graduated only for a liquid having one definite coefficient of expansion, and cannot be used without error for others.

Of the other two methods, I. and II., method I. has been the usual practice at Kew. The liquid under test and the water to which it is referred are both taken to be at the standard temperature of the instrument, and this, in ordinary practice in England, is about 60°. No. II. has the advantage that the reference temperature of the water is fixed and gives results in agreement with the usual definition of specific gravity, which assumes a fixed temperature for the water.

These notes are circulated with the view of eliciting opinions from makers and users, and also of obtaining information from other countries.

The director of the National Physical Laboratory will be glad to have an expression of opinion from people interested in the subject.

[2] A fourth variation might be added by requiring that in this case the water should not be at the temperature to which the liquid is cooled or heated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BRISTOL.—On the nomination of the Society of Merchant Venturers, in the college of which the faculty of engineering of the University is provided and maintained, the council has appointed the Right Hon. Sir William Mather, P.C., a member of the board of that faculty, in succession to the late Sir William H. White, K.C.B.

CAMBRIDGE.—The following awards are announced: Harkness Scholarship (geology) for 1913, J. M. Wordie, St. John's College. Frank Smart prizes, J. Line, Emmanuel College (botany); D. J. Gray, King's College (zoology). Wiltshire prize (mineralogy) for 1913, E. V. Appleton, St. John's College; honourable mention, W. E. Evans, St. John's College.

ST. ANDREWS.—The Senatus Academicus has resolved to confer the honorary degree of LL.D. on the following:—Lieut.-Col. Sir Chas. H. Bedford, Dr. George Albert Boulenger, F.R.S., Mr. J. Balfour Browne, K.C., Mr. F. Cornwallis Conybeare, Prof. Herbert J. C. Grierson, and Prof. W. R. Hardie.

THE issue of the *London University Gazette* for June 4 gives particulars of the advanced lectures in scientific subjects which have been arranged during the present month for students of the University and others interested. Of those lectures which have still to be delivered may be mentioned a special lecture on the work of the Carnegie Nutrition Laboratory in Boston, to be given in the Physiological Laboratory of the University, South Kensington, on June 20, at 5 p.m., by Prof. F. G. Benedict, director of the Carnegie Laboratory. The admission to the lecture is free, without ticket.

THE report of the council for the year 1913 to the members of the City and Guilds of London Institute provides full statistics and particulars of the subscriptions and donations of the great City companies to the institute since its inauguration. The total amount given to the institute during thirty-four years for the purposes of higher education reaches 889,139*l*. Three of the companies—the Goldsmiths', Clothworkers', and Fishmongers'—have each given above 120,000*l*.; eight others have each contributed above 20,000*l*., and other five more than 10,000*l*. The most recent gift is that of the Goldsmiths' Company towards the extension of the City and Guilds (Engineering) College, which is incorporated in the Imperial College of Science and Technology. During the year under review the Goldsmiths' Company supplemented by a further sum of 37,000*l*. its original gift of 50,000*l*., which was commented upon in the last report of the council.

THE King Edward VII. British-German Foundation, instituted by Sir Ernest Cassel, decided last year to assist a number of young men of British nationality to prosecute special studies in Germany after the completion of their studies at one of the British universities. The council of the British sec-

tion of the foundation has just awarded seven studentships with this object in view, and from the list of successful candidates, published in *The Times*, we notice that four of the students will proceed in Germany with scientific research as follows:—Mr. F. H. Smith, Pembroke College, Cambridge, chemical research; Mr. R. S. Wishart, Edinburgh University, chemical research; Mr. A. Cowe, Edinburgh University, neurology and gynæcology; Mr. S. G. Barker, Imperial College of Science and Technology, London University, scientific research in vapour pressures. The studentships are for one year and of the value of 175*l*., and a condition of their tenure is continuous residence in Germany for this period. The cost of these will be defrayed by the German section of the foundation, while the British section is bearing the expense of a limited number of German students who, under a corresponding scheme, will visit this country in the autumn.

In a communication from *The Times* correspondent at Toronto on June 5, it is announced that the report of the Royal Commission on Industrial Training and Technical Education in Canada, instituted three years ago, has now been made public. The report suggests that a fund of 600,000*l*. be provided annually by the Dominion for a period of ten years, and be divided among the provinces on the basis of population for the promotion of higher technical education and industrial training, while for elementary schools teaching manual training and domestic science a grant of 70,000*l*. a year for ten years is recommended. The report also proposes the establishment in each province of a board qualified to carry on industrial training. It advocates the provision of suitable and adequate apparatus and equipment for teaching purposes, the foundation of scholarships for students, the engagement of experts with experience in industrial training, and the creation of central institutions to supplement the work carried on by the provincial and local authorities. Workers in factories whose main task is to attend or to operate machines should, it is suggested, receive instruction which would develop all-round skill and increase their interest beyond the routine of automatic operations. Such training should be provided as will conserve and develop occupations in which skilled handicraft is required. The interests of the rural population should be preserved so far as possible by industrial training and technical education suitable to the needs of its workers. The needs of girls and women for organised instruction and training in housekeeping and home-making under modern industrial conditions should be recognised. The report also recommends that schools for fishermen should be established, and that provision be made for instruction in packing and curing. The distinguishing characteristic of the report is the attention which it gives to the problems of the rural communities.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 12.—Sir Archibald Geikie, K.C.B., president, in the chair.—Commendatore G. **Boni**: Address on recent researches on the Palatine, in relation to geology, ethnology, and physics.—J. G. **Thomson** and D. **Thomson**: The growth and sporulation of the benign and malignant Tertian malarial parasites in the culture tube and in the human host.—Sir David **Bruce**, Majors D. **Harvey** and A. E. **Hamerton**, and Lady **Bruce**: (1) *Plasmodium cephalophi* sp. nov. (2) The trypanosome causing disease in man in Nyasaland. II., Susceptibility of animals to the human strain. (3) Trypanosome diseases of domestic animals in Nyasaland. I., *Trypanosoma simiae* sp. nov. Part ii., The susceptibility of various animals to *Trypanosoma simiae*. (4) Trypanosome diseases of domestic animals in Nyasaland. I., *Trypanosoma simiae* sp. nov. Part iii.

Zoological Society, June 3.—Prof. E. W. MacBride, F.R.S., vice-president, in the chair.—Sir Arthur H. **Church**: Notes on turacin and the turacin-bearers. This paper contains a summary of the chief facts as to the composition, properties, and occurrence of turacin, the soluble crimson pigment of the Musophagidæ. Special stress is laid upon its constancy of composition, the limitation of its occurrence to certain plantain-eaters, and the relation of its spectrum to the spectra of hæmoglobin and chlorophyll. Some current errors concerning turacin are corrected.—Dr. P. Chalmers **Mitchell**: Observations on the anatomy of the shoe-bill (*Balaeniceps rex*). The author showed that Balæniceps and Scopus shared so many anatomical characters, and of these so many occurred also in storks, that if the reasoning generally followed by anatomical ornithologists were adopted, Balæniceps and Scopus must be placed with storks rather than with herons. He submitted, however, that such a method was irrational, unless it were accompanied by a much closer scrutiny of the value of the characters than had hitherto been made or was yet possible, and that for the present Balæniceps must be regarded as the representative of a division equivalent to storks and herons. He thought also that the relation of the Steganopods to these three groups required reconsideration.—T. H. **Withers**: Some Miocene Cirripedes of the genera Hexelasma and Scalpellum from New Zealand. An account is given of the "gigantic Cirripede" of New Zealand, originally described as *Scalpellum aucklandicum*, of which remains have long been known to occur in the Waitemata Beds (Miocene) of Motutapu Island, Auckland Harbour.—Prof. A. **Dendy** and R. W. **Row**: The classification and phylogeny of the Calcareous sponges, with a reference list of all the known species, systematically arranged. This memoir aims at a complete revision of the genera of Calcareous sponges. Fifty recent genera are recognised and diagnosed, and all the described species, amounting to 433, are arranged under these genera. The rejected generic names, which are listed separately, amount to ninety-seven. The fifty accepted genera are grouped in ten families, and Poléjaeff's subdivision into Homocœla and Heterocœla is abandoned.—Surgeon J. C. **Thompson**: Contributions to the anatomy of the Ophidia.—Prof. T. Wingate **Todd**: Observations on Osteomalacia in the zoological collections of Manchester and Cleveland.

Linnean Society, June 5.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Miss L. S. **Gibbs**: A contribution to the flora and plant-formations of Kinabalu and the highlands of British North Borneo.—H. **Scott**: The Histeridæ of the Percy Sladen Expedition to the Seychelles.—Mme. Weber van **Bosse**: Red marine algæ from the Indian Ocean.—J. G. **Needham**: Myrmeleonidæ.—W. L. **Distant**: Rhynchota from the Seychelles. Part I., Heteroptera.—Prof. R. J. Harvey **Gibson**: Mystropetalon, Harv.

Mathematical Society, June 12.—Prof. Love, president, in the chair.—Sir J. **Larmor**: The electromagnetic force on a moving charge in relation to the energy of the field.—Prof. E. **Landau**: Einige Ungleichungen für zweimal differentierbare Funktionen.—G. H. **Hardy** and J. E. **Littlewood**: (1) The fractional part of $n^k\theta$. (2) The trigonometrical series associated with the elliptic θ-functions.—Dr. T. J. I'A. **Bromwich**: Foucault's pendulum.—J. **Hammond**: A certain definite inegral.

Royal Astronomical Society, June 13.—Major E. H. Hills, C.M.G., F.R.S., president, in the chair.—F. W. **Dyson** and E. W. **Maunder**: Position of the sun's axis as determined from photographs of the sun from 1874 to 1912, measured at the Royal Observatory, Greenwich. In a previous paper corrections to the position of the axis were deduced from observations of spots crossing the sun's disc; in the present paper the material employed was extended by the consideration of spot groups passing across the further side of the sun. A still more important addition consisted in the observation of the latitudes of spots near the centre of the disc. No change was observed, either with sun-spot cycle or with phase.—A. S. **Eddington**: Preliminary results of observations with the Cookson floating zenith telescope. Mr. Cookson had photographed trails of the same star with reversed positions of the instrument; at Greenwich trails of different stars were taken, a method which brings the trails closer together, and near the centre of the plate. This method considerably reduced the probable error, but there remained discordances, the cause of which was uncertain; there seemed reason to believe that they were atmospheric.—J. A. **Harker**: The origin of solar electricity. A simple apparatus was described with which experiments were made, showing increase of electrical emission in all metals with increasing temperature. The cosmical bearing of the phenomena observed was pointed out.—Prof. E. C. **Pickering**: Some work carried on at the Harvard Observatory, especially the classification of stellar spectra by Miss Cannon. One thousand spectra had been classified by Miss Cannon alone in three years, but with her great experience and by carefully organising the work, Miss Cannon and her staff of assistants were now able to classify 5000 spectra a month. The work to be done was very great; there appeared to be more than 150,000 spectra to be dealt with.—Miss **Cannon**: Classification of spectra of gaseous nebulæ. Many gaseous nebulæ have precisely the character of the spectra of stars of the fifth type.—S. S. **Hough**: Progress of the Cape of Good Hope share in the work of the Astrographic Chart. The catalogue plates were all taken and checked by comparing the overlapping quadrants. Mr. Hough described briefly the other work carried on at the Cape, especially mentioning the high degree of stability of the system of meridian marks used.—Dr. H. N. **Russell**: Studies of stellar evolution, carried on at the Princeton Observatory. Dr. Russell showed diagrams exhibiting the relation between the spectra of stars and their real brightness, that is the brightness which they would have if all were placed at a uniform distance corresponding to a parallax of ten seconds. Interesting relations between colour and brightness were shown by the diagrams.

CAMBRIDGE.

Philosophical Society, May 19.—Dr. Shipley, president, in the chair.—Dr. G. F. C. **Searle**: (1) Some methods of measuring the surface tension of soap films. In one method the pressure excess due to a curved soap film is measured by aid of what may be called a "viscosity potentiometer." Air from a gasometer flows through two tubes AB, BC in series. The pressure at A is measured by a manometer; the end C is open to the air. From the junction B a side tube leads to a cup with a horizontal circular rim on which a soap film is placed. On account of the viscosity of the air, there is a fall of pressure along each tube. For a given flow of air, the fall of pressure in either tube is proportional to the length of the tube, and inversely proportional to the fourth power of its internal radius. The excess of the pressure at B over that of the atmosphere causes the film to become part of a sphere. From the distance of the highest point of the film above the plane of the rim and from the radius of the rim, the radius, r, of the film can be computed. (2) A simple method of testing lens systems for aberration. On account of spherical aberration, a lens does not bring to a mathematical point all the rays which have reached it from an object point on its axis. When there is aberration, the emergent beam has at one place a finite minimum cross section called the least circle of aberration; the smaller this circle is the more nearly is the lens free from spherical aberration for the given position of the object point. A metal plate is pierced with three equally spaced circular holes, A, B, C, each about 0·1 cm. in diameter, and the distance AC (measured from centre to centre) is about 2 cm. The holes are illuminated by a flame and their "images" formed by the lens system under test are received upon a very fine ground-glass screen backed by a micrometer scale divided to 0·01 cm.; this scale is viewed by an eyepiece. The examination shows whether the lens is free from spherical aberration or whether it is (1) under-corrected or (2) over-corrected for aberration.—R. D. **Kleeman**: The unstable nature of the ion in a gas. The ions in a gas in thermodynamical equilibrium must at any instant consist of free ions and clusters of various complexities (Proc. Camb. Phil. Soc., vol. xvi., pt. iv., p. 285). In order to obtain some experimental information on the nature of the ions, the ionisation by collision between a gauze and plate was studied, the initial ions being formed outside the space between gauze and plate in a weak field which drew the ions through the gauze. Some of the elementary ions were thus able to form clusters before being seized upon by the strong field producing further ions by collision.—W. A. Douglas **Rudge**: A dust electrical machine. The author has shown that clouds of dust raised by the wind or by artificial means are always strongly charged with electricity, the sign of the charge depending upon the nature of the dust. By a suitable arrangement of apparatus it is possible to get a continuous supply of electricity, by directing a current of air laden with dust through an insulated tube. When the current is passing a stream of sparks, sometimes 6 cm. in length, may be obtained from the tube. Flour, sulphur, road dust, or fine iron filings may be used. The air which escapes from the exit tube of the apparatus is also strongly charged, and if the apparatus is used inside a room the charge may be retained by the air of the room for more than half an hour. The origin of the charge upon the apparatus is probably due to (1) the actual raising of the cloud, (2) friction of the dust against the walls of the tube.—R. **Whiddington**: A mechanical vacuum tube regulator. One of the devices for regulating the speed of kathode rays within a discharge tube is to provide the kathode with a movable glass sheath. The position of the sheath determines the speed of the rays. Experiments are described which show that the inside of the sliding sheath concentrates the cylindrical beam of rays to a fine beam, thus diminishing the effective size of the kathode.

EDINBURGH.

Royal Society, May 4.—Sir William Turner, K.C.B., president, in the chair.—Dr. W. S. **Bruce**: The skulls of antarctic seals (Scottish National Antarctic Expedition). The paper contained the measurements of the skulls of the different seals found in the Antarctic, with careful photographs of the skulls in various aspects.—Miss Laura R. **Thornley**: The Bryozoa of the Scottish National Antarctic Expedition. Of the eighty-five species described, three were new to science and six of the remainder had been found in the southern seas for the first time.—W. **Watson**: The

compressibility of solutions of certain salts. Dilute solutions of NaOH, KOH, $MgSO_4$, $ZnSO_4$, and Na_2CO_3 were investigated by the electrical-contact method of measuring compressibility. The pressures were from one to one thousand atmospheres, and the temperature was 15° C. Within certain limits the observed compressibilities were found to satisfy Tammann's formula,

$$\frac{1}{v_0}\frac{dv}{dp}=\frac{A}{B+p+\Delta k^2}\frac{1}{v_{\Delta k}},$$

where Δk is the internal pressure due to the added salt and A and B are constants.

May 18.—Prof. T. Hudson Beare, vice-president, in the chair.—J. H. Harvey **Pirie**: Deep-sea deposits of the Weddell Sea and South Atlantic Ocean. The *Scotia* collections included three main types, viz. globigerina ooze, diatom ooze, and glacial muds and clays. The latter differs from most blue muds of terrigenous origin mainly in the character of its finest constituents—"rock feons"—and in the irregular size of its coarser components, this being due to its distribution by floating ice. A peculiar feature is the absence of diatoms, although they flourish in the surface waters over it. They seem to be carried off northwards by currents set up by the melting ice to be deposited in the diatom ooze band to the north.—F. Gordon **Pearcey**: Foraminifera collected by the *Scotia*. A record of 267 species, including eleven new forms, separated from the deposits. The collection is very rich in arenaceous forms (to which most of the new species belong) from the glacial deposits. It includes also examples of such rare forms as *Verammosphaera fusca*.—Miss Margaret **Moir**: The effect of thermal treatment and the effect of longitudinal strain in inducing a sensitive state in certain magnetic materials. Under certain conditions it was found that longitudinal strain and heating had very similar effects on the manner in which the steels experimented with responded, as regards their induction, to the magnetising force acting on them.

PARIS.

Academy of Sciences, June 2.—M. F. Guyon in the chair.—E. L. **Bouvier**: The genera Pseudibacus and Nisto.—M. de **Forcrand**: The Trouton quotient and the molecular heat of vaporisation of pure bodies boiling at high temperatures. In connection with a modified Trouton formula recently proposed by the author, the experimental methods of determining the latent heat of vaporisation at high temperatures are discussed, and preference is given to the vapour-pressure method, with application of the Clapeyron equation. Experimental data for mercury, cadmium, zinc, bismuth, lead, silver, tin, and copper are compared with those deduced from the Forcrand formula.—M. **Ciamician** was elected a correspondant for the section of chemistry in the place of the late Lecoq de Boisbaudran.—J. **Bosler**: The spectrum of the Schaumasse comet 1913*a*. Three condensations are clearly shown on the spectrographs, the blue band of the Swan spectrum, the cyanogen band (λ 388), and a large band λ 400 to λ 407.—M. **Borrelly**: Observations of the comet 1913*a* (Schaumasse) made at the Observatory of Marseilles with the comet-finder. Positions of the comet and comparison stars are given for May 9, 10, 15, 22, 29, and 30.—M. **Coggia**: Observations of the comet 1913*a* (Schaumasse) made at the Observatory of Marseilles with the Eichens 26-cm. equatorial. Positions for May 26, 27, 28, and 29.—N. **Lusin**: The convergence of Fourier's trigonometrical series.—Paul **Lévy**: The integration of functional partial differential equations.—Jacques **Chapelon**: The numbers of classes of positive binary quadratic forms with negative determinant.—Vasilesco **Karpen**: Hovering flight.—Louis **Roy**: Complement to two recent notes on the movement of indefinite viscous media.—Ernest **Esclangon**: A temperature regulator. The regulator consists of a circular glass tube containing mercury and a volatile liquid supported on a knife edge at the centre of the circle formed by the tube. It is in indifferent equilibrium, and can be rendered extremely sensitive. Curves are given showing the behaviour of this as compared with an ordinary bimetallic regulator.—R. **Détrait**: The slip of liquids on the walls of capillary tubes. The flow of two liquids, petrol and water, was studied in tubes of glass, wetted by both liquids, and sulphur, wetted by the petrol only.—H. **Parenty**: The reconstitution photographically of certain invisible details of ancient drawings. Lighting in various ways a *Décollation de Saint Jean Baptiste,* attributed to Rubens, the signature *Rubês* appeared, the first two letters in all the negatives, the last three in one or other of them.—Pierre **Weiss**: The kinetic theory of the paramagnetism of crystals.—G. **Friedel**: The general law of the diffraction of the Röntgen rays by crystals.—A. **Perot**: The movement of the light centres in electric discharges in Geissler tubes.—G. **Malfitano** and Mlle. A. **Moschkoff**: The deflocculation of starch and the solution of glucose.—Edouard **Bauer**: 1-Benzoyl-2-phenyl-Δ_1-*cyclo*pentene. With sodium amide this compound behaves similarly to benzophenone, breaking up partially into 2-phenyl-Δ_1-*cyclo*pentene-1-carboxylic acid and benzene and partially into 1-phenyl-Δ_1-*cyclo*pentene and benzamide.—E. **Léger** and Ferdinand **Roques**: Contribution to the study of carpiline or pilosine.—M. **Chaillot**: Researches on the morphology of the bud in Labiates with subterranean stolons.—E. **Boucherie**: The cytological phenomena and sporogenesis in *Barbula muralis*.—M. **Molliard**: Semi-parasitic *Lepidium sativum* produced experimentally.—D. **Chouchak**: The penetration of different forms of nitrogen in plants; adsorption phenomena.—N. **Patouillard**: A conidiferous Septobasidium.—J. M. **Lahy**: The physical signs of professional superiority in dactylographs.—L. **Bordas**: The gizzard of the Dytiscideæ.—A. **Gruvel**: Fishing for the large Cetaceans on the western coast of Africa. The present rate of destruction is so great that an international control is suggested.—Edouard **Chatton**: Spontaneous septicemia due to the cocobacillus in the cockchafer and silkworm.—Auguste **Lumière** and Jean **Chevrotier**: The toxicity of antityphoid vaccines. The vaccines studied proved to be very slightly toxic for the guinea-pig.—M. **Dalloni**: The marine Oligocene and its fauna in Algeria.—Alphonse **Berget**: The exact position of the continental pole of the earth.

June 9.—M. F. Guyon in the chair.—E. **Jungfleisch** and L. **Brunel**: The reactions between water and sulphurous acid at varying temperatures. The formation of hyposulphurous acid. Aqueous solutions containing from 20 per cent. to 21 per cent. of sulphur dioxide were heated to various temperatures. At about 150° C. sulphur and sulphuric acid were formed, an equilibrium being reached in twenty days. A study of the reaction at lower temperatures showed that hyposulphurous acid was formed; this then decomposes into sulphur and sulphuric acid.—Prince Albert de **Monaco**: The twenty-fifth scientific expedition (*Hirondelle II.*). Results obtained in the neighbourhood of the Azores and Madeira in the summer of 1912.—Pierre **Duhem**: An elementary remark on the problem of spherical waves.—Paul **Sabatier** and A. **Mailhe**: The use of calcium carbonate as a catalyser of the organic acids and their anhydrides. A column of precipitated chalk, 15 cm. to 40 cm. long, and maintained at a temperature of 450° C. to 500° C., gives a fair yield of ketones when the vapours of the acids are led over it. Acetic acid and propionic acid give

very good yields, but there is an increase in the secondary products as the molecular weight of the acid is higher. Benzoic acid gives no benzophenone, but mixtures of benzoic and fatty acids give fair yields of the mixed fatty-aromatic ketones.—A. de **Gramont** was elected a member of the section of free academicians in succession to the late Alfred Picard.—J. **Guillaume**: Observation of the occultation of a star of the eighth magnitude by Jupiter made at the Observatory of Lyons.—J. **Guillaume**: A curious aspect of the third satellite of Jupiter. Instead of the usual round disc the satellite Ganymede presented a gibbous appearance recalling that of Mars at certain periods. Two illustrations of the satellite are given.—L. **Godeaux**: The classification of the involutions of genus 1 belonging to a surface of genus 1.—A. **Buhl**: Formulæ analogous to the formula of Stokes.—Th. **Got**: The fundamental domains of certain Fuchsian groups.—M. **Schwarz** and M. **Villatte**: The first determination of the difference of longitude by wireless telegraphy in western French Africa. The stations were Kissidougou and Conakry.—A. **Magnan**: Data for the construction of an ideal monoplane based on the flight of birds.—M. **Levavasseur** and M. **Gastambide**: An aëroparachute.—Eugène **Bloch**: The principle of an electrostatic motor. An ordinary quadrant electrometer is modified to serve as a motor.—M. de **Broglie**: The diffraction and reflection of the Röntgen rays.—Jacques **Carvallo**: The electrical conductivity of some pure liquids: ammonia, acetone, ethyl and methyl alcohol. The method used was to seal up the purified liquids in glass tubes furnished with electrodes, and apply a constant electromotive force. The liquid is purified by the action of the current, without, however, any electrolytic phenomena being observable, and the current is noted as a function of the time and voltage.—A. **Tian**: The determination of the order of a photochemical reaction. An attempt to elucidate the effect of absorption on the reaction velocity.—Eugène **Fouard**: A law of tonometry and its consequence as regards the ionic theory.—P. **Leroux**: Magnetic study of the constitution of some antimony alloys. Curves are given for the tin-antimony and lead-antimony alloys.—Daniel **Berthelot** and Henry **Gaudechon**: The photochemical synthesis of a new compound, carbon oxycyanide, by means of ultra-violet light. Mixtures of carbon monoxide and cyanogen are acted upon by ultra-violet light of wave-length less than 0·25μ, the gases combining in equal volumes. The substance formed is gaseous at about 100° C., and solid at the ordinary temperatures. An analysis, combined with a study of the reactions of this compound, shows that it is carbonyl cyanide, $CO(CN)_2$, analogous with carbonyl chloride.—F. **Bourion** and A. **Deshayes**: The quantitative separation of iron and chromium.—H. **Copaux**: The constitution of the para-molybdates and the para-tungstates.—Léon **Guillet**: The transformation points and the structure of nickel-chrome steels.—Jean **Nivière**: The preparation of diglyceric alcohol.—Marcel **Godchot** and Félix **Taboury**: Some derivatives of β-methyl*cyclo*pentanone. The preparation of the monochloro-derivative and some substances obtained from this are described.—A. **Guilliermond**: New observations on the chondriome of fungi.—D. **Chouchak**: The absorption of different forms of nitrogen by plants; the influence of the medium. The absorption of mineral or organic nitrogen by young wheat plants does not depend immediately upon the living material. It is determined by substances which are contained in the roots and which are not removed by boiling water.—R. **Argaud**: A directly excitable endocardiac region.—Jacques **Mawas**: Action of the traction of the zonule on the general configuration of the human crystalline lens. The possibility of flattening the periphery of the crystalline lens during accommodation.—Em. **Bourquelot** and H. **Hérissey**: The biochemical synthesis with the aid of emulsin of a glucoside isomeric with salacin. β-Salicylglucoside.—L. **Cayeux**: The meaning of mineral gravels included in the Hettangian iron deposits of Burgundy.—Jean **Groth**: The southern border of the Iberian Meseta.—Lucien **Mayet** and Joseph **Mazenot**: The discovery of a prehistoric cave of the Aurignacian age at Brancion (Saone-et-Loire). The cave showed three different archæological levels and a fairly uniform fauna of the middle Quaternary.

CAPE TOWN.

Royal Society of South Africa, April 16.—The president in the chair.—Miss E. L. **Stephens**: A new species of Hæmatoxylon (Leguminosæ-Cæsalpineæ) from Great Namaqualand. The discovery of a South African species of Hæmatoxylin is of particular interest, as the genus has hitherto been represented only by one species—*H. campecheanum*, L., the log-wood tree, a native of Mexico, Central America, the northern parts of South America, and the West Indies. The species here described was found among rocks near Holoog, in Great Namaqualand, by Dr. H. H. W. Pearson, in February, 1909, during the Percy Sladen Memorial Expedition in South-West Africa, 1908–9. It is a shrub, 1–1·5 metres high, and it differs from *H. campecheanum* by its shrubby habit, its more or less pilose and glandular young parts and inflorescence, its smaller leaves, its longer flowered and terminal inflorescence, its bilabiate calyx, and its longer petals and stamens. On a more recent expedition, Dr. Pearson has obtained some wood of this species, which has yielded the characteristic log-wood dye.—G. **Rattray**: Notes on the pollination of some South African Cycads. *Encephalartos Altensteinii*, Lehm., is pollinated by insect agency, the pollen bearer being a weevil belonging to the genus Phlæophagus. Anemophily may still occasionally occur in this species. *E. villosus*, Lehm., from its habitat and cone structure, appears to be exclusively entomophilous. No evidence of entomophily has been found in *Stangeria Katzeri*, Rgl.—R. A. **Dümmer**: A synopsis of the species of Lotononis and of Pleiospora.—T. **Muir**: Note on an overlooked theorem regarding the product of two determinants of different orders.—R. T. A. **Innes**: Note on the Newcomb operators used in the development of the perturbative function.

BOOKS RECEIVED.

Herpetologia Europaea. By Dr. E. Schreiber. Pp. 54. (Jena: G. Fischer.) 2 marks.

County Borough of Halifax. Bankfield Museum Notes. Second Series. No. 2, Ancient Egyptian and Greek Looms. By H. Ling Roth. Pp. 41+plate. (Halifax: F. King and Sons, Ltd.) 2*s*. 6*d*.

National Antarctic Expedition, 1901–4. Meteorology. Part ii. Prepared in the Meteorological Office, under the superintendence of M. W. C. Hepworth. Pp. 26+charts. (London: The Royal Society.)

Konstitutions-Formeln der organischen Chemie in graphischer Darstellung. By J. Loschmidt. Edited by R. Anschütz. Pp. 154. (Leipzig: W. Engelmann.) 5 marks.

Handwörterbuch der Naturwissenschaften. Edited by E. Korschelt and others. 43 and 44 Lief. (Jena: G. Fischer.) 5 marks each Lief.

Die Chemie als mathematisches Problem. By C. Mezger. Pp. 108. (Metz: G. Scriba.) 3 marks.

Das selbstgefertigte Lichtbild. By W. Dix. Pp. 70. (Leipzig: Quelle and Meyer.) 1 mark.

Ausländische Kultur- und Nutzpflanzen. By L. Trinkwalter. Pp. vi+120. (Leipzig: Quelle and Meyer.) 2.40 marks.

Methodik des chemischen Unterrichts. By Dr. K. Scheid. Pp. xv+448. (Leipzig: Quelle and Meyer.) 10 marks.

Probleme der physiologischen und pathologischen Chemie. By Dr. O. von Fürth. II. Band. Stoffwechsellehre. Pp. xiv+717. (Leipzig: F. C. W. Vogel.) 23 marks.

Guy Mannering, or the Astrologer. By Sir Walter Scott, with Introduction and Notes by J. H. Boardman. Pp. xxx+482. (London: A. and C. Black.) 2s.

Geological Survey of New Jersey. Bulletin 8: Annual Administrative Report of the State Geologist for the Year 1912, including a Second Report on Shark River Inlet, by C. C. Vermeule, and a List of New Bench Marks. Pp. 103. (Trenton, N.J.: MacCrellish and Quigley.)

Geological Survey of New Jersey. Bulletin 9: A Preliminary Report of the Archæological Survey of the State of New Jersey made by the Department of Anthropology in the American Museum of Natural History, compiled by A. Skinner and M. Schrabisch. Pp. 94+map. (Trenton, N.J.: MacCrellish and Quigley.)

Chemie, allgemeine Kristallographie und Mineralogie. By E. v. Meyer, C. Engler, L. Wöhler, O. Wallach and others. Pp. xiv+663. (Leipzig and Berlin: B. G. Teubner.) 21 marks.

Documents of British History, A.D. 1815–1900. By M. W. Keatinge and N. L. Frazer. Pp. 77. (London: A. and C. Black.) 8d.

Récits et Compositions d'après l'Image. By M. Anceau and E. Magee. Pp. 33+14 plates. (London: A. and C. Black.) 6d.

Zoology. By Prof. E. Brucker. Pp. xiii+219. (London: Constable and Co., Ltd.) 2s. net.

Department of the Interior. U.S. Geological Survey. Mineral Resources of the United States. Calendar Year 1911. Part i., Metals. Pp. 1018. Part ii., Non-Metals. Pp. 1224+maps. (Washington: Government Printing Office.)

Department of the Interior. U.S. Geological Survey. Water Supply Paper. 259, 293, 297, 300, 310, 311, 313, 316. (Washington: Government Printing Office.)

Department of the Interior. U.S. Geological Survey. Bulletin. 502, 503, 510, 521. (Washington: Government Printing Office.)

Mechanics and Heat. By J. Duncan. Pp. xiii+381. (London: Macmillan and Co., Ltd.) 3s. 6d.

Principles and Practice of School Gardening. By A. Logan. Pp. xv+313. (London: Macmillan and Co., Ltd.) 3s. 6d.

U.S. Department of Agriculture. Weather Bureau. Report of the Chief of the Weather Bureau, 1911–12. Pp. 272+4 charts. (Washington: Government Printing Office.)

DIARY OF SOCIETIES.

THURSDAY, JUNE 19.

ROYAL SOCIETY, at 4.30.—Atomic Specific Heats between the Boiling Points of Liquid Nitrogen and Hydrogen. I. The Mean Atomic Specific Heats at 50° Absolute of the Elements—a Periodic Function of the Atomic Weights: Sir James Dewar.—An Active Modification of Nitrogen produced by the Electric Discharge. V.: Hon. R. J. Strutt.—The Electrical Emissivity and Disintegration of Hot Metals: Dr. J. A. Harker and Dr. G. W. C. Kaye.—A Method of Measuring the Viscosity of the Vapours of Volatile Liquids, with an Application to Bromine: Dr. A. O. Rankine.—The Efficiency of Selenium as a Detector of Light: E. E. Fournier d'Albe.—The Hall Effect in Liquid Electrolytes: A. E. Oxley.—The Displacements of the Particles and their Paths in Some Cases of Two-dimensional Motion of a Frictionless Liquid: Prof. W. B. Morton.—The Diurnal Variations of the Earth's Magnetism produced by the Moon and Sun: S. Chapman.—The Electric Effect of Rotating a Magnetic Insulator in a Magnetic Field: Prof. H. A. Wilson and Marjorie Wilson.—The Magnetic Materials in Claywares: A. Hopwood.—Synthesis of the Anhydrides of α Aminoacyl Glucosamines: A. Hopwood and C. Weizmann.—The Flexure of Telescope Mirror-discs arising from their Weight, and its Influence upon Resolving Power: H. S. Jones.—(1) Fourier Series and Functions of Bounded Variation; (2) A Condition that a Trigonometrical Series should have a certain Form; (3) Trigonometrical Series the Cesaro Partial Summations of which Oscillate Finitely: Prof. W. H. Young.

LINNEAN SOCIETY, at 8.—Impressions of the Feeding-tracks of *Limax maximus* and *Helix aspersa*: Mrs. Longstaff.—African Species of the Genus Crotalaria: E. G. Baker.—Aphareocaris, nom. nov. (Aphareus, Paulson), a Genus of the Crustacean Family Sergestidæ: Dr. W. T. Calman.—Water-colour Drawings of Australian and South African Plants: Miss Fuller.—An Anatomical Study of the Cone-genus Lepidostrobus: Dr. Agnes Arber.—Fresh-water Rhizopoda from North and South America: G. H. Wailes.—A Revision of the Genus Symphytum, Tourn.: Cedric Bucknall.—Some New British Plants: Dr. C. E. Moss.

MONDAY, JUNE 23.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Geographical Excursion across the United States: G. Chisholm, H. O. Beckit, and A. G. Ogilvie.

WEDNESDAY, JUNE 25.

GEOLOGICAL SOCIETY, at 8.—The Miocene Beds of the Victoria Nyanza and the Geology of the Country between the Lake and the Kisii Highlands: Dr. F. Oswald.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, JUNE 26.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Light Sensations and the Theory of Forced Vibrations: Dr. G. J. Burch.—The Fluctuation in the Ionisation due to γ Rays: P. W. Burbidge.—The Force Exerted on a Magnetic Particle by a Varying Electric Field: J. G. Leathem.—The Luminosity Curve of a Colour-blind Observer: Dr. W. Watson.—A Critical Study of Spectral Series. Part iii. The Atomic Weight Term, and its Import in the Constitution of Spectra: Prof. W. M. Hicks.—A Band Spectrum attributed to Carbon Monosulphide: L. C. Martin.—Phosphorescence of Mercury Vapour after Removal of the Exciting Light: F. S. Phillips. *And other Papers.*

FRIDAY, JUNE 27.

PHYSICAL SOCIETY, at 5.

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