Nature

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

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INDEX.

REVIEWS AND OUR BOOKSHELF.

Supplement to March 5.

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

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

THURSDAY, NOVEMBER 7, 1907.

SCIENTIFIC WORTHIES.

XXXVI.—Sir William Crookes, F.R.S.

SIR WILLIAM CROOKES has the rare privilege of looking back upon a scientific activity extending already over more than fifty-five years. By numerous papers and by several volumes the results of his experimental researches in different departments of physics and chemistry have been spread all over the world. Though born in 1832, even his advanced age has not diminished his scientific productiveness.

All Sir William Crookes's researches, with the exception of the first, were made in his private laboratory in Kensington Park Gardens. Although the motion of the walls of this laboratory, as seen under the high magnifying power of the horizontal pendulum, gave rise, at first sight, to doubts as to the solidity of its construction (Philosophical Transactions, 1876, Crookes, "On Repulsion, &c.," § 134), it has stood the test of time. The perennial stability, however, of many of the stones joined by Crookes to the edifice of science never was questionable. Most of those who have risen to eminence in physics have done so by giving their exclusive attention to that science, and it is only rarely that the physicist can do pioneer work also in chemistry. Rarer still is the case of Sir William Crookes, whose series of physical papers is frequently interrupted by communications concerning his chemical discoveries.

In the *Philosophical Magazine* of April, 1861, Crookes tells us:

"In the year 1850, Prof. Hofmann placed at my disposal upwards of 10 lb. of the seleniferous deposit from the sulphuric acid manufactory at Tilkerode, in the Hartz Mountains, for the purpose of extracting from it the selenium, which was afterwards employed in an investigation of the selenocyanides."

In the examination, by the spectroscope, of the residue left in the purification of the crude selenium, Crookes's attention was attracted by a bright green line, which he had never met with before. In following up its appearance, he succeeded in isolating a new metal, which he called thallium, after the emerald green line which has become now as familiar to chemists, even if not brought up in a spectroscopic atmosphere, as the lines of sodium and lithium; and the physicist again and again enjoys the homogeneity of thallium light when observing interference for large differences of path, either with his Rowland or his Michelson grating, or with his Fabry and Perot apparatus, or with his Lummer and Gehrcke plate.

The year 1861 brought the first great triumph to Crookes. During the next twelve years he carried out minute investigations of the many properties of the new element, culminating in his determination of its atomic weight—203·642, or when reduced with the now accepted values for the atomic weights of oxygen and nitrogen, 204·04. Extreme care was given to the necessary weighings, and the pains taken to start with pure substances were enormous. The international committee for the atomic weights and other authorities regard Crookes's determination of the atomic weight of thallium as the best we possess, though thirty-four years have elapsed since the date of its publication.

Crookes finished his determination not without tribulation, having been troubled with discouraging irregularities in his weighings. In order to improve his results, the weighings were made in a partial vacuum, but even under these conditions the balance behaved most capriciously. Sometimes the substance appeared to be heavier when cold than when in a heated condition; sometimes the action was opposite. Working further with indefatigable ardour he came to what he then called "repulsion resulting from radiation," and going on he invented in 1875 an apparatus in illustration of the thoroughly novel and striking phenomena he had observed, the radiometer. His researches in this new field, contained in 485 paragraphs, and published in the Philosophical Transactions of 1874, 1875, 1876, 1878, 1879, represent an immense amount

of experimental work of the greatest interest and ingenuity.

Under the influence of the dynamical theory of gases the general nature of the perplexing phenomena was recognised and referred to the intervention of the residual gas. The genius of Schuster, Osborne Reynolds, Tait, Dewar, and Maxwell was associated with this explanation, but special mention should here be made of the more personal, yet beautiful and ennobling example of scientific cooperation given by Sir William Crookes and Sir George Stokes, the documents relating to which have just been published. The new and fascinating chapter in the dynamical theory of gases, relating to the stresses in rarefied gases arising from inequalities in temperature, which thus sprang up in connection with Crookes's experimental work, is, notwithstanding the 110 references to the literature of the radiometer in a modern German text-book, still unfinished. We may be sure that quantitative experiments concerning the radiometer actions under entirely new conditions will again prove the importance of the chapter, emblazoned on its cover by Crookes's light-mill.

Crookes thus was brought into touch with the dynamical theory of gases and with experimental work in high vacua, and so came to his experiments concerning the electric discharge in gases. In this province we are indebted to him for some very striking discoveries relating to the now well-known kathode rays, then already associated with the names of Plücker (1859), Hittorf (1869), and Goldstein (1876). His brilliant experiments ("The Trajectory of Molecules," "Molecular Physics in High Vacua," "Phosphorogenic Properties of Molecular Discharge") were published in the Philosophical Transactions for 1879, but became generally known to the world—not to the scientific world alone—by his lecture on "Radiant Matter," delivered on Friday, August 22, 1879, at Sheffield, to the British Association for the Advancement of Science. Even now the reading of this lecture, though the facts in it have become familiar, brings one under its irresistible charm, and Lenard and Tesla, describing in eloquent terms the impression made by it on their young minds, certainly give utterance to a prevalent opinion. In the beautiful volumes on "Ions, Electrons, Corpuscules," for which physicists are indebted to the Société française de Physique, only one lecture has been inserted, that of Sir William.

There exists perhaps only one lecture given on a similar occasion which has become as popular and made on the hearers as deep an impression, both by its contents and its accomplished form; I mean the lecture delivered before the Association of German Naturalists at Stuttgart in 1889 by Hertz, in which his great discoveries were expounded.

All the wonderful and important properties of the constituents of the kathode rays or of radiant matter: its darting in a straight line from the negative pole, the position of the positive electrode being unimportant; its casting of a shadow when intercepted by solid matter; the strong mechanical action radiant matter seems to exert where it strikes; the change of direction by a neighbouring magnet; the heat produced when its motion is arrested; the remarkable power which the molecular rays possess of causing phosphorescence in preparations of calcium sulphide shining with blue-violet, yellow, orange or green light, in diamonds shining with nearly all colours of the rainbow, in rubies glowing with a rich full red; all these results Crookes tried to explain by the hypothesis that the kathode rays, or streams of radiant matter, or of matter in an ultra-gaseous state are particles or molecules negatively charged and projected with great velocity from the negative electrode. The inherent truth of Sir William Crookes's hypothesis concerning the nature of the kathode rays is, after much controversy for a space of nearly twenty years, now established, and the original hypothesis, with finer contents, is now accepted by all physicists.

In Crookes's experiments for the first time the majestic simplicity of the kathode rays became clearly apparent. In the irritating complexity of the other phenomena of the vacuum tube, appearances of great purity had been isolated, so that Crookes could risk the opinion "that we are here brought face to face with Matter in a Fourth state or condition," neither solid, liquid, nor gaseous.

Crookes alone among his contemporaries recognised the essential importance of the kathode rays, and with almost prophetic insight foresaw the part radiant matter would have to play in the development of physical science. In the splendid evolution of electronic theory we are now witnessing, we see how true Crookes's foreshadowing of the *rôle* of radiant matter was.

"In studying this Fourth state of Matter, we seem at length to have within our grasp and obedient to our control the little indivisible particles which, with good warrant, are supposed to constitute the physical basis of the universe. We have seen that in some of its properties Radiant Matter is as material as this table, whilst in other properties it almost assumes the character of Radiant Energy. We have actually touched the border land where Matter and Force seem to merge into one another, the shadowy realm between Known and Unknown, which for me has always had peculiar temptations. I venture to think that the greatest scientific problems of the future will find their solution in this Border Land, and even beyond; here, it seems to me, lie Ultimate realities, subtle, far-reaching, wonderful.

"Yet all these were, when no Man did them know,
Yet have from wisest Ages hidden beene;
And later Times thinges more unknowne shall show.
Why then should witlesse Man so much misweene,
That nothing is, but that which he hath seene?"

All the experiments in this lecture now have become classical, and several of them are repeated every year in every university of the world. The most familiar and representative of the group is perhaps that one with the Maltese cross in the pear-shaped Crookes's tube, in which the black shadow of the cross is projected on the hemispherical phosphorescent end

of the tube, in such a manner that a permanent impression on the memory of the student is made.

As an outcome of work recorded in Crookes's various preceding papers, "On Repulsion resulting from Radiation," &c., and, therefore, with paragraphs numbered in continuation of his "Phosphorogenic Properties of Molecular Discharge," Crookes in 1881 published a research on "The Viscosity of Gases at High Exhaustion." Maxwell's great theoretical discovery that the viscosity of a gas is independent of the density, one of the most beautiful proofs for the reality of molecular motion, had already been the starting-point of experiments by Maxwell himself, Kundt and Warburg, using the method of rotating discs.

In Crookes's experiments the method of observation consisted in noticing the subsidence of the vibrations of a delicately suspended lamina oscillating within a bulb containing the gas. By these simple yet adequate means, very careful measurements were made, and the falling off of the viscosity of different gases from atmospheric pressure to very high exhaustions downwards observed, especial attention being paid to the highest vacua and definite measurements made of the degree of exhaustion employed. At these high exhaustions Maxwell's law completely breaks down, as Maxwell himself foresaw. His observations were discussed in a splendid "note" by Sir George Stokes, another example of the cooperation between these physicists.

Crookes's apparatus afforded at the same time many other data and measurements. The apparent attraction by heat was only found in air of greater than one-thousandth part of ordinary density; while there is repulsion when the density is further increased, the repulsion increasing to a maximum, and thence fading away towards zero as the rarefaction is continued.

In 1881 Crookes's paper on radiant matter spectroscopy appeared. An entirely new method of spectrum analysis is given, based on the well-known fact that under the influence of the kathode rays a large number of substances emit phosphorescent light, some faintly and others with great intensity. Most bodies give a faint continuous spectrum, but more rarely the spectrum of the phosphorescent light is discontinuous, and to bodies manifesting it his attention has been specially directed. This characteristic spectrum is given by the group of elements known as the rare earths, especially yttria in some of its compounds; and in the study of this group the method is of very great importance, and has given, in the hands of Sir William Crookes, at an immense amount of trouble and time, very valuable results. To give, however, an adequate survey of these investigations would demand much space, and uncommon chemical knowledge of the rare earths. We mention only that not long ago Crookes isolated from yttria a new earth, characterised by an isolated strong group of lines high up in the ultra-violet, ascribed by Sir William to a new element named by him victorium.

In connection with his work on the photographed spectra of the elements, of which it seems only a small portion has been published, we record one of his smaller papers, relating to "the slit of a spectroscope," that narrow, but extremely important, gate to a large domain. Crookes makes the very ingenious suggestion to use quartz jaws, cut in the same manner as metal ones. The prismatic edges refracting away all the light which falls on them, their transparency offers no objection, while only the light passing between the jaws comes into operation. As the quartz jaws can be worked to a finer edge, they give better definition.

"With a pair of jaws in the spectroscope at present in use, I can take excellent photographs when they are only 0·0001 inch apart. For eye observation the width can easily be less than that."

Another small paper of date 1879 is also characteristic of Crookes's experimental skill, and illustrates at the same time, if I may say so, the purity of his work. The exceedingly small rate of leak of electricity in a high vacuum is illustrated by Crookes's observation that a pair of gold leaves in a vacuum bulb retains an electrical charge for months.

Of Crookes's recent work, we mention his experimental work on radium. In 1900 Crookes first effected the separation from uranium by two distinct chemical methods of the one direct transformation product, called uranium X. He discovered in 1903 that the alpha rays from radium produce, probably by their bombardment, phosphorescence on a target of crystalline zinc sulphide. This wonderful phenomenon, perhaps the most direct proof of the discontinuous structure of matter, was popularised in his spintharoscope.

These examples must suffice to impart an idea of Crookes's work. "The best history," it has been verily said, "is but like the art of Rembrandt; it casts a vivid light on certain selected causes, on those which were best and greatest; it leaves all the rest in shadow and unseen." What is true in the science of history cannot become untrue in the history of science. It would be desirable to follow a similar precept in trying to picture before our mind the origin of the gratitude and admiration physicists feel for a philosopher, who by his experimental skill, his acute observation, and the continuity of his endeavours, combined with his daring intuition, has impressed indelible marks in different branches of physics and chemistry. This involves, however, more than we can attempt here.

Sir William Crookes is a member or corresponding member of a number of scientific societies in his own country and abroad. At one time or another he has occupied the presidential chair of many of the leading learned and scientific societies of Great Britain. The Royal Society awarded him a Royal Medal in 1875, the Davy Medal in 1888, the Copley Medal in 1904; the French Académie des Sciences, a gold medal and a prize in 1880; the Society of Arts, the Albert Medal in 1899; and he was knighted by the late Queen Victoria in 1897.

P. ZEEMAN.

THE SOILS OF IRELAND.

A Description of the Soil-Geology of Ireland, based upon Geological Survey Maps and Records, with Notes on Climate. By J. R. Kilroe. Department of Agriculture and Technical Instruction for Ireland. Pp. xii+300. (Dublin: H.M. Stationery Office, 1907.) Price 6s.

IN his preface the author states that on the completion of the one-inch geological map of Ireland "the opportunity seemed favourable for presenting to the public a succinct account of the geology of the country, prepared chiefly from the standpoint of agriculture," of which opinion the present work is the outcome.

It is certainly a matter of cardinal importance to an agricultural country like Ireland that its Geological Survey officers should have the needs of the farmers before them, and should in the progress of their mapping look at the country-side with something of the farmer's eye, and an appreciation of the kind of information that is likely to be of value to him.

It is perhaps too much as yet to ask that the Geological Survey should give rise to a second department charged with the preparation of soil maps, though in other countries the State is undertaking this service for the agriculturist; but, failing so large a measure, what information of value to the working farmer can the geologist proper put into his maps and memoirs? A good "drift" map must be the basis, a map in which, however, the drift should be differentiated further than it is on our present maps, where the common designation of "boulder clay" is often made to cover in a single district true clays, coarse stony gravels, and deposits that are little more than sand. Of course, the boundaries of such drifts can only be indicated approximately, partly because they grade into one another in some places, and in others thin out insensibly into true "sedentary" soils derived from the underlying "solid" rock. To the farmer, lithological character is the important feature in a drift, not its origin, and we believe the field geologist would find no difficulty in providing the information if he had the requirement before him from the outset. Again, some indication of the thickness of the drift might be given, with notes as to the proximity of valuable soil ameliorators, like beds of marl below peat or chalk below clay. Of course, much chemical analysis cannot be recorded, but we think the map should indicate whether a clay formation is calcareous or deficient in lime; again, some notes on drainage and water supply might be added to the memoir. A farmer, for example, finds a certain field full of springs; a geologist could generally tell him whether this is due to the outcrop of an impermeable band or to a fault (in which case a ditch can be cut to tap the springs), or to general ground water, in which case the field will want tile draining.

Mr. Kilroe, however, has no opportunity in this book of working on such a scale; his object has rather been to do for Ireland what the late Prof. E. Risler did for France in his "Geologie Agricole," to take the formations one by one and show how the nature of the rock is reflected in the physiography and the soil constitution, and in its turn in the agriculture of the district it occupies. To produce such a book is a noble ambition, but we fear that the materials for it hardly exist as yet in the case of Ireland, for throughout Mr. Kilroe's book we are struck by the paucity of data really bearing on the point at issue. The analyses of rocks and soils, even of waters, are rarely of Irish origin; often, indeed, they refer to Continental specimens, and they are of very various dates and values. There is hardly a reference to Irish farming in the book; for instance, barley growing is a very special and localised culture in Ireland, and one which has had considerable attention from the Department of Agriculture, but when we inquire if it is associated with any formation in particular, we find no reference to it, nor, indeed, to the distribution of any other crop, in Mr. Kilroe's book. Instead, Mr. Kilroe gives us too much of his views on agricultural chemistry, generally in the form of extracts from other writers, and these extracts only show how difficult it is for a specialist to preserve a due critical sense when "getting up" another subject. For example, we read:—

"When it is considered that silicate of alumina (clay) in itself furnishes no essential element of plant food . . . it is evident that the stony particles, pebbles, &c., contain the stock supplies of mineral nutrients."

Or again:—

"The waters flowing from the Old Red Sandstone would doubtless be poor in lime for the purpose of irrigation. They, however, probably contain such a proportion of potash as would justify some expense in distributing them over meadow-land or pasturage not being grazed."

We only wish that Mr. Kilroe could have tempered his zeal for imparting information. It is just the same with the section on climate; we have a series of paragraphs on soil and air temperatures, on cyclones and weather forecasts, on clouds and similar generalities, but little or nothing on the Irish climate or its local distribution, which counts for so much in the agriculture of the country.

"Cut the cackle and come to the 'osses" was an old and sound piece of advice, and the "'osses" we hope to get from Mr. Kilroe are Irish—Irish rocks, Irish soils, Irish crops and stock. A. D. H.

SCHOLARSHIPS AND INDUSTRY.

Dyeing in Germany and America. By Sidney H. Higgins. Pp. xvi+112 (Manchester: University Press, 1907.) Price 1s. net.

THE Gartside scholarships of commerce and industry were established in 1902 for a period of ten years. They are of a special character, the main feature of the scheme under which they are administered being the close manner in which they are linked up with industrial life. The first year of the scholarship is tenable in the University of Manchester, a course of study being adopted which will directly qualify the scholar to investigate some special branch

of commerce or industry at home and abroad during the second year. The scheme is a most valuable recognition of the close union which should exist between science and industry, and the late Mr. Gartside has certainly indicated a very useful direction in which others may endow further scholarships. The book now under review represents a report to the electors of the work carried out during the period of the scholarship.

A comparison of the development of the coal-tar colour industry in Germany and this country has been so frequently made to the great disparagement of English enterprise and educational methods, that very properly this branch of the subject was not further investigated by the author, his work being concerned with the application rather than the manufacture of dyes. The fact that in the main we hold our own against all competitors in the dyeing and printing industry is brought out very clearly. In Germany the dye-houses are, with few exceptions, smaller, and the methods less scientific, than in the large centres of the industry in England, such as Manchester and Bradford; and in handicraft skill the English dyer is perhaps unapproachable. The great volume of dyeing done in the United States appears to be chiefly due to the large and rapidly increasing demand made by the home market, and the competition of America in foreign markets is comparatively insignificant in this branch of trade. Moreover, in most of the principal dye-houses in New England the managers and foremen are British. The distribution of trade is, however, a matter of very delicate balance, and the fact that Germany has almost the monopoly of the manufacture of coal-tar dyes may easily result in the transfer to her of the leading position in the dyeing industry.

The coal-tar colour industry is, in fact, one of Germany's greatest industrial assets, and apart from its directly profitable character it has also been of the greatest importance as the mother of many new industries, such as those of synthetic pharmaceutical products, liquid chlorine, anhydrosulphuric acid, &c. The requirements of the industry have also reacted largely on the standard and character of the instruction given in the German universities and colleges, and, most important of all, have been a great object-lesson to the German Government and people with regard to the supreme importance of science in industrial life. This has again reacted in the direction of the more general appreciation and utilisation of technical education in Germany, and has been an important factor in inducing the Government and local authorities to render assistance in fostering the various industries; a condition of things which, unfortunately, is largely absent in this country.

A great feature of the dyeing trade in England has been the establishment of powerful trade combinations, whereas the industry has not developed along these lines in Germany or in America. It is undoubtedly true that when efficiently managed these large associations lead to great economies in such directions as the concentration of work, improvement of equipment, and better conditions for buying and selling. Operations conducted on a large scale can be carried on more cheaply and more profitably than is possible by a large number of smaller producers. Consequently, both workman, employer, and consumer should benefit. On the other hand, the danger of the misuse of great concentration of power is well known, and experience has yet to show whether the condition of an industry controlled in this manner is as stable and permanent as when competition and individual enterprise have freer scope.

Turning to a more definite criticism of the work under review, it undoubtedly forms very interesting reading if not examined too closely as regards technical accuracy. The material is arranged under the following headings:—cop dyeing, sulphur colours and indigo, mercerising, bleaching, the industry in the United States, conditions of life in the industry, efficiency of the industry, colour production. It could not reasonably be expected that the author would be able to show a profound knowledge of present-day practice in all branches, and it would not be fair to criticise the book from this standpoint. It must rather be considered as the statement of an organised series of observations made by a trained mind upon a subject of which the observer has some special knowledge. If read with this in view, the book will be found most interesting and valuable. The author has made excellent use of the great facilities placed at his disposal, and has done much to justify the idea of the founder of these scholarships that they would be of value, not only to the individual, but to the trade of the country. In conclusion it must be said that the literary style and even the grammar and punctuation of the subject-matter are open to much more criticism than is desirable in a book issued with the imprint of a university. The idea that a careless use of the English language is permissible in books dealing with technical subjects is one to which too strong exception cannot be taken.

WALTER M. GARDNER.

PERSONAL HYGIENE.

The Care of the Body. By Dr. Francis Cavanagh. (The New Library of Medicine, edited by Dr. C. W. Saleeby.) Pp. xvi+292. (London: Methuen and Co., n.d.) Price 7*s.* 6*d.* net.

THIS book belongs to the excellent "New Library of Medicine" series issued by Messrs. Methuen. In the series, as planned, all the great aspects of "preventive medicine" are dealt with from many standpoints. In "The Care of the Body" Dr. Cavanagh handles in a very popular yet fundamentally scientific way the leading generalities of personal bodily hygiene—sleep, baths, exercise, training, fatigue and massage, clothing, skin, hair, teeth, feet and hands, light, eye, ear, nose. Each of these has a chapter. The volume is completed by chapters on position, habit, and the functions of the physician. The style is breezy and rapid. It is well adapted to the lay reader, who more easily acquires casual than rigidly ordered knowledge. But Dr. Cavanagh indicates in every page an easy familiarity with the latest science at the moment when apparently he is most exuberant in his verbal flow.

The method has its dangers, for it may give currency to vague and inexact doctrines. But here the sparkle of the writing secures the interest without impairing the science. Health is undefined, but the problem of health is mainly how to maintain the fight against malign environment, and "fitness" is largely the capacity to master hostile germs. The discussion of sleep adapts scientific theory to practice, and has many sound hints Of the cold bath it is said, "In general, the value of a cold bath is in inverse proportion to its length" (p. 39). Of exercise, the view is that "all mental processes are based upon a simple unit of action or process, in which some one muscle-fibre is a chief factor" (p. 55). Play is preferred.

The criticism of current superstitions as to exercise and training is pointed and conclusive. The cardinal point is the relation of exercise to diet. Dr. Cavanagh is somewhat dogmatic (p. 60) on the intellectual training of women. He assumes too readily that accepted intellectual standards are a true test of mental capacity even in men. In exercise, walking and running, not any artificial system, are fundamental. "Muscles are not meant to work or be developed individually" (p. 78).

The discussion of fatigue is highly general, but adequate for its purpose. Of clothing a good deal is said in detail, the principle being that "man is homoiothermal," and 98°·4 Fahrenheit is his normal temperature. Clothing is closely criticised from this standpoint. In the other chapters—teeth, eyes, &c.—many hints of experience are embodied, and, though the main facts are well known, every reader will find them set forth in a fresh and stimulating way. The chapters on position and habit are well loaded with good matter. The last chapter points the view that dominates this book and the series it belongs to, namely, that henceforward the physician's true function is to prevent, not to cure, and the profession should be organised accordingly. Altogether, the author succeeds in his effort to be simple, scientific, and vivacious. The aim of the series is to apply scientific medicine to the informing of public opinion, and this volume, within its range, certainly furthers that aim. If looked-for topics are sometimes omitted, they are likely to be found in other volumes.

OUR BOOK SHELF.

Practical Mathematics. By Prof. John Perry, F.R.S. Pp. 183. (London: Wyman and Sons, Ltd., 1907.) Price 9*d*.

THE first edition, a slim little pamphlet price sixpence, was reviewed in these columns about the end of the last century; this new edition begins to show signs of corpulence.

The pamphlet has raised a crowd of imitators, bulky works on engineering and mathematics, workshop arithmetic, and general utilitarian and commercial theory; it would be better, for historical interest, to preserve its original size.

The author has forced the Mathematical Tripos to adopt the Slide Rule for numerical computation; and would do well to follow up by a description of the Hospitalier notation of writing derived units, as ft.^{2} and ft.^{3} for square and cubic feet, lb./ft.^{2} for pressure, and so on; no need then for the mathematical Esperanto suggested some years ago.

The slide-rule hint—"practise with simple numbers"; "ask no one to help you"—should be followed by arithmetical exercises intended to show the learner how to discover the use for himself: such as cube 2, 3, 4, . . . and then extract the cube root; better then to discard all rules, as they can always be re-invented with greater ease than recollected. Considering that the slide rule and logarithm table work to the base 10, the definition of the logarithm in § 8 is $-n=\log N$, if $10^n=N$; not $a^n=N$, which is confusing by its useless generality.

The practical student Prof. Perry has in view is called upon to work and act, but not to write and explain. His geometry is so very easy, consisting in drawing a few lines by instruments. But if required to give an explanation he would find himself compelled to give six lines or more of tedious definition to one line of demonstration; he would become Euclidean without knowing it.

The author enjoys attacking the schoolmaster, who shows certainly many weak points of inherited prejudice. Prof. Perry looks at geometry from the point of view of everyone becoming an engineer in his turn; the schoolmaster deals with very few students of that class, and can make out a very good case for Euclid; Greek in Euclid and Euclid in Greek; and he has an answer ready for the question in the note on p. 8—"Why not say—*delogarize?*"—Because the word is a mongrel.

La Théorie de la Physique chez les Physiciens contemporains. By Abel Rey. Pp. vi+412. (Paris: Félix Alcan, 1907.) Price 7.50 francs.

RECOGNISING the serious discordance between the views of contemporary physicists upon the true meaning and value of physical theories, the author of this interesting book inquires whether this conflict of opinion justifies the contention of the anti-intellectualist philosophers that such theories are purely arbitrary constructions leading, not to completer knowledge of the world, but merely to more effective practical control of its course. M. Rey proceeds by an able cross-examination of actual scientific thinkers, classifying them by reference to their attitude towards the post-Newtonian mathematical physics—which assumed the actuality in detail of the molecular machinery that it invoked to explain phenomena.

In his first group fall Rankine, Mach, Ostwald, and Duhem, who agree in rejecting the ontological pretensions of the mechanical theory and in conceiving the various departments of physics as autonomous sciences connected with one another and with mechanics by the notion of energy. British readers will be gratified by the importance which the author attaches here to the work of our countryman—whom he regards as the father of the critical movement—and will welcome his clear account of the views of the brilliant professor of Bordeaux. Next to these M. Rey places Poincaré as a critic who corrects rather than rejects the traditional doctrine, accepting its belief that the data of observation in physics are the product of the superposition of an infinite number of elementary phenomena to which the differential equations of theory refer, but recognising that its conception of these phenomena as molecules in movement is only a description in one idiom of objective relations that could equally well be rendered in another. Last come the physicists (including most of the British school) who have lost the confidence of the post-Newtonian mechanists rather than their ideals; who still hold that physical phenomena can be explained by the conceptions of

mechanics, but no longer profess to be able to describe, detail by detail, the ultimate moving elements and motions that underlie these phenomena.

In the second part of his book the author seeks to show that the salient divergences between the schools simply mask the essential congruity of their views. All physicists admit—in whatever idiom they may describe them—the same ultimate objective data; while even if their hypotheses are only methodological instruments of organisation and discovery, it must be recognised that the science presents in the different schools a real though not obvious unity of development. T. P. N.

How to tell the Birds from the Flowers: a Manual of Flornithology for Beginners. Verses and illustrations. By Prof. R. W. Wood. Pp. 28. (San Francisco and New York: Paul Elder and Company, n.d.) Price 50 cents net, or in cat-bird cambric, 75 cents net.

IT will come somewhat as a surprise to those of our readers who know Prof. Wood only as a physicist to learn that the present booklet contains nothing but quaint illustrations and jest in verse. The volume is obviously a satire directed against the sentimental nature-study literature which sometimes masquerades as scientific teaching, particularly in the United States.

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.*]

Winding of Rivers in Plains.

A CURIOUS obsession as to a matter of fact, to which everyone is more or less liable when obfuscated by an erroneous theory, has recently been noticed by me in some geological books, *e.g.* in Le Conte's "A Compend of Geology," and in Tyndall's "Glaciers of the Alps." I noticed it first in my late colleague Prof. Watts's recent little text-book of geology; but, indeed, I have not found any book of the kind quite clear and correct on the subject.

The statement is clearly made and illustrated by a figure that the flow of a bending river is most rapid on the outer side, where its banks are concave; and the well-known scouring or excavating action which a stream exerts on this bank is then attributed to this imaginary more rapid flow.

But the fact is that the flow is most rapid on the inner or sediment-depositing side of the bend, and Prof. James Thomson showed in 1876, in a well-known communication to the Glasgow meeting of the British Association—when he exhibited a model, confirming calculations previously made by himself—that the excavating action of a river is not due to the direct scouring action of the main stream at all. The explanation which he gave was virtually as follows:—

The rapid flow on the inner and strongly curved side of the bend piles up the water on the outer side by centrifugal force, so that near the concave bank it is nearly stationary, but elevated; its energy there is potential, not kinetic. Now if the rapidity of flow were uniform from top to bottom the slope would be in equilibrium; but owing to the retardation of the bed the flow near the bottom is slower, and there is not nearly so much centrifugal force exerted down below; wherefore the piled-up water is continuously returning from upper to lower level, that is, from the concave to the convex bank, as an undercurrent, almost at right angles to the main stream, bringing with it, by its undertow, silt and solid matter, which it deposits near the inner side of the bend; thus constantly increasing its own sinuosity in the well-known way.

The stream itself, combining a progressive with a lateral circulating motion, may be said to *screw* itself like a corkscrew round a bend: and it is the lateral circulation which shifts the bed.

So much for streams, now for glaciers. Prof. Tyndall, as is well known, took careful measurements of the flow of glaciers, and finding that their line of quickest motion was *more* sinuous than the glacier bed, said that this was another analogy to the flow of a river.

There, however, he was in error. The line of most rapid flow of a river is *less* sinuous than the river itself. The water flows round the bend somewhat as it would flow in a vertical columnar vortex; most rapid on the inside, and almost stationary or even retrograding on the outside of some bends. If ice flows otherwise—and I have no reason whatever to doubt Tyndall's measurements—it must be because the rate of change of momentum of so slow a motion, compared with its lateral stiffness, is very small; so that we might certainly anticipate that the laws of its flow would be in many respects different from—though also in some respects singularly like—those of a liquid of but small viscosity. Probably it obeys exactly the laws of an *extremely* viscous liquid the viscosity of which could be specified. The flow cannot be much governed by inertia, as that of water is.

But I know that glacier motion is a thorny subject upon which I have no desire to tread. I would not be understood as making any assertion concerning it, but merely throw out a hint.

As to winding rivers, however, the matter is fairly simple; and the writers of geological and geographical text-books may easily amend some incautious though natural statements as to matters of fact, which they sometimes illustrate by erroneous diagrams.

OLIVER LODGE.

Recalculation of Atomic Weights.

DURING the last few years our knowledge of the accurate atomic weights of the elements silver, sodium, potassium, chlorine, and bromine has been greatly extended by the masterly researches of T. W. Richards and his colleagues. At present, however, there is no really trustworthy value for the ratio of silver to oxygen, and a satisfactory value for nitrogen has only just been obtained by Gray and by Guye.

While reading an account of the determination of the ratio $Ag : AgNO_3$, it occurred to me that this result, together with others previously obtained by Richards, afforded a means of calculating absolutely the atomic weights of the above-mentioned elements in terms of oxygen. The following values are available:—

		Error
(1)	$Ag : KCl = 100 : 69{\cdot}1073$	$0{\cdot}0004 = v$
(2)	$AgCl : KCl = 100 : 52{\cdot}0118$	$0{\cdot}0004 = x$
(3)	$Ag : AgNO_3 = 100 : 157{\cdot}479$	$0{\cdot}001 = w$
(4)	$Ag : AgCl = 100 : 32{\cdot}867$	$0{\cdot}0005 = y$
(5)	$N_2O_5 : K_2O = 100 : 87{\cdot}232$	$0{\cdot}002? = z$

We have thus five simultaneous equations, from four of which the four unknown quantities Ag, K, Cl, and N can be calculated in terms of O. Neglecting 2, and putting O = 16, I worked out the atomic weight of N, and was intensely surprised to find the value 13·940.

Now it is a well-known fact that the final results of an "indirect analysis" such as the above may be greatly influenced by a small experimental error, and so I proceeded to estimate the maximum effect which could thus be produced. Putting $(69{\cdot}1073 + v)\text{Ag} = 100\,\text{KCl}$, where v is the error, instead of the first equation above, and similar expressions for the last three, I obtained the formula

$$N = \frac{2422{\cdot}08 + 600v - 600y - 336w - 287z}{2779{\cdot}94 - 200v + 200y + 174w + 115z} \times 16.$$

From this it is evident that, if v is made positive and the other three quantities negative, the numerator will be increased and the denominator diminished, both these facts tending to raise the value of N. Putting for the symbols their values given in the table of errors, the following result is obtained:—

$$N = \frac{2422{\cdot}08 + 1{\cdot}45}{2779{\cdot}94 - 0{\cdot}58} \times 16 = 13{\cdot}951.$$

In a precisely similar way, but using equation 2 instead of 1, the value 13·937 is obtained, which can be increased to 13·948.

This being the case, the question is, How can this value arise? The experimental work upon which the figures are based seems to have been carried out with every possible precaution, and all the values agreed very closely. The only possible weakness appears to lie in equation 5; the result was deduced from only three experiments, and the agreement was not so good as usual. Assuming for the moment that this value is wrong, it is easy to calculate by how much it is so. Taking N = 14·010, we may say

$$N = 14{\cdot}010 = \frac{2422{\cdot}08 + 6{\cdot}62}{2779{\cdot}94 - 3{\cdot}57} \times 16.$$

If the values of x, w, and y are taken as before, this gives 0·028 as the *minimum* value of z, and it is hardly to be expected that such a large error could have escaped notice. Another possibility is that all the errors are about five times as large as the values given, but even if this were so it would be very improbable that they should all be of such a nature as to raise the atomic weight. Consequently, granted that the discrepancy is due to experimental error, it is almost certain that the analysis of potassium nitrate is at fault. This was carried out by heating with silica, and if the nitrate was not completely decomposed the number 87·232 would be too great. This is the only explanation which seems reasonable; and, moreover, if the ratio obtained in this experiment be changed to 100 : 87·203, all five equations become consistent, and yield frequently accepted values for the atomic weights, silver being 107·883.

Whether this be the true explanation or not, it is obvious that the method outlined above affords an excellent means of checking atomic weight determinations, and is also applicable to finding the absolute weights, since there is no great accumulation of errors.

H. E. WATSON.

University College, Gower Street, October 26.

The Fauna of Madagascar.

MADAGASCAR, with certain adjacent islands, has been regarded by some naturalists as forming a distinct "region," the Malagasy, equivalent to the other main regions of the world. On the other hand, Messrs. P. L. and W. L. Sclater ("The Geography of Mammals," London, 1899, p. 108) adhere to the earlier opinion of the first-named of the two authors, as well as of many subsequent writers, and place Madagascar in a subregion only of the Ethiopian region. They remark that "Madagascar appears to contain a sample of the ancient Ethiopian fauna, which has been almost exterminated on the mainland."

The archaic nature of the Madagascar fauna has lately (*Zool. Jahrb.*, 1902) received further confirmation at the hands of Miss A. Carlsson, who found that the peculiar Viverrid genus Eupleres showed likenesses to both the Viverrine and Herpestine sections of the Viverridæ, and was therefore probably an ancient type of Viverrid. Having had lately the opportunity of making some anatomical observations upon another Madagascar genus, viz. Galidictis, I am able still further to support this view. This interesting Viverrid has the external scent glands of the Viverrine section, and a cæcum which is comparatively long, like that of the Herpestinæ. The brain, like that of Eupleres, shows intermediate characters. Finally, the archaic nature of this animal is demonstrated by the completely double uterus, a feature new to the Carnivora, where a bicornuate uterus is at least the rule.

It has been pointed out that Madagascar also shows an unexpected likeness to the neotropical region in its fauna, especially in the group of reptiles. As to mammals, the late Dr. Dobson showed reasons for believing that the alleged close resemblance between the Cuban Soleonodon and the Mascarene Centetes had been exaggerated; but among the Reptilia there are genera which are common to the two regions, *e.g.* the snakes Boa and Corallus. I have been able lately to compare *Corallus madagascariensis* with a South American form, *C. cookii*. In the former the bronchus extends a long way down the larger lung, the liver is prolonged by one lobe nearly to the gall bladder, the umbilical vein of the fœtus does not persist, and the mode of distribution of the intercostal arteries is as in the pythons. In the latter species these characters are as in the Anaconda.

The anatomical differences may possibly seem slight to those not specially acquainted with the structure of serpents; but in the features mentioned there is, if anything, rather a greater difference between the two species of Corallus than between two admittedly distinct genera such as Eryx and Python. It is very desirable that the alleged close resemblance between other forms occurring both in Madagascar and in the neotropical region should be carefully scrutinised.

FRANK E. BEDDARD.

Zoological Society's Gardens.

The Interpretation of Mendelian Phenomena.

DR. ARCHDALL REID'S letter in NATURE of October 3 contains a very positive statement in reference to the relation of Mendelian phenomena to man, which I think should be immediately answered. I delayed supplying an answer because I wished to discuss his statement on a tangible basis. I desired to analyse certain data which I have been collecting, and which throw light upon the problem of segregation in man. This analysis is as yet incomplete, but it is sufficient to show that Dr. Archdall Reid is too confident when he asserts that "there is no segregation in man," and that, "with the exception of eye-colour, and possibly one or two other traits, such as the Mongolian eyelid, human hybrids appear to blend every character as perfectly as skin-colour."

The accounts which I have collected deal with various marriages between Europeans (chiefly Scotch) and the Canadian Red Indians. It is well known that many of the early European settlers in Canada married Red Indian women. The resulting half-breeds in their turn were in some cases intermarried, and in others mated to Europeans.

The Canadian Red Indians can be marked off from Europeans by six definite characters, which concern the nature of the hair, eyes, skin, cheek-bones, nose, and beard. The Indian hair is invariably black, long, glossy, and lank, and cannot be confounded with European hair; the eyes are almost invariably black or, very seldom, dark brown; the skin is tawny brown-yellow (varying from pale olive-yellow to dark brownish yellow); the cheek-bones are high (there is no obliquity to the eyes, thus differing from the Mongol); the nose is very prominent and broad at the base, and is of the *busque* type, that is, the profile is made up of two lines, which diverge widely from the bridge towards the base; and, lastly, there is either no beard or a very scant one of straight hairs on the face of the men. These characters, when well developed, are so different from the corresponding features in Europeans that they cannot easily be confused. No one, for instance, would mistake the long, lank, black hair and black eyes of the Indian for the thick red hair and blue eyes of some of the Scotch persons concerned in the histories now under review.

We may therefore use these six characters as differentiating ones, and may tentatively regard the Indian characters as being allelomorphic to the corresponding European ones. For the sake of brevity I will use symbols, which will have the following significance:—

I = Indian, E = European, H = hair, E = eyes, S = skin, C = cheek-bones, N = nose.

First, then, with regard to the matter of dominance. We must, in this case, be quite sure that the European concerned marries a full-blood Indian. In the cases which I have so far collected, I have only one marriage of such an Indian with a European, and there were only two children of the marriage. The European was a Highland Scot. His complexion was fair, and eyes blue. I have no information of the colour of his hair, since it was white with age when observed, but it was quite thick and not lank. In all the features (with the exception of the beard, of which I have no information) which mark off the Indian from the European, the son and daughter of this marriage were quite Indian.

So far, then, as this one case will take us, these five

Indian characters appear to be dominant over the corresponding allelomorphs of the European. This conclusion, however, receives corroboration from the results of marriages between Europeans and three-quarter blood Indians, when they are traced to the F_2 generation. There is thus no blending, even of colour, but dominance.

We can now deal with the important question of segregation. If segregation occurs in man, and we regard these five characters (the beard is excluded) as allelomorphic pairs, then when a half-breed Indian (that is, the child of a European and Indian marriage) is mated with a European we should expect, *among* others, to find the following types in the offspring:—

(1) Wholly European, EH, EE, ES, EC, EN.
(2) Wholly Indian, IH, IE, IS, IC, IN.
(3) European except in the cheek-bones, EH, EE, ES, IC, EN.
(4) European except in the eyes and cheek-bones, EH, IE, ES, IC, EN.
(5) Indian except in the nose, IH, IE, IS, IC, EN.
(6) Indian except in the hair, EH, IE, IS, IC, IN.
(7) Indian except in the skin and nose, IH, IE, ES, IC, EN.

And all these predicted seven types are to be found in the records of four marriages between an E and ½ I which have been sent to me. A total of seventeen children are considered in this description.

It is perfectly clear that segregation of these five characters is taking place. There is no blending even of the colour of the hair, eyes, or skin. The blue eyes of a Scotchman who was mated to a full-blood Indian, and whose wholly Indian-type hybrid was mated in turn to a Welshman of hazel eyes, came out blue in two members of an offspring of eight children in the F_2 generation. That is clearly enough segregation.

If segregation is really occurring, and if the Indian features are dominant over the European, then it follows that once a pure European type has separated out and is mated with a European, Indian features ought not to appear among their offspring. In the records which I have there are two marriages of this kind, *i.e.* between E and extracted E. From one of these there have resulted five daughters, and from the other a son and a daughter. All seven are European in every trait. The recessive characters have thus far bred true.

These facts, therefore, are not only opposed to Dr. Archdall Reid's statement that there is no segregation in mankind, but they supply him with that instance of an appearance of a "latent" character in a cross between two "natural varieties" as contrasted to "artificial varieties" for which he seeks. For I suppose he will regard (if I may judge from the context of his letter) a cross between an E×½ I, followed by a cross of E×extracted E, as crosses between natural varieties. At any rate, they are crosses between human varieties, and he denies rather too emphatically that "latent" characters have ever been revealed in such.

Dr. Archdall Reid is apparently not aware of Farabee's observation on the mating of albino negroes with pigmented negresses. The facts are important, so perhaps I may describe them. An albino negro married a normal negress. They had three children, all pigmented sons. These sons married, and two of them had only normal (pigmented) children; but the third son married twice, and by the first wife had five normal and one albino children, and by the second six normal and three albino children. If we assume that the two negresses which the third son married were themselves carrying albinism recessive (that is, in Dr. Archdall Reid's sense of the word, "latent"), the result is accurately in accordance, as Castle has shown, with Mendelian expectation. For, in the offspring of this third son, coloured individuals and albinoes are expected in the proportion of 3 : 1. There is actually 11 : 4, which is the nearest possible approximation in an offspring of fifteen.

If Dr. Archdall Reid can explain these results, *i.e.* those of the Red Indians and the negroes, on any other theory than Mendelian segregation, or can even show that it is a case of an abnormality of sexual reproduction which occurs under conditions of "artificial selection," it will be of the most entrancing interest.

It may, of course, be objected that the negro case is one of the crossing of artificial and not of natural varieties. To me such an objection presents itself as a play with words. No one, I take it, will deny that if the conditions of the Mississippi region were favourable to albinism and unfavourable to pigmentation, a variety of albino negro would arise as permanent in its characters as any other natural variety of man. Besides, the albino case must be read with that of the Canadian Red Indian, and this is a natural variety as well as the European crossed with it. Both cases lead to the same conclusion.

Dr. Archdall Reid's doubt as to whether Mendelians "are engaged in anything more than the investigation of those abnormalities of sexual reproduction which occur under conditions of artificial selection" therefore becomes an assumption with an inadequate basis.

GEO. P. MUDGE.

Biological Laboratory, London Hospital Medical College, October 21.

I HAVE already (NATURE, October 31) dealt with mutations, of which albinism is one. I have no first-hand acquaintance with Red Indian half-breeds. In the case of such characters as skin-colour and shape of nose and cheek-bones, even "when well developed," "the personal equation of the observer and the precision of his categories" have sometimes to be reckoned with. Having regard to the Mendelian doctrine of the independent inheritance of characters, does it not strike Mr. Mudge as singular that in the only example he possesses of marriages between E and extracted E *all* the offspring should be "European in *every* trait"? If his correspondent is correct, the Indian half-breed of the F_1 generation is "quite" indistinguishable from the full-blooded Redskin. I venture to appeal to readers of NATURE who have first-hand acquaintance with the facts. The information we need is not whether exceptional half-breeds of the F_1 generation resemble pure-bred Indians, but whether this resemblance is the rule. Personally, I have a fairly large and close acquaintance with the half-breeds of Europeans on the one side, and negroes, Maoris, Kanakas, and several Asiatic races on the other. To my eyes, except in eye-colour, they are clearly distinguishable as half-breeds, though variations occur, and the dark race is sometimes approached rather closely. The case of eye-colour is remarkable. The black persists until one or more infusions of north European blood occur, when the light-coloured eye suddenly appears. So far as I am able to judge, though here I cannot speak with any degree of certainty, the quickness of the re-appearance of the light eye bears a relation to the degree of pigmentation of the dark race; that is, fewer infusions from the light-eyed race are required when it is crossed with the black-eyed European type than when it is crossed with the Asiatic, and more especially the negro. Whatever all this indicates—and I think I know, though lack of space forbids any attempt to entrance Mr. Mudge—very obviously it does not indicate Mendelian segregation. By latent characters I meant those long-lost ancestral traits which re-appear when domesticated races of rabbits, mice, pigeons, and the like are crossed.

G. ARCHDALL REID.

Newton's Rings in Polarised Light.

IN NATURE of October 24 (vol. lxxvi., p. 637) Mr. Edser asks whether anyone has tried the experiment of Lloyd's single mirror fringes with polarised light to see whether a change of the character of the fringes would occur on rotating the plane of polarisation of the light. Lloyd tried the experiment himself with light polarised by transmission through tourmaline, and observed no change in the appearance of the fringes (Lloyd, "Papers," p. 156). I have made the same experiment with Lloyd's fringes by internal reflection, and found no effect on rotating a Nicol prism through which the fringes were observed (*Phil. Mag.*, October, p. 507).

The change of phase for grazing incidence is π, whatever be the plane of polarisation of the incident light. The fringes, therefore, are of the same character for light of all kinds.

P. V. BEVAN.

Trinity College, Cambridge.

THE FISHES OF THE NILE.[1]

THESE two handsome volumes are a tribute to the late Dr. John Anderson's zeal in the cause of Egyptian zoology, and a justification of the cordial support which he had from Lord Lister, Dr. Günther, Sir E. Ray Lankester, and Dr. Sclater in prevailing on the Egyptian Government to undertake the inquiry. The author, the collector and the artist are to be congratulated on this important contribution to African ichthyology. Moreover, the region embraced in the description, as shown in the two excellent maps of the Nile system—Upper and Lower—is one of great interest to the general zoologist, for it contains the sole survivors of an order (Polypteridæ) abundantly represented from the Devonian to the Cretaceous, and includes one of the remarkable Dipnoans. It is an area in which the rare electrical fishes Mormyrus and Malapterurus (or, as the author has it, Malopterurus) are mingled with the subtropical and tropical Gymnarchus, the curious Heterotis, the Characinidæ, the Siluridæ, Ophiocephalus, the Anabantidæ, and the Cichlidæ; whilst by way of contrast these are associated with the cosmopolitan *Clupea finta* and *Mugil capito*, with the common *Anguilla vulgaris* and the ubiquitous *Morone labrax*. Yet these do not exhaust the sources of special interest, for not only were fishes, such as the Nile perch, preserved as mummies, their forms inscribed on ancient monuments or perpetuated in bronze models, but in this old-world country the number of fishes which carry and hatch their comparatively large ova and protect their young in the bucco-pharyngeal cavity is remarkable.

The problems connected with the origin and distribution of the fish-fauna are also replete with interest, and though many of these were dealt with by Mr. Boulenger in his valuable address to the zoological section of the British Association in South Africa, much yet remains for future workers both in substantiation and extension.

In the brief introduction the progress of the ichthyology of the Nile is described from 1757, the date of Hasselquist's "Iter Palæstinum," when only thirteen species from the Delta were known. Without going into detail, they had mounted up to eighty-nine in Dr. Günther's account of the fishes of Petherick's expedition, but did not exceed a hundred when the Egyptian Government undertook the present survey. Now the total is 192, and no one has had a greater share in this increase than the author.

An important part of the introduction is the illustrated account given by Mr. Loat, the collector, of the methods of fishing in the Nile, the accumulated skill of many ages having given the native all the practical advantages of his art, so that in this respect he is not inferior to the English, American and Japanese. The throwing- or casting-nets, circle-nets, sweep-nets, modified trammel-nets, long nets like those for sand-eels with a median pocket, push-nets, conical wicker traps, elaborate weirs of stones which closely resemble those at present in use in Japan, besides baited and unbaited hooks, show how varied these methods are. It is not to be supposed, however, that the casting-net is a novelty, for on the coast of Suffolk, for instance, an adept will throw it in a perfect circle. Mr. Loat collected no less than 11,000 specimens, and amongst these were thirty new species. Moreover, just as the Irish use the fatal spurge-root in their rivers, so the Egyptian pulverises the seeds of *Berbera* (or *Mellettia*) *ferruginea*, or "Burberra," for poisoning fishes. In two or three hours thousands, it may be, rise to the surface.

The thorough method in which Mr. Boulenger treats his subject is apparent throughout; elaborate tables of twelve measurements, in addition to nine notes of the number of spines, rays and scales in different parts, accompany each species. He, however, evidently makes too much, at the expense of Rüppell and others, of De Johannis as a pioneer in Egyptian ichthyology, for this author's descriptions and figures have much that is incorrect in them. Moreover, there is a tendency to split species where others group them, and to group them where others split them, the latter being just the fault he himself lately criticised, and with justice, in Smitt. Further, insignificant specific variations between the Nilotic fish-fauna and that of West Africa need not be insisted on too strongly where, as pointed out long ago, the similarity is so great. In looking at the slight diversities between such species as *Marcusenius discorhynchus*, *M. petherici*, *M. budgetti*, and *M. tanganicanus*, the thought involuntarily asserts itself that in the future a different view may be taken of their relationships. Again, there are cases in which the indefatigable author has examined 100 to 200 examples of a fish normally possessing ten to eleven dorsal rays, but he finds that three or four per cent. have seven or eight rays only. It is surely unsatisfactory to describe such a fish as possessing D. 7–10. A more correct method would have been to record it as Dr. Günther has done, viz. D. (7–8) 9–10.

FIG. 1.—Fishing at the mouth of the Sobat. From "The Fishes of the Nile."

One of the most interesting features in the Crossopterygians is the frequent allusion to the labours of the lamented Mr. J. S. Budgett, who contracted a fatal illness whilst pursuing his valuable work on the development of the group in the Niger Delta. Considerable advances have been made in the Dipnoans, that of the Nile (*Protopterus aethiopicus*) differing in habit from *P. annectens* of the West Coast. Of Teleosteans there are nineteen families, and the author gives two classifications, (1) an anatomical, and (2) one based on external characters. Both are valuable. The first family of the Malacopterygians is the generalised Mormyridæ, remarkable for the large size of the brain and the "problematic organ" above it, as well as for their electric organ. Four families, each repre-

[1] "Zoology of Egypt. The Fishes of the Nile." By G. A. Boulenger, F.R.S. Vol. i., text, pp. li+578; vol. ii., plates, pp. xviii+97 plates. (London: Published for the Egyptian Government by Hugh Rees, Ltd., 1907.) Two vols., price 8*l.* 8*s.* net.

sented only by a single species, follow, the last being Cromeria, distinguished from the Galaxiidæ of the Haplomi by the presence of a mesocoracoid (Swinnerton). The family of the Characinidæ (under the Ostariophysi) form a very generalised group confined to the fresh waters of Africa and Central and South America, from which the author thinks they may have migrated by a land connection in Upper Cretaceous times. These supposed precursors of the Cyprinoids number eighteen species in the Nile.

The widely distributed family of the Cyprinidæ comprises the largest number of species within its limts, viz. fifty, and thirty-five of these belong to the genus Barbus, a large proportion, seeing that in Day's "Fishes of India and Neighbouring Regions" there are but seventy. Yet the genus is conspicuous by its absence from the Senegal, the Gambia, and Lake Chad. The author's wealth of material has enabled him to clear up the synonymy of certain species, such as *Lates coubie*, yet it is doubtful if, as in Europe, hybridism may not occur to a greater extent than is at present imagined. The representatives of the genus

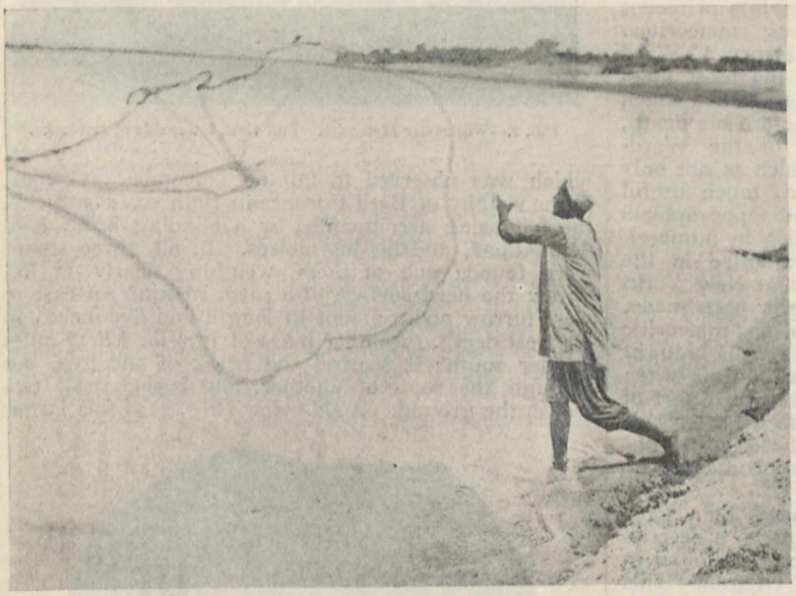

FIG. 2.—Throwing-net as used on the Lower Nile. From "The Fishes of the Nile."

Barbus, of which there are no fewer than twenty-seven new species in the work, offer a wide field for the features just mentioned, since many are very closely allied, though separable, perhaps, by such points as the proportions of the snout. The tropical or sub-tropical Silurids are largely represented by fifteen genera and forty-one species, and the habits of some, such as Clarias, are full of interest, for they spend the dry season in burrows in dried-up marshes, which they leave at night in quest of food—both animal and vegetable—using the spines of the pectorals in progression. The name Malapterurus has so long been used that the author's change to Malopterurus jars, and for similar reasons he himself does not follow Starr Jordan in calling the species "*Torpedo*" *electricus*. It is noteworthy that whilst the fresh-water species are all generically distinct from the American, those species which enter the sea on both shores of the Atlantic agree (*e.g.* Arius). The Cichlidæ, a family which presents great difficulties from the close resemblances of many—*e.g.* those of Lake Victoria—have increased, largely by the labours of Mr. Boulenger, during the last few years from twenty species to 210 in Africa, and of these eighteen belong to the Nile. The author considers that the forms inhabiting that great lake (Victoria) sprang from a small number of original (isolated) types, and were modified into a multitude of species according to lines different from those followed by other colonies. Only two or three of these are identical with or very closely related to forms in neighbouring rivers.

Though many interesting facts in regard to reproduction and development are incidentally noted in this fine work on Nile fishes, especially in connection with Mr. Budgett's investigations on Polypterus, Protopterus, and on the breeding of the Mormyridæ, very much yet awaits the observer in this department, and no more fascinating field exists, to judge from the fragmentary knowledge available. Some, like *Hyperopisus bebe*, attach their oval eggs to rootlets of grass, and the larvæ hang in thousands, like amphibians, to the rootlets until the yolk-sac is absorbed. Others have floating nests 2 feet long by 1 foot broad (*Gymnarchus niloticus*) for eggs 10 mm. in diameter, and for larvæ with long gill-filaments. A still larger nest (4 feet in diameter) characterises *Heterotis niloticus*, the larvæ of which also have gill-filaments. The eggs of *Cyprinodon fasciatus* have long filaments, like those of the garfish, which entangle them in masses or suspend them to various objects. The large number of fishes which carry their ova and larvæ in their bucco-pharyngeal cavity is a prominent feature, and Mr. Boulenger has found that it is almost invariably the female which does so, not the male, as in such forms as Arius. In some cases (*Haplochromis strigigena*) the male makes a small cavity in the sand where the eggs are fertilised, the female thereafter taking them into her mouth, and fasting for a fortnight. Yet animals much lower in the scale than fishes do almost the same thing, as in the case of *Asterias Mülleri*, the fertilised eggs and larvæ of which are borne in a mass by the parent over the mouth. The Egyptian fishermen, however, explain the presence of the ova in the mouth of the fishes very simply, viz. by a "reversed method of parturition." The whole subject, from the development of the nuptial tubercles in the males to the post-larval stages of these remarkable Nile fishes, bristles with features of interest. In addition, the field of fish-physiology is inviting. Why is it that *Polypterus bichir* (a fish which dies in tolerably fresh water if prevented from reaching the air) cannot live in brackish water, and that slight salinity kills it? whilst one species of fish in Lake Menzaleh thrives either in fresh or salt water, and another dwells equally in a hot spring at Makulla, in the Persian Gulf, and in salt water all round the Red Sea. The author takes in hand the explanation of the peculiar coloration of *Synodontis batensoda*, in which the ventral aspect of the body is darker than the upper, viz. as a provision in connection with the habit of swimming in a reversed position. Yet this explanation will not avail for the post-larval Callionymus. Again, are the habits of Anabas in Africa similar to those in India?

The able author has brought to the task not only his former experiences of African fishes—north and south, east and west—but the whole resources of the British Museum, and the vast storehouse of information amassed during the lifelong labours of Dr. Günther, and he has accomplished it in a manner creditable to the Egyptian Government, to science, and to himself. His work, indeed, will long form the basis of future labours in the ichthyology of the Nile. The whole of the families are as admirably illustrated as described in the beautiful volume of lifelike lithographs by Messrs. Smit and Green, their work rivalling the exquisite finish of the late G. H. Ford, long *facile princeps* in the department. Finally, if any suggestion may be made in a work so carefully performed, it is that in the index the synonyms might have been printed in italics, and that, in the text, plate xiv. should be substituted on p. 84 for plate xv. W. C. M.

SOME RECENT PAPERS ON METEORITES.

WE have before us a number of reprints of recent papers descriptive of various meteorites. Several of these are by the late Dr. Henry A. Ward and the late Prof. E. Cohen, two of the most indefatigable workers in this subject, whose loss is much to be deplored. In 1904, two years before his death, Dr. Ward published a "Catalogue of the Ward-Coonley Collection of Meteorites," which is not only a catalogue, but contains, in addition, much useful information, including alphabetical and topographical lists of all known meteorites (about 680 in number). The Ward-Coolney collection, now exhibited in the American Museum of Natural History at New York, is one of the most complete that has ever been made, containing as it does representatives of 603 meteoritic falls; it is further remarkable in that it was brought together in the comparatively short space of time of ten years. Prof. Cohen died in 1905, and a third part of his "Meteoreisenkunde" was published after his death; this, which is the only general work that has yet been attempted on meteorites, unfortunately remains incomplete.

Dr. H. A. Ward (Proc. Rochester Acad. Sci., 1904, vol. iv., pp. 137–148, with 6 plates) gives a description of the Willamette meteorite, which was found in 1902 near the town of Willamette, in Oregon. This mass of metallic nickel-iron measures $10 \times 6\frac{1}{2} \times 4\frac{1}{4}$ feet, and weighs 31,107 lb. (about $15\frac{1}{2}$ tons); it is the third largest meteorite as yet known. Like the largest on record, the Anighito, of $36\frac{1}{2}$ tons, brought by Commander R. E. Peary from Cape York, in Greenland, it is now exhibited in the American Museum of Natural History. The second largest known meteorite is that of Bacubirito, in Mexico, which has an estimated weight of $27\frac{1}{2}$ tons; this mass, though unearthed and described by Dr. Ward in 1902, has not been removed from the place where it was found. The Willamette meteorite is roughly conical in form, and it was found embedded in the ground with the base of the cone uppermost, suggesting that the apex of the cone was to the front of the falling meteor. The mass is remarkable for the deep, rounded, and cylindrical pits, of which several types are distinguished, on the sides and the base of the cone. The deep cavities on the base (Fig. 1) are accounted for by the weathering and rusting action of water standing in pools on the exposed part of the mass as it lay for unknown ages in the soil of the primeval forest of a very moist region. The pittings and groovings on the sides are attributed by the author to the erosive action of the air during the flight of the meteorite; but it seems more likely that they have been produced by weathering in the ground, and that none of the original surface now remains. The nodules and rods of troilite (iron sulphide) enclosed in the metallic iron no doubt formed the centres around which the weathering has proceeded. The Widmanstätten figures on an etched section of the iron show the structure to be octahedral with broad lamellæ. The specific gravity of the iron is 7·7, and it contains $91\frac{1}{2}$ per cent. of iron, 8 per cent. of nickel, and small amounts of cobalt and phosphorus.

Dr. H. A. Ward (*ibid.*, 1905, vol. iv., pp. 193–202) also gives an account of the Bath Furnace aërolite,

FIG. 1.—Willamette Meteorite. Full view, lower side of meteorite.

which was observed to fall on November 15, 1902, in the vicinity of Bath Furnace in Bath co., Kentucky, the fall being accompanied by a blinding light, loud detonations, and hissing noises. In all, three stones were found; one of them, weighing nearly 13 lb., struck the hard surface of a road, making an east to west furrow about a foot in length and five inches in greatest depth. Another mass of $177\frac{1}{4}$ lb. fell $1\frac{3}{4}$ miles further south; it scarred the trunk of one tree, cut through the roots of another, and buried itself two feet in the ground. A side view (Fig. 2) of this larger

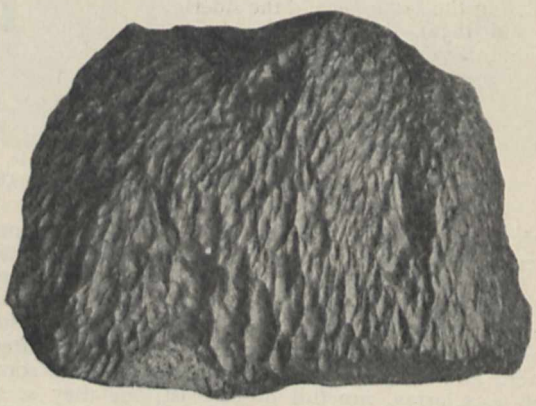

FIG. 2.—Bath Furnace Meteorite. Side view, showing furrows radiating from apex.

stone shows very clearly a system of furrows radiating from the apex, which were produced by the intense erosive action of the air during the flight of the stone. The internal structure of the Bath Furnace meteorite is that of a spheroidal chondrodite like that of the three previously known meteorites (Werchne Tschirskaja, South Russia, 1843; Trenzano, Italy, 1856; and Saline Township, Kansas, 1898), which fell during the November Leonids. Both the Bath Furnace and the Willamette meteorites gave rise to suits at law between the finders and the land owners. In other papers, Dr. Ward describes some new Chilian

meteorites, and also gives general notes on the history of meteorites and collections of meteorites, especially as regards the aims of the latter.

Prof. E. Cohen (Ann. S. African Museum, 1906, vol. v., pp. 1–16, with 3 plates), describes the meteoric stone of 30½ lb. which was observed to fall on January 3, 1903, at the mission station of St. Mark's, in Transkei, Cape Colony. The description of the microscopical structure and chemical composition of this stone was completed by Prof. C. Klein, another well-known worker on meteorites, who also died recently (1907).

Mr. L. L. Fermor (Records Geol. Survey India, 1907, vol. xxxv., pp. 79–96, with 12 plates) collects together information respecting the circumstances of the fall of various Indian meteorites, and gives brief notes on their external characters. At greater length (*ibid.*, pp. 68–78, with 3 plates) he describes the fall of stones near Dokachi, in Bengal, on October 22, 1903; here, along a line six miles in length, twenty-four fragments, with a total weight of 3838 grams, were picked up. A list is given of seventy-one meteoritic falls recorded in India since 1798; more records exist in later years, and in the more thickly populated districts, and latterly they have averaged one each year. All, except three, of these Indian meteorites are composed of stony material.

Prof. O. C. Farrington (Field Columbian Museum, Geol. Ser., 1907, vol. iii., pp. 57–110) collects together 360 published analyses of 248 meteoric irons, tabulating them in different classes according to the structure of the iron. It is then seen that there exists a close relationship between chemical composition and structure. All irons with a hexahedral structure are very uniform in composition (94·12 per cent. Fe), whilst in those with an octahedral structure the amount of nickel increases with the fineness of the lamellæ. In the ataxite group, in which the structure is finely granular to compact, there is more variation in composition. The average composition of all meteoric irons is approximately Fe, 90; Ni, 9; Co, 0·9; Cu, 0·02 per cent. The same author also describes in detail in the same journal the siderite of Rodeo, Mexico (found 1852), the siderolite of South Bend, Indiana (found 1893), and the aërolite of Shelburne, Ontario (fell August 13, 1904).

The papers on meteorites noted above are but a few selected at random from the many that have been recently published: except in details, one paper is, however, more or less a repetition of another.

L. J. S.

NOTES.

THE president and council of the Royal Society have recommended the following fellows for election as members of the council for the ensuing year at the anniversary meeting on November 30:—*President*, Lord Rayleigh, O.M.; *treasurer*, Mr. A. B. Kempe; *secretaries*, Prof. J. Larmor, Sir Archibald Geikie, K.C.B.; *foreign secretary*, Prof. J. R. Bradford; *other members of council*, Dr. H. F. Baker, the Right Hon. A. J. Balfour, Sir William Crookes, Mr. Francis Darwin, Sir George Darwin, K.C.B., Prof. J. C. Ewart, Prof. D. Ferrier, Mr. C. T. Heycock, Prof. S. J. Hickson, Prof. J. Joly, the Hon. C. A. Parsons, Dr. A. Scott, Prof. A. C. Seward, Prof. F. T. Trouton, Dr. A. D. Waller, Mr. W. Whitaker.

THE late Dr. Edward Sang's collection of MS. calculations in trigonometry and astronomy has been gifted to the British nation by the Misses Sang, and the president and council of the Royal Society of Edinburgh have been appointed custodiers of the collection, with power to publish such parts as may be judged useful to the scientific world. The society has also been given custody of the duplicate electrotype plates of Dr. Sang's 1871 new seven-place table of logarithms to 200,000, with power to use them for reproducing new editions, or publishing extended tables of seven-place logarithms. At the meeting of the society on November 4, the chairman, Dr. R. H. Traquair, F.R.S., read a statement regarding Dr. Sang's monumental work. The manuscript volumes number forty-seven in all, the contents of thirty-two of which are in transfer duplicate. Vols. i. to iii. contain the details of the steps of the calculations on which the results contained in the next thirty-six volumes are based. Vol. iv. contains the logarithms, calculated to twenty-eight figures, of the prime numbers up to 10,000, and a few beyond. Vols. v. and vi. contain the logarithms to twenty-eight figures of all numbers up to 20,000. From these the succeeding thirty-two volumes are constructed, giving the logarithms to fifteen places of all numbers from 100,000 to 370,000. This colossal work must ever remain of the greatest value to computers of logarithmic tables. It is a great national possession. The other tables in the collection are trigonometrical and astronomical. Of special interest are the tables of sines and tangents calculated according to the centesimal division of the quadrant. It is hoped that ere long some of these tables may be published in such a form as to make them more immediately accessible to computers. They are the foundation of Dr. Sang's published book of seven-place logarithms to 200,000, undoubtedly the most perfect of its kind ever printed. The complete account of the various tables will be printed in the society's Proceedings, and other scientific bodies will have their attention directed to the importance of the collection now in the custody of the society.

THE Huxley memorial medal of the Royal Anthropological Institute was presented to Prof. E. B. Tylor, F.R.S., on Tuesday, November 5, in recognition of his distinguished services to anthropology. On October 2 Prof. Tylor celebrated his seventy-fifth birthday, and the anniversary was made the occasion of the presentation to him of a volume of essays representative of British anthropology. The current volume of the Journal of the Royal Anthropological Institute is dedicated to Prof. Tylor; and the presentation of the Huxley memorial medal is another mark of the esteem in which he is held by anthropologists.

SIR OLIVER LODGE has accepted the invitation of the council of the Faraday Society to succeed the late Sir William Perkin as president of the society.

ON October 20 the Paris newspaper *l'Éclair* liberated 10,000 pilot balloons from a boat on the Seine. One of these balloons was found at mid-day on October 21 at Undermannlaani, near Kausala, which is on the railway mid-way between Helsingfors and Wiborg, in Finland. The distance is 1950 kilometres. The balloon was found twenty hours after the start, and, assuming that it had only just fallen, the average rate was nearly 100 kilometres per hour. The lift of the balloons, including weight of postcard, &c., was supposed to be about 1 gram, but departures from this value must have been frequent, for Mr. Charles J. P. Cave, who witnessed the ascents and sends us these particulars of them, states that the rates of ascent of different balloons varied greatly. The diameter of the balloons was about 35 centimetres. The greatest distance covered by a manned balloon is 1925 kilometres, in the ascent of Count de la Vaulx from Vincennes on October 9, 1900.

THE *Pioneer Mail* states that the Secretary of State for India has sanctioned the establishment of a new bacteriological department on a permanent basis.

IT is reported that the town of Karatagh, in Bokhara, was destroyed by an earthquake on October 21. A message from New Bokhara states that 600 farmsteads have been destroyed, and 200 persons killed.

THE FitzPatrick lectures of the London Royal College of Physicians will be delivered by Dr. Leonard Guthrie on December 3 and December 5, on "Contributions from History and Literature to the Study of Precocity in Children."

IT is reported by *Science* that the observatory of the University of Michigan is being enlarged under the direction of Prof. Hussey. The old instruments are being reconstructed, and a new reflecting telescope added, having an aperture of about 37½ inches.

FROM the *Pioneer Mail* we learn that the Government of India has sanctioned the opening of wireless telegraphic communication between Mergui (Lower Burma) and Victoria Point, with a land line between Victoria Point and Maliwun. An annual guarantee will be given from the provincial revenues of Burma in respect of the combined system. The guarantee will be subject to reconsideration at the end of ten years.

THE opening meeting of the Institution of Electrical Engineers will take place on November 14 at the Institution of Civil Engineers, Great George Street. Lord Kelvin is president for the present session, this making the third time he has occupied the presidential chair. Owing to his absence no presidential address will be given at the opening meeting, but a paper on the dielectric strength of insulating materials and the grading of cables will be read by Mr. A. Russell.

THE council of the Institution of Civil Engineers has made the following awards for the year 1906–7:—the Howard quinquennial prize to Mr. T. E. Vickers, C.B., in recognition of the part he has taken during his career in developing and improving the production of steel for important engineering purposes; Telford gold medals to Mr. Dugald Clerk (London) and Mr. E. J. Way (Johannesburg); Watt gold medals to Mr. J. T. Milton (London), Dr. A. W. Brightmore (Egham), and Mr. C. W. Lloyd-Jones (Secunderabad); George Stephenson gold medals to Mr. G. A. Hobson (London) and Mr. W. C. Copperthwaite (London); Telford premiums to Messrs. C. F. Jenkin (London), W. A. P. Tait (Edinburgh), A. P. Trotter (London), M. Kellow (Penrhyndeudraeth), H. J. S. Heather (Johannesburg), A. M. Robeson (Johannesburg), and J. W. Kitchin (Bristol); a Crampton prize to Mr. R. F. Thorp (London); Manby prizes to Mr. S. A. Frech (London) and Mr. G. D. McGlashan (Blyth); the Miller scholarship and the "James Forrest" medal to Mr. A. C. Anderson (Wolverhampton); Miller prizes to Messrs. R. A. Whitson (Basutoland), C. A. Ablett (Addiscombe), E. H. Heathcote (Henbury, near Macclesfield), G. B. G. Hull (Stockport), H. Stringer (Stoke-on-Trent), G. F. Walton (Edenfield, near Manchester), and A. T. Weston (Woolwich); Bayliss prizes, awarded on the results of the October and February examinations, 1906–7, respectively to Mr. F. C. R. H. Boyd (Luxor, Upper Egypt) and Mr. D. J. Morris (Swansea).

THE inaugural address of the eighty-ninth session of the Institution of Civil Engineers was delivered on Tuesday evening, November 5, by the president, Sir William Matthews, K.C.M.G. In the course of his remarks, the president referred to certain branches of engineering which are associated with the conduct of over-sea traffic, and therefore have an intimate and important bearing on our maritime commerce. In the ships of our mercantile marine we may with certainty look for expansion both with regard to dimensions and numbers. Again, we are fully entitled, in the light of recent events, to anticipate in the immediate future further and possibly great developments in steam propulsion with turbines, either employed alone or associated with reciprocating engines. Then there is the extended use of oil for raising steam, or directly in internal combustion engines. With regard to harbours, docks, and waterways, due and adequate provision must be made for larger and deeper draught ships, in the designs to be prepared for new works, and also where harbours and docks exist of inadequate dimensions for present requirements. As to the actual construction of sea-works, the arrangement of their design so that their execution may entail, so far as possible, repetitions of the same process, with the use of heavy masses and the generous application of suitable plant, may be usually expected to produce satisfactory and economical results, so far as the structures themselves are concerned.

THE awards for the Marseilles International Oceanographic Exhibition, which was held last year, have been issued. Among the recipients we notice the following:—*Grand Prix d'Honneur* to the Admiralty, the British Museum (Natural History), Meteorological Office, Sir John Murray, K.C.B. (president of the British Committee), Fishery Board for Scotland, Department of Agriculture for Ireland. *Grand Prix* to the Scottish National Antarctic Expedition, Challenger Society, Marine Biological Association, Royal Geographical Society, Captain Scott, R.N., Dr. Herbert Fowler (honorary secretary of British Committee), and Mr. W. S. Bruce. In addition, the *Diplôme Commémoratif* has been awarded to about thirty individuals and societies.

THE South Wales Institute of Engineers celebrated its jubilee on October 29. The institute was founded at Merthyr on that date of 1857 by the late Mr. Wm. Menelaus, manager of the Dowlais works. A strong and representative executive was formed, every member of which has now passed away. In 1881 a charter of incorporation was obtained, and in 1894 the institute buildings were opened at Park Place, Cardiff, at a cost of more than 10,000*l*., whilst the new library added last week has cost another 5000*l*. The present membership is 565. Sir W. T. Lewis, who was present at the first meeting of the institute, became in later years its president. The present holder of that office is Mr. T. H. Deakin, and secretary Mr. T. Jones-Price. The library was formally opened by the president on the afternoon of October 29, and a portrait of the founder of the institute (by Mr. Parker Hagarty) was unveiled. Addresses were delivered by Mr. T. Hurry Riches, Mr. Henry Martin, Mr. McMurtrie, and others. The quarterly meeting was then held, and in the evening there was a conversazione, at which there was a crowded attendance. Several lecturettes were delivered by Principal Griffiths, F.R.S., Dr. Hampson, Dr. Perman, and Mr. S. W. Allen. Among other interesting features was an installation of electrophones "laid on" to the London opera and music halls. Sir W. T. Lewis, who was unavoidably absent, sent a congratulatory letter, in which he referred to the fact that the South Wales coal output to-day was nearly seven times its figure at the time of the foundation of the institute.

THE fourth International Fishery Congress will be held at Washington on September 22–26, 1908, on the invitation of the United States Bureau of Fisheries. The first congress was held at Paris in September, 1900, the second was held at St. Petersburg in 1902, and the third at Vienna in 1905. Persons who expect to attend the congress or to submit papers are asked to communicate with the secretary-general as soon as practicable, and the secretaries of institutions and organisations interested in the work of the congress are requested to register their official designation and address so that they may receive further announcements, programmes, invitations, &c. The congress will deliberate on all important affairs concerning fishing and fish culture, and will submit propositions and memorials to Governments and to provincial and local authorities. The subjects to be brought before the congress may be grouped as follows:—(1) commercial fisheries; (2) matters affecting the fishermen and the fishing population; (3) legislation and regulation; (4) international matters affecting the fisheries; (5) aquiculture; (6) acclimatisation; (7) fish-ways and fish-ladders; (8) biological investigation of the waters and their inhabitants; (9) diseases and parasites of fishes, crustaceans, molluscs, and other water animals; (10) angling and sport fishing. In connection with the congress there have been arranged a number of competitive awards for the best or most important investigations, discoveries, inventions, &c., relative to fisheries, aquiculture, ichthyology, fish pathology, and related subjects during the years 1906, 1907, and 1908. The awards will be in the form of money, and aggregate about 440*l.*; and, although the individual amounts are not large, it is hoped that the conferring of the awards by so representative a body as the International Fishery Congress will induce many persons to compete, and will result in much benefit to the fisheries and fish culture. Communications regarding the congress should be addressed to the Secretary-General, International Fishery Congress, Washington, D.C., U.S.A.

A REMARKABLE hailstorm occurred in Cairo on the evening of October 21, preceded by lightning from 6 p.m. to 7.30 p.m. The hailstones measured on an average about 25 mm. in diameter, the largest stones measuring up to 35 mm. The storm was very violent, but only lasted a quarter of an hour. Had it been of longer duration considerable damage would have been inevitable. Such storms are very rare in Egypt. Coming after many hot, rainless months, the sudden downpour of hail caused great excitement amongst the natives. The hailstones fell on the flat-roofed houses with a loud crackling sound resembling that of burning wood-work. Newspapers spread out to catch the falling hail were simply riddled through by the larger stones. Most of the hailstones were spheroidal in shape with white nuclei. After striking the ground they quickly became hemispherical. The temperature in Cairo at the time was 25° C. The weather report issued by the Egyptian Survey Department does not indicate anything exceptional in the general weather conditions before or after the storm. The barometer was nearly normal, with short periodic disturbances between 5 p.m. and 8 p.m. The atmosphere was slightly clouded, and a light wind blowing. The hailstorm was very limited in extent, and apparently the path was N.W. to S.E. The temperature at various altitudes is variable, depending upon meteorological changes, but in ordinary circumstances the rate of change of temperature with altitude amounts to 1° C. for each 100 metres for the first 1500 metres. This would give about 2500 metres as the minimum height for the formation of ice. A systematic exploration of the atmosphere by means of kites and captive balloons with self-recording instruments is now being undertaken by the energetic director of the Helwan Observatory which will greatly extend our knowledge of the upper air over north-east Africa.

WE have received a copy of a paper by Mr. J. F. Bovard, issued as No. 14 of the third volume of the University of California Zoological Publications, on the structure and movements of *Condylostoma patens*, one of the largest of unicellular organisms.

A WRITER in the October number of the *Zoologist* figures a specimen of the "false scorpion," *Chelifer cancroides*, taken last year in a bake-house at Manchester. Up to the year 1892 only four British examples of this creature were known, but since that time the species has been discovered in stables, stores, &c., in various parts of England and Scotland.

"A MONOGRAPH OF THE PETRELS" is the title of a quarto work, by Mr. du Cane Godman, to be published in parts by Messrs. Witherby and Co., of High Holborn. It is to include all the known species of petrels, shearwaters, and albatrosses, and will be illustrated by more than one hundred hand-coloured plates. Mr. Godman's former colleague, the late Mr. Osbert Salvin, contemplated issuing a work of this nature, for which a number of plates were prepared; these will be used in Mr. Godman's volume.

WE have received a copy of a paper, by Mr. H. B. Greene, on the influence of heredity on the diseases and deformities of poultry, issued in connection with the second National Poultry Conference held in July last. From the fact of the isolation of the germ-cells, diseases are not, in the author's opinion, transmissible through the egg, and they must accordingly be regarded as the effects of environment rather than of inheritance. This is distinctly encouraging to the poultry-breeder, as it indicates that much may be done in the way of preventing disease by careful attention to food and sanitation.

AMONG the contents of *Verhandlungen deutsch. zool. Ges.* for 1907, we may refer to a paper by Dr. Steche, of Leipzig, on two luminous fishes, *Photoblepharon palbebratus* and *Heterophthalmus catoptron*, from the Malay Archipelago. Both species are of small size, and belong to the family of horse-mackerels (Carangidæ); they are remarkable among luminiferous fishes in being shallow-water forms, the first-named dwelling among stones at the bottom, while the second is a free-swimmer. Their light-organs, which are situated in the cutis, resemble generally those of deep-water luminous fishes, though they have certain structural peculiarities of their own. The whole upper surface of these fishes appears to be luminiferous.

A LARGE portion of vol. xlix. of the Smithsonian Miscellaneous Collections is occupied by an account of the crabs collected by the North Pacific exploring expedition of 1853–6. Dr. W. Stimpson, it appears, accompanied the expedition as naturalist, and after his return transferred the invertebrate collections to Chicago, where, together with notes and drawings, they were burnt in 1871. After his death in the following year an illustrated report on the crustaceans was discovered, and it is this report which has just been published by the Smithsonian Institute. The only additions to the original MS. are references to Stimpson's preliminary descriptions of species and certain emendations in nomenclature. Among the

generic names we may refer to Ptychognathus, which was published in 1858, and therefore antedates and invalidates Owen's use of that term for a South African anomodont reptile.

IN a supplemental Bulletin (No. 3) on "leaf-hoppers," recently issued by the Experimental Station of the Hawaiian Sugar Planters' Association at Honolulu, Mr. G. W. Kirkaldy suggests that the Australasian zoological region should be subdivided as follows:—(1) Austro-Malayan, or Papuan, including, in addition to the limits laid down by Wallace, the tropical forests of Queensland, and New Caledonia and the neighbouring islands as far as Fiji; (2) Euronotian, comprising Tasmania and the south-eastern third of Australia; (3) the Maorian, embracing New Zealand and adjacent islands; (4) the Westralian. The Caroline, Marshall, and Marianne groups may be provisionally included in the Austro-Malayan subregion, while the Hawaiian Archipelago forms an unattached subregion of great antiquity. Fiji seems to be related, as regards fauna, to the Papuan Archipelago or to the tropical forest of East Australia, and Wallace's Polynesian subregion should accordingly be abolished. Celebes is perhaps best regarded as an unattached or intermediate subregion.

A LIST of sedges from Jamaica, compiled by Dr. N. L. Britton from specimens examined in herbaria in New York and London, has been published as a supplement to the fifth volume of the Bulletin of the Department of Agriculture, Jamaica. With regard to previous determinations, Dr. Britton follows in the main the monograph on West Indian Cyperaceæ by the late Mr. C. B. Clarke, published in Urban's "Symbolæ Antillanæ" in 1900, but prefers a broader acceptation of the genus Cyperus. Fifteen genera and about a hundred species are enumerated, of which some require confirmation from additional specimens.

IN the October number of the *Trinidad Bulletin* the editor notes, with regard to the species *Theobroma angustifolia* allied to the cacao, that while the fruit is useless for commercial purposes, the tree, being more robust and resistant, is likely to prove useful as grafting stock for cacao plants. Reference is also made to an ornamental grass, *Thysolaena agrostis*, introduced from America, that may be grown in clumps similar to pampas grass. The report by Mr. F. A. Stockdale, mycologist to the Imperial Department of Agriculture in the West Indies, on the palm diseases investigated in Trinidad is published in full. Of the three diseases recorded, the most serious is the root disease caused by a fungus assigned to Botryodiplodia, a genus included in the Sphæropsideæ.

IT is reported in the daily papers that Prof. Koch, who is returning home after a long sojourn in the sleeping-sickness districts of Uganda, regards sleeping sickness as an enormous danger to the whole of East Africa. He finds that the tsetse-fly, the *Glossina palpalis*, which conveys the disease, breeds not only on the lake shores, but along the whole length of the rivers. Prof. Koch considers that there is a distinct connection between crocodiles and sleeping sickness. Wherever crocodiles are found the disease may be discovered, but only in places near the water. The blood of crocodiles forms the chief nourishment of the Glossina, which sucks the blood between the plates of the animal's hide. The extermination of the Glossina is impossible, but it is suggested that the same end may be reached by destroying the crocodiles or by the removal of the bushes and undergrowth where the animals lurk.

NO 1984. VOL. 77]

No one more fully understands the danger of indiscriminately using a *questionnaire* than Dr. J. G. Frazer, who in publishing through the Cambridge University Press his "Questions on the Customs, Beliefs, and Languages of Savages" is careful to point out the true method of utilising them. They are intended, not so much to be put directly to the savage, as to indicate to the inquirer in the field those subjects upon which students at home desire information. Leading questions should be avoided, as they tempt the savage to give answers which he thinks will be acceptable. The savage should be encouraged to talk in his usual vague way on the subject under investigation until he has exhausted his information for the time, when a question judiciously asked may jog his memory. Unexpected information casually offered is the most valuable of all, "first, because not being foreseen by the civilised man it cannot have been consciously or unconsciously suggested by him to the savage; second, because it may put an entirely fresh complexion on a whole series of customs and beliefs about which we had fancied that we knew all that was worth knowing." If used with this much needed caution, this suggestive collection, which is supplementary to the manual issued by the Royal Anthropological Institute, will be of much value to travellers with a taste for investigating the manners and customs of savage or semi-savage races.

STRIKING evidence of the industrial advantage of the occupation of the Philippines by the United States is afforded by a copiously illustrated article on railway development in the Philippines, by Mr. P. H. Ashmead, in the *Engineering Review* (vol. xxxiii., No. 6). The construction of the railways under Government patronage cannot fail to be of permanent benefit. The vast sums distributed as wages will be spent in the islands. An industrial army of some 30,000 men will have been formed, and such of these as are not required in the working of the railways will be available for other industries, which will receive an impetus by the supply of cheap means of transport.

THE Royal Cornwall Polytechnic Society, of which the seventy-fourth annual report has been received, continues to carry on successfully the valuable work in promoting the commercial prosperity of Cornwall and in encouraging mining invention for which it was brought into existence. The annual exhibitions of the society do much to stimulate inventive genius, and from the report on the seventieth exhibition it is seen that in view of the increased mining activity in the county special attention was devoted to life-saving appliances in mines. The papers contributed to the society and published in the report, whilst containing nothing of striking novelty, give much useful information. They include papers on tantalum, by Mr. F. H. Michell; on uranium ores, by Mr. F. J. Stephens; on deep bore-hole surveying, by Mr. W. R. Bawden; on modern mining methods, by Mr. J. H. Collins; and on the bees, wasps, and ants of Cornwall, by Mr. James Clark. The volume concludes with a report on the work of Falmouth Observatory, by Mr. W. L. Fox and Mr. E. Kitto.

IN the *American Journal of Mathematics*, xxix., 4, Prof. G. W. Hill shows how the attraction of a homogeneous spherical segment can be evaluated in terms of elliptic integrals.

WRITING in the *Popular Science Monthly*, lxxi., 3, under the title of "A Scientific Comedy of Errors," Profs. T. D. A. Cockerell and F. R. B. Hellems present a summary of the early history of the cochineal and allied dye-

producing insects. It contains, in particular, an account of a little-known pamphlet by Dr. Friedel (Leipzig, 1701), a man who, as the authors point out, was possessed of the true scientific spirit, but who appears to have corrected the blunders of Leewenhoek only to make lesser blunders of his own.

THE *Rendiconto* of the Bologna Academy for 1905–6 has been recently issued. It contains papers by Prof. Guido Tizzoni and Dr. A. Bongiovanni on the curative action of radium on the virus of rabies, together with a short communication on the same subject by Prof. Ivo Novi, who seems to have arrived at somewhat different conclusions regarding the efficacy of the cure. In addition, Prof. Cesare Arzella discusses in two short notes the conditions of integrability of a series of integrable functions and of partial differential equations respectively.

FROM Captain Lyons's report of the Survey Department of Egypt in 1906, it appears that the two principal features of the work during the year were the completion of the cadastral survey (large-scale plans of the cultivable land of Egypt, on which the individual holdings are indicated), and the publication of about one-quarter of the general map of the Nile valley and the delta on the scale of 1 : 50,000. The work of the meteorological section has greatly increased; among many improvements we may mention that since January, 1906, monthly summaries of the weather have been prepared and published, and that subsequently the area of the Daily Weather Report has been enlarged to include pressure and wind data over the eastern Mediterranean and Nile basin, thus filling up an important gap in the regions for which weather conditions are mapped daily.

THE September part of the Journal of the Institution of Electrical Engineers contains a paper by Mr. E. W. Moss in which, under the title "Electric Valves," short accounts are given of the theory and modes of action of many of the devices used at present for converting alternating into direct currents. Of these, the Norden electrolytic valve and its modifications appear to have proved themselves most capable of dealing with heavy currents, while the glow-lamp valve of Dr. Lee de Forest and Prof. Fleming seems one of the most convenient for the small currents used in wireless telegraphy.

OUR knowledge of the electrical state of the atmosphere should in the near future receive considerable additions from the observations which, according to the June number of *Terrestrial Magnetism and Atmospheric Electricity*, are about to be taken on board the United States magnetic survey yacht *Galilee* during her cruise in the Pacific and by the staff-surgeons on board two of the vessels of the German Royal Navy. The potential gradient, the conductivity of the air, and the radio-activity of air and sea-water are all to be measured regularly during calm weather.

CRYSTALLISED alumina occurs in nature in varying shades of colour, ranging from the colourless sapphire to brown and opaque corundum. The ruby, sapphire, and oriental amethyst are varieties distinguished by their transparency and colour. These colours have been attributed to the presence of traces of salts of iron, manganese, chromium, titanium, and other metals, but the experiments described by M. F. Bordas in the current number of the *Comptes rendus* (No. 18, October 28) would appear to prove that this explanation is insufficient, since by submitting a coloured stone to the action of a highly active radium bromide the colour is modified, passing from red through violet, blue, and green to yellow. Radium bromide of an activity of 1,800,000 was used in these experiments, the time of exposure not being stated. The action could be modified by graduating the activity of the radium salt or by increasing the distance of the stone from the radio-active material. The stones thus treated are not radio-active; they do not light up in the dark under the influence of pure radium bromide, and the coloration is permanent as regards heating.

DR. W. DOBERCK has retired from the position of director of the Hong Kong Observatory, and has been succeeded by Mr. F. G. Figg. He desires it to be known that his permanent address is now "Knowloon," Elgin Road, Sutton, Surrey.

UNDER the title of "A Chronicle of Science," the *Graphic* publishes fortnightly articles which deal attractively and accurately with topics of scientific interest. The issue of October 19 contained an illustrated description of the Percy Sladen Trust Expedition to the Indian Ocean, and the current number (November 2) includes portraits of Sir John Evans and the Rev. W. H. Egerton—the "father" of the Geological Society. Sir John Evans will celebrate his eighty-fourth birthday on November 17, and Mr. Egerton his ninety-sixth on November 13. Mr. Egerton was elected a Fellow of the Geological Society in 1832, and has therefore been on its roll for seventy-five years.

AMONG new books shortly to be issued are to be noted:—"The Functional Inertia of Living Matter," by Dr. D. Fraser Harris; "A Manual of Prescribing," by Dr. C. R. Marshall; and a revision of "Waring's Bazaar Medicines of India," by Lieut.-Colonel C. P. Lukis, I.M.S. Messrs. J. and A. Churchill will publish these three books.

A NEW edition of Mr. Wm. Woods Smyth's "The Bible in the Full Light of Modern Science" has been published by Messrs. Simpkin, Marshall and Co. Much new matter has been added. The price of the book is 1*s.* 6*d.* net.

MR. CARL ZEISS, of Jena (London address, 29 Margaret Street, W.), has published in brochure form full particulars of the field glasses he is prepared to supply. It is convenient to have in this concise form details as to price, linear magnification, and so on of these widely used glasses.

Erratum.—In Prof. Rutherford's letter in NATURE of last week (October 31, p. 661, col. 2, line 23), for "picradium" read "preradium."

OUR ASTRONOMICAL COLUMN.

COMET MELLISH (1907*e*).—Observations of comet 1907*e* made at the Lyons Observatory on October 17 showed that the object had the appearance of a diffused nebulosity of about 35″ diameter, was of about the tenth magnitude, and had a slight central condensation. Observing at the Marseilles Observatory on October 17 and 18, M. Borrelly found the comet to be fairly bright and extended, with a granular appearance (*Comptes rendus*, No. 17, October 21).

Other observations are recorded in No. 4210 of the *Astronomische Nachrichten* (p. 163, October 28), in which Herrn G. van Biesbroeck reports that on October 19, using the 15-inch refractor of the Uccle Observatory with a magnification of 240, he saw the comet as a circular, nebulous object of 1′ diameter and of the tenth magnitude. A central condensation, but no stellar nucleus, was seen.

Prof. Becker, director of the Strassburg Observatory,

directs our attention to the fact that the Strassburg observation of this comet, mentioned in these columns last week, was made by Dr. Wirtz.

The following is an abstract from the ephemeris published in No. 4209 of the *Astronomische Nachrichten* (p. 147, October 25) by Dr. M. Ebell :—

Ephemeris 12h. (M.T. Berlin).

1907	α (true) h. m.	δ (true)	Brightness
Nov. 4	6 24·3	+ 8° 26′·4	2·7
,, 8	5 29·7	+15 6·5	3·0
,, 12	4 24·4	+21 28·1	2·8
,, 16	3 18·3	+25 51·0	2·3

The brightness on October 15, magnitude 9·5, is taken as unity.

From the above it will be seen that the comet is apparently travelling rapidly through Taurus, and will pass some 4° to the north of Aldebaran on November 11. On November 15 it will be less than 1° north of the Pleiades.

THE TRANSIT OF MERCURY.—Astronomers who intend to observe the approaching transit of Mercury, which will take place on November 14 in accordance with the times communicated by Dr. Downing to last week's NATURE, will find many interesting notes and suggestions in M. Bigourdan's articles in the *Comptes rendus* (Nos. 16 and 17) for October 14 and 21 respectively. In the former article M. Bigourdan discusses the conditions which are necessary for a transit, the results of earlier observations, and a few of the phenomena which it is advisable to observe. For example, he suggests that an attempt to repeat Langley's observation of Mercury before the first contact in 1878 might be made. In the same year Janssen, using a spectroscope, was able to see the planet projected on a bright prominence before contact with the sun's limb, but this is an unlikely observation at the coming transit, because the contacts take place near the north pole of the sun, where prominences are fewer.

In the second article M. Bigourdan deals with other points of interest, such as the exact measurement of the distances between the edge of the planet and the sun's limbs in order to determine more exactly the times of the contacts, the form of Mercury's disc as seen on the sun, and the possible observation of satellites, which, if they existed, might be seen projected on the bright solar disc; the determination of the planet's diameter and the effects of different apertures in such observations are also discussed. As Mercury will be seen on the sun's disc at midday in Europe, its exact position on the disc may be determined with meridian instruments. M. Bigourdan then discusses the previous observations of both bright and dark rings surrounding the disc of Mercury, and suggests that a spectroscopic examination might reveal special absorption lines, the existence of which would prove the reality of the annuli, and hence the existence of an atmosphere belonging to the planet. Observations of bright points and spots on the planet's disc have been frequently reported during previous transits, but the real existence of such phenomena still requires further confirmation. M. Bigourdan's second paper concludes with a discussion of the methods of observation and the class of instruments it is advisable to employ.

CHANGES ON SATURN'S RINGS.—A telegram, dated October 28, transmitted by Prof. Pickering to the Kiel Centralstelle, announces that Prof. Campbell observed prominent bright knots, visible during the past week, in Saturn's rings. The knots were symmetrically placed, two being to the east and two to the west (Kiel Circular, No. 101, October 28).

A BRIGHT METEOR.—Mr. Arthur Mee reports that a magnificent meteor was seen by observers at Cardiff and Newport on the evening of October 31. It appeared at exactly 10 o'clock, and fell leisurely from γ Cygni to a point just west of Vega. The head "opened out like a rocket," leaving a train that remained visible for several seconds. Those who saw it are not quite agreed as to the colour of the head, but all testify to its great brilliancy, though the night was by no means a dark one.

THE NEW MUNICIPAL TECHNICAL INSTITUTE, BELFAST.

THE formal opening of the new Municipal Technical Institute, Belfast, on October 30, by the Lord Lieutenant of Ireland (the Earl of Aberdeen), may be said to close the first epoch in the history of technical education in that city, and, indeed, in the whole of Ireland. When it is remembered that the Agriculture and Technical Instruction (Ireland) Act became law so recently as 1899, the progress already made is most noteworthy. Within that brief period the annual enrolment of students has risen to 5000, and these are now housed in a building which in beauty of architecture and excellence of equipment may challenge comparison with anything of a similar nature in the United Kingdom.

In the year 1900 the Corporation of Belfast decided to put the Act in force, and appointed a strong committee to carry on the work. The committee chose as its chairman Alderman Sir James Henderson. A happier selection or one more fruitful of good results it is difficult to imagine. A former Dublin University man, a member of the Irish bar, a past Lord Mayor of the City, and the managing director of an old and influential newspaper (the *Belfast News-Letter*), Sir James was admirably fitted to take up the duties of pioneer of technical education in his native city and province. Operations on the site were commenced in February, 1902, but, owing to the peculiar nature of the subsoil, great care was requisite in the formation of a suitable foundation. The site itself is 240 feet by 205 feet in size, and into this area were driven 2756 piles, each 40 feet in length. The heads of these piles were connected to longitudinal timbers, and the whole bonded together in concrete. The formal laying of the foundation-stone was performed on November 24, 1902, by the Earl of Dudley, at that time Lord Lieutenant of Ireland.

A general idea of the external architectural design of the building will be readily grasped from the accompanying reproduction from a photograph; and it will be sufficient to state here that the height of the top of the surmounting balustrade above the pavement is 85 feet; to the top of the domed towers the height is 135 feet. Internally, the building surrounds two courtyards, these courtyards being lined with white glazed bricks and roofed in with glass over the ground floor. The corridors are carried round these areas, and are spacious and well lighted. The floors throughout are of steel and concrete, finished in the laboratories and class-rooms with solid wood blocks, and in the corridors and lavatories with marble terrazzo. Ample gas and water supplies are laid on everywhere, and the building is lighted throughout by electricity. Heating and ventilation are provided by the "Plenum" system. The air, after being washed and screened, enters the heating chamber, where it is passed over tempering coils, and is finally driven throughout the building by a large pair of "Ulster" centrifugal fans. The capacity of these fans is 140,000 cubic feet of air per minute. Arrangements are also made for driving these fans by electricity when heat is not required.

Coming to the question of departmental arrangement, the general idea has been to group together the work of each department in one suite of rooms. The subjects taught are grouped into departments as follows:—mathematics, mechanical engineering, naval architecture, physics and electrical engineering, building trades, textiles, pure and applied chemistry, miscellaneous industries, natural science, commerce, domestic economy, and art.

The department of mechanical engineering includes a total area of 13,000 square feet. On one floor are the lecture rooms, drawing rooms, a photo-printing room, and a mechanical laboratory in which fifty students can work at the same time. The engineering laboratory, workshops, and boiler house are on another floor. The mechanical laboratory is fitted with a large range of appliances of small type all of the newest description. The central idea in providing the equipment has been to keep the application of mechanics to engineering well to the front. A small hydraulics section is attached to this laboratory. The floor of the engineering laboratory is double, and in the intervening space are stored all shafts,

belts, pipes, and also the arrangements not directly required for experimental work, thus leaving the floor clear from obstruction. Beneath the lower floor a tank of ten thousand gallons capacity has been built. A wide range of machinery has been installed. The department also comprises a machine shop and a pattern shop.

In the lecture rooms and laboratories of the department of physics and electrical engineering the machinery is of the latest type. Everything has been provided for giving a complete training, theoretical and practical, to the students.

As is to be expected in a city like Belfast, particular attention has been paid to the equipment of the department of textile manufactures, and the result has been to make the new institute almost unique in this respect. Particular emphasis has naturally been laid on the various flax products, and in this connection a very complete range of machines has been installed.

It is unnecessary to examine in detail the equipment of the remaining departments. In every case the expenditure has been equally generous, and the results equally satisfactory. Special mention may be made of the art school, which occupies the entire top storey, and now ranks as one of the best schools in the kingdom. The chemical laboratory is the largest room in the institute, and has been furnished on a complete scale.

Belfast may well be proud of its new institute. Facilities are now provided for the carrying on of the work of technical education such as cannot fail in the immediate future to have an important and beneficial influence on its trade and industries.

In connection with the opening ceremony, a "Souvenir" book has been issued. This contains a number of portraits, views of the institute, a chronological table, salient facts and statistical data, and a historical retrospect of technical instruction in Belfast, whilst the book is finely illustrated with internal and external views of the institute. The book is to be sold at 1*s*., or by post 1*s*. 3*d*. Copies can be obtained on application to the institute.

The Municipal Technical Institute, Belfast.

LONDON DAY TRAINING COLLEGE FOR TEACHERS.

IN June, 1901, in response to urgent representations from the School Board for London and other important bodies, the late Technical Education Board of the London County Council secured the adoption of a scheme under which the Council undertook to provide and maintain a day training college for men and women teachers in close connection with the newly re-constructed University of London, and a chair of education in the University to be held by the principal of the college.

Work was commenced in October, 1902, under the direction of Prof. John Adams, and has been continued in various temporary premises until the present term, when the college entered into possession of the southern half of the fine block of buildings designed by the Council's architect (Mr. W. E. Riley) to fill a site recently cleared at the Holborn end of Southampton Row. (The northern half of this block will, when finished, be occupied by the L.C.C. Central School of Arts and Crafts.) The celebration of the entrance of the college into its permanent home was the motive of an interesting ceremony conducted by the chairman of the Council (Mr. Percy Harris) on Saturday last, when Lord Rosebery, as Chancellor of the University, formally declared the building open.

The majority of the students of the college are "recog-

nised students" (formerly "King's scholars"), receiving a grant from the Board of Education, who have matriculated, and are thus qualified to enter one of the schools of the University for a three years' course, leading up to the degree in arts or science. Concurrently with their academic studies they take a course of professional instruction at the training college with a view to certification by the Board. In addition to these students, there is a smaller number of graduates who take a one year's course in preparation for the University's diploma in pedagogy, and intend to teach in secondary schools. Since, however, a rapidly increasing proportion of the recognised students enter with a higher qualification than matriculation, and obtain the degree before the conclusion of the three years' course, the work of the college will in a few years become very largely post-graduate, and may be expected to have an important influence upon the standard of teaching in the elementary schools of London.

Since every student is either a graduate or an internal student of the University in arts or science, the equipment of the college has been determined solely by the needs of the professional side of the course of training. Thus the laboratories, which together with the art studio occupy the top floor of the building, are used almost entirely for the demonstration of methods of teaching science subjects. The larger laboratory (55 feet by 30 feet) contains benches of a special design planned for elementary work in chemistry, physics, and mechanics, fume cupboards, a well-equipped demonstration table, and teak tables used chiefly in connection with the instruction in practical mathematics. Between the mathematical and physical benches accommodation is provided for students following the course of a lesson given to a class of children.

The smaller laboratory (30 feet by 20 feet) is devoted to nature-study. In addition to working benches, it is equipped with specimen cases, a dark cupboard, and other fittings. A balance room and a preparation room situated between the two laboratories serve the needs of both. There is also a small room (readily transformable into a photographic dark room) equipped with water, gas, and electric power, and intended to be used for anthropometric work and for researches in pedagogical psychology.

On the roof, within easy access from the laboratories, is a plant house containing a large tank for aquatic plants and animals. The level space around this is utilised as a meteorological observatory in connection with lessons in geography. Finally, on the floor below that already described, is a pedagogical museum, which performs the functions of a geographical laboratory.

Carefully planned and closely correlated courses in mathematics, geography, nature-study, and physical science are taught in these laboratories to the children of the demonstration schools by students under supervision. Most of these students either have already graduated or are about to sit for the B.Sc. degree, and are paying special attention during their last year to the teaching of the scientific subjects of the curriculum.

IMMUNITY TO DISEASE AMONG PLANTS.[1]

THE question of immunity to disease has been so closely studied and so frequently discussed in connection with the diseases of man that it seemed to me that it might be of interest to bring together some of the facts now known to us about the incidence of disease among plants and the theories which have been advanced as to the cause of the immunity which some species and varieties exhibit to various diseases.

The late Prof. Marshall Ward has shown that *Puccinia dispersa*, the brown rust of grasses, seems to exist in several "biologic forms," each of which attacks only one group of nearly related species of Bromus, and the same condition obtains in the Erisipheæ, or mildews, according to Salmon. How is it that these fungi are incapable of infecting such nearly related host plants as are represented by the species within a single genus? The suggestion was originally made that differences in the thickness of the cell walls, fewer or smaller stomata, longer hairs, &c., were the obstacles which repelled the fungi and rendered certain species and genera of plants immune to the attacks of particular fungi. Working with the different species of Brome, Marshall Ward was, however, able to show that there was no relationship between the stomata, hairs, and so forth, and the infectibility of the species. Immunity did not in any way depend upon the anatomical characters of the host plant, but entirely on physiological reactions of the protoplasm of the fungus and of the cells of the host. In other words, infection and resistance to infection depend on the power of the fungus protoplasm to overcome the resistance of the cells of the host by means of enzymes or toxins, and reciprocally on the protoplasm of the cells of the host to form anti-bodies which destroy such enzymes or toxins, just as is the case with resistance of animal organisms to their bacterial foes. Salmon has shown in his experiments that susceptibility in a leaf normally immune to the attacks of the biologic form of a particular mildew may be induced by various mechanical means, such as cutting the leaf or searing it with a red-hot point of a knife, or by exposing the leaf to ether or alcohol vapours, or by exposing it to heat. The resistant vitality is thereby impaired, and the fungus gains the upper hand. Plants, if not immune to a particular disease, may be rendered so to a certain extent by similar methods to those employed in the case of animals. More or less successful injection experiments have been made in the case of fruit trees suffering from chlorosis, and as a result animal parasites have been got rid of as well. Undoubtedly if the general vitality of the tree can be raised some diseases can be thrown off.

Marchal has stated, 1902, that young plants of the lettuce could be rendered immune against *Bremia latucae* by feeding the plants with a solution of copper sulphate (1 in 30,000). This view has received support from Laurent and Massée, but Salmon has not been able to confirm these results. It will be seen that the views are still somewhat conflicting, and too much must not be expected from such methods of treatment.

The hope of the agriculturist lies in another direction. Plants, like animals, are subject, as Darwin has shown, to a considerable amount of variation, and all characters, whether anatomical or physiological, are subject to change or mutation. Immunity to disease, dependent as it is on certain physiological peculiarities, the secretion of anti-toxins, rather than on anatomical structure, is similarly a subject of variation. We see this readily illustrated when passing through a field exposed to some epidemic disease, where here and there plants are found which have been either only slightly damaged or not attacked at all. These should be selected for breeding purposes, and thus hardier varieties can be produced. Another method which has shown itself useful for producing resistant forms is by hybridising. It is a well-known fact that hybrids, while partaking of the nature of one or both of the parents in most characters, generally exceed both in vegetative vigour—a characteristic to which the sterility of some hybrids is attributed. But vegetative vigour, as we have seen above, is generally associated with immunity to disease, and hence hybrids are often found to be more resistant. This is not always the case, for in this respect hybrids vary too, but the French horticulturists MM. Bouttes and Guillon have been successful in producing hybrid vines which are more resistant to the mildew than either of the parents.

In the selection of immune varieties one is faced with the unfortunate fact that many of the most resistant forms are the least valuable, producing poorer fruits and seeds than the delicate forms. But by judicious hybridising this defect of the immune race can be largely counteracted. Mr. Lewton Brain has collected a good deal of information on this point. Both in the case of vines and in wheat many disease-resisting forms have been produced.

In connection with cotton crops, it is remarkable how great is the range of variation with regard to the resistance of the plants to the wilt disease (*Neocosmospora vasinfecta*). By selection and suitable hybridising, Rivers has been able to obtain varieties which remained untouched by the disease, while of the neighbouring crops

[1] Abridged from an address delivered at the annual meeting of the British Pharmaceutical Conference at Manchester by Prof. F. E. Weiss.

95 per cent. were destroyed. In the West Indies the Bourbon cane has been given up on account of disease, but very useful and disease-resisting hybrids have been produced by crossing the valuable but easily attacked Tjeribon cane with the resistant Indian Tschan cane.

It will thus be seen that breeders have the power by careful selection to combine disease-resisting powers with relatively great fertility, and therein lies our hope for the future success of agriculture.

THE BED OF THE WESTERN PACIFIC OCEAN.

THE results of surveys carried out by the surveying vessel *Edi* and the cable-ship *Stephan* during 1903 and 1905 in the western and south-western parts of the Pacific Ocean have been published in a paper by Drs. G. Schott and P. Perlewitz, recently issued in the *Archiv der deutschen Seewarte*. An abstract by Dr. Schott appears in the *Annalen der Hydrographie* (1907, p. 108). Taken in conjunction with the work of the American vessel *Nero* (already noticed in these columns) and of the German vessel S.M.S. *Planet* (see *Annalen der Hydrographie*, 1907, pp. 49 and 50, 193 and 194, and 196), these soundings throw a great deal of new light on the configuration of the sea bottom in those regions, disclosing certain characteristic features of great interest in their bearing on the history of the Pacific Ocean and its extension westward at the expense of the Asiatic continent, and also on the general problem of the form of the surface of the lithosphere.

The typical form may be described thus. Along a line running seaward from the coast of Asia the depth is (beyond the continental shelf) about 3000 metres; it diminishes slowly and fairly uniformly at first, then rapidly, until the surface is reached on a cross-line of islands. To seaward of the islands the bottom falls first slowly and then very steeply to a line of "deeps," in which depths of 7000 metres to 9000 metres are reached; then follows a fairly gradual rise to a "Horst" some 4000 metres below the surface. These structures, so far as appears from these observations, occur (1) in the Liu-Kiu Islands and deep; (2) in the Tulur Islands and deep; and (3) in a line following the Pelew Islands, Yap, Guam, and the eastern Ladrones. The soundings of the *Planet* show that the "Tulur" deep (2) is continuous with a long, narrow trough extending northward along the east coast of the Philippines, and it seems not unlikely that the "Liu-Kiu" deep (1) is part of the same depression. The "Guam" deep is identical with the "Caroline" deep discovered by Friederichsen in 1901.

The troughs forming the deeps are usually about ten miles wide (the Guam deep is as much as twenty miles across), and Drs. Schott and Perlewitz are of opinion that they are the result of subsidence occurring on an enormous scale along lines of fracture. It is probable that the disturbances which produced these structures are comparatively recent; geological relations suggest Tertiary times, at least in the case of the Liu-Kiu deep, and there is obviously nothing in the suggestion incompatible with the great antiquity of the Pacific basin as a whole.

HYDROLOGY IN EGYPT.

"THE Rains of the Nile Basin and the Nile Flood of 1906" is the first of a new series of periodical reports which are being published by the Survey Department of Egypt. These departmental papers are intended to comprise results of technical or scientific interest which are obtained in the course of the work of the department.

Captain H. G. Lyons, the director, says that although the increase of rainfall stations in British Central Africa, Uganda, and the Sudan has materially reduced the difficulty of forecasting the flood, the absence of any definite information as to the meteorological conditions of Abyssinia, especially during the rainy season, June to August, is a great drawback, and to overcome this somewhat he intended early in 1907 to send a qualified meteorologist to Addis Abbaba to study the local conditions.

The chapter on the normal distribution of rainfall traces the heavy rains from Zomba and British Central Africa and German East Africa in January and February to Abyssinia and the Sudan in July and August. During these two months these countries receive 60 per cent. of their annual rainfall. In September the rain begins to moderate in Abyssinia, and to retreat southwards.

In discussing the rainfall for 1906, it is shown that most places in the districts under observation had excess rain at the period of normally heavy rains, whilst in their respective dry seasons there was deficiency. In the Nile Basin the rains were somewhat late in commencing.

At the end of October, 1905, it seemed likely that during 1906 the Nile would be low, for the summer rains in Abyssinia had been weak. In November, February, and March some exceptional and heavy rains improved matters, and gave a fairly good supply of water.

At Khartoum the flood commenced on May 27, sixteen days late, and reached its maximum on September 14, ten days late. The volume of the flood estimated from the discharge curve of the Aswan gauge during July, August, September, and October was 0·87 of the mean of thirty-eight years.

During April, 1906, Mr. J. I. Craig made an investigation to determine the amount of seepage through the banks of the river. Using the records of flow at Aswan and Sarras, and special observations of flow made at Kareima, Mr. Craig came to the conclusion that at the period of low water, and on that stretch of the river between Khartoum and Sarras, a distance of 1480 kilometres, water flowed through the banks into the river at the rate of between 140 and 200 cubic metres per second. During the flood water passes out of the river similarly, for then the level of the water-table in the surrounding country is lower than the surface of the river.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sites Syndicate has had under consideration the most suitable position for the proposed buildings in connection with the school of agriculture. It is of opinion that the most suitable position would be one on the Downing site, to the south of the botany school and parallel with it. The building on this site would be near the departments of botany and geology, and would be accessible from three roads, and it would be well lighted. At the present time the department of agriculture is housed in the basement of the chemical laboratory, but in view of the greatly increasing number of students in agriculture proper provision of laboratories, lecture-room, and museums is urgently needed. Towards the cost of an agricultural school some 13,000*l*. has already been subscribed by friends of agriculture and the University. A suitable building would probably cost some 20,000*l*., and it is further desirable that some provision should be made for maintenance.

Mr. A. E. Shipley has been nominated a manager of the Frederick James Quick fund from January 1, 1908, to December 31, 1913.

The following have been nominated examiners for the Natural Sciences Tripos in 1908:—*Physics*, Mr. J. A. McClelland and Mr. P. V. Bevan; *chemistry*, Dr. Fenton and Mr. K. J. P. Orton; *mineralogy*, Mr. A. Hutchinson and Mr. L. J. Spencer; *human anatomy*, Mr. T. Manners-Smith and Prof. R. Howden; *geology*, Mr. E. J. Garwood and Mr. W. G. Fearnsides; *botany*, Mr. F. W. Oliver and Mr. F. F. Blackman; *zoology*, Dr. Harmer and Mr. R. C. Punnett; *physiology*, Mr. F. G. Hopkins and Dr. M. S. Pembrey.

OXFORD.—The preamble of a statute establishing a professorship of engineering science was passed by Congregation on October 29 by a majority of 152 to 20.

The Burdett-Coutts scholarship in geology has been awarded to R. L. Robinson, Magdalen College; C. H. Dinham, Magdalen College, distinguished himself in the examination.

LORD AVEBURY has been elected without opposition Lord Rector of the University of St. Andrews.

ACCORDING to the *Pioneer Mail*, one lakh of rupees has been added to the Griffith bequest to found a university library attached to the Madras University, and another sum of sixty thousand rupees for university lectureships and research scholarships.

AT a recent meeting of the Senate of the University of London, the following resolution was unanimously adopted:—"That the Senate have received with sincere regret the announcement by Sir Arthur Rücker that he wishes to relinquish office on September 30, 1908, and record their appreciation of the great services he has loyally rendered to the University as principal since its reconstitution."

THE graduate school of applied science at Harvard University recently received the gift of about 2000 acres of valuable timber land as a special adjunct to its instruction in forestry. According to Prof. R. T. Fisher, the forest included in this gift comprises the best body of timber now to be found on an equal area in Massachusetts. Its special advantage is in the arrangement of the age-groups or generations of timber. It so happens that stands of various ages, from the small sapling to the mature tree, are almost equally represented in separate sections of the forest.

THE annual prize distribution and conversazione of the Northampton Polytechnic Institute, Clerkenwell, E.C., will be held on Friday and Saturday, November 29 and 30. The Duke of Connaught has consented to distribute the prizes on November 29, and after the prize distribution the whole of the laboratories, workshops, drawing office, and studios of the institute, both in the main building and in the British Horological Institute adjoining (the technical optics department), will be on view in working order. The conversazione of members and students will be held on the following evening.

THE Board of Education, South Kensington, has issued the following list of candidates successful in this year's competition for the Whitworth scholarships and exhibitions:—(1) Scholarships, 125*l*. a year each, tenable for three years: A. A. Rowse, London; N. J. Perryman, Portsmouth; G. Hudson, Portsmouth; J. Warren, Portsmouth. (2) Exhibitions, 50*l*. a year each, tenable for one year: A. W. Judge, Portsmouth; J. H. Hyde, Leytonstone; E. A. Steed, Devonport; A. J. Begg, Plumstead; M. R. Dewhurst, London; R. D. Given, Edinburgh; F. A. Bumpus, Birmingham; R. J. Iliffe, Liverpool; S. L. Symns, London; F. Morris, Portsmouth; W. P. Johnson, Kelsall Hill, Chester; T. W. Johnstone, Neyland; J. H. Neal, Devonport; H. Mawson, Hunslet, Leeds; E. W. Stedman, Sheerness; F. Morrison, Aberdeen; R. G. Milner, Plumstead; A. Hutchison, Glasgow; H. J. Middleton, Forest Gate; A. T. Phillips, Barking, Essex; W. Macgregor, Greenock; M. J. C. McCarthy, Sheerness; H. T. Wright, London; A. McFadyen, Lasswade, Midlothian; F. G. Rendell, Portsmouth; J. H. Blight, Devonport; F. C. D. Mann, Hayes, Kent; J. E. Collyer, South Woolwich; B. Baker, Southsea; L. C. Brown, Wolverton.

MR. ASQUITH, Chancellor of the Exchequer, visited Aberystwyth on November 1 to open the Edward Davies chemical laboratories, the gift of Mr. David Davies, M.P., and his mother and sisters, to the University College of Wales, Aberystwyth. The new buildings have been erected at a cost of 25,000*l*. In the course of a speech at a great public meeting held subsequently, Mr. Asquith said Aberystwyth has owed little, at all events, until that day to the munificence of the man of wealth, and there are very few other institutions, either in England or in Wales, of which it can be said that it was brought into being and that for many years it was kept in being by the pence of the Welsh people. There are few more interesting or encouraging chapters in the history of democracy than that which recounts what in our time the Welsh people has done for education. In the course of thirty years something very near 120,000*l*. has been subscribed for the purposes of the college, Aberystwyth, and the remarkable feature is that it has been subscribed by 100,000 separate donors. The figures no doubt are equally striking at Bangor and Cardiff. The university system in Wales has been undertaken by the people for the people. During the same period there has been voluntarily subscribed to set on foot a system of intermediate schools something approaching the same sum—80,000*l*. to 100,000*l*. There is still much work to be done, many gaps to be filled; but the Welsh people formed their intermediate system first of all, and now, by the founding of their university colleges, any Welsh child of brains, zeal, and good character, whatever the social surroundings of its parentage, can climb without undue favour or assistance to the very highest position in the pursuits of industry or commerce.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 27.—"Note on the Use of the Radiometer in observing Small Gas Pressures; Application to the Detection of the Gaseous Products produced by Radioactive Bodies." By Sir James **Dewar**, F.R.S.

The experiments described in this paper seem to show that the radiometer may be used as an efficient instrument of research for the detection of small gas pressures and the study of radio-active products. For quantitative measurements the torsion balance or bifilar suspension must be employed. It would be interesting to repeat light repulsion experiments in the highest attainable charcoal vacuum. The author hopes to extend the investigation later.

Entomological Society, October 16.—Mr. C. O. Waterhouse, president, in the chair.—*Exhibits*.—A. H. **Jones**: A series of *Pieris napi*, var. *bryoniae*, from comparatively low altitudes near Budapest, showing a wide range of variation, and a remarkable aberration of *P. napi* (*napaeae*) bearing a strong resemblance on the underside to *P. rapae*.—M. **Burr**: An example of *Apterygida albipennis*, discovered by him near Dover this year; and a ♂ specimen of *D. verrucovirus*, an inhabitant of Scandinavia, from the same locality.—H. **Campion**: *Platycleis roeselii*, Hagenb., ♀, taken September 13 near Herne Bay, of which there are but few well-authenticated British specimens.—E. W. **Campion**: An aberrant specimen of *S. sanguineum*, ♂, from Epping Forest, suggesting relationship with certain Orthoptera, and two *Calopteryx virgo* of his own from the New Forest showing failure in pigment.—W. J. **Kaye**: Specimens of *Callicore aurelia*, Guen., together with a photograph of its larva, showing the remarkable branch-like horns rising out of the head.—Rev. F. D. **Morice**: A normal ♂ specimen of the bee *Anthidium manicatum*, L. (the "hoop-shaver bee" of Gilbert White's "Natural History of Selborne"), and a monstrosity or malformation of the same insect from Argentat, Corrèze, France.—C. O. **Waterhouse**: (1) A living ant, a species of Camponotus, found by Mr. Watson at Kew, in the pseudo-bulb of an orchis (probably a Bulbophyllum) from the Gold Coast. The bulb was much excavated, but it had no opening by which the ant could have entered; (2) a large wasp (a Salius allied to *dedjax*) with a spider, a Mygale rather larger than itself, but which it had captured and was carrying off.—Lieut.-Colonel Neville **Manders**: A melanic variety of *Hestina nama*, captured near Darjeeling, and a monstrosity of *Papilio krishna*, from Sikkim, in which the wings on the right side were much larger than those on the left.—H. **Main**: The larva of a hymenopterous parasite of *Pygaera bucephala*, of great size comparatively to its host.

Institution of Mining and Metallurgy, October 17.—Prof. William Gowland, president, in the chair.—The origin of the gold in the Rand banket: Prof. J. W. **Gregory**. A carefully reasoned argument in favour of the marine placer theory, as opposed to the infiltration theory. The author quoted the leading authorities both for and against his own conclusions, which are based on a personal visit to the Rand and a subsequent weighing of all available evidence. After a brief historical introduction, the paper was subdivided under the following heads:—theories of the genesis of the Rand gold; the rocks of the Rand goldfield; the arguments against the placer theory; evidence against the infiltration theory; evidence of the microscopic structure of the rocks; com-

parison with other goldfields; economic bearing of the problem; and, finally, summary of conclusions. The author stated that in his opinion the theory as to the origin of the banket in best agreement with the facts appeared to be that which regarded the banket as a marine placer in which gold and black sand (magnetite with some titaniferous iron) were laid down in a series of shore deposits. Owing to the late hour at which the discussion on this paper terminated, the other paper on the evening's agenda, the deviation of Rand boreholes from the vertical, by Mr. Joseph Kitchin, was held over for discussion at the meeting on November 21.

MANCHESTER.

Literary and Philosophical Society, October 1.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The president delivered an inaugural address, in which he referred shortly to the work on radio-activity, with which is intimately associated the name of Prof. E. Rutherford; the work of Messrs. Barlow and Pope, by which the valency of the chemical atom has been connected in a definite manner with its volume in crystalline structures; the researches of Prof. Perkin on the formation and stability of various carbon rings, more particularly his work on the camphor and terpene series, and at somewhat greater length on the work in which he was most interested personally—the propagation of the explosion wave in gases, the direct determination of the specific heat of CO_2, the temperature of the ignition points of gases, and the re-determination of the atomic weight of chlorine.

October 15.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The relation between the crystalline form and the chemical constitution of simple inorganic substances: Prof. W. J. **Pope** and W. **Barlow.** The authors have applied the methods employed in their paper of October 16, 1906, to the study of the crystalline structure and molecular condition of a number of simple inorganic substances, such as the crystalline elements, binary compounds like silver iodide, potassium chloride, &c., ammonium halogen salts and compounds of the type of rubidium tri-iodide, RbI_3.

PARIS.

Academy of Sciences, October 28.—M. H. Becquerel in the chair.—The disease of the pine in the Jura: MM. **Prillieux** and **Maublanc.** The disease of the pines in the Jura, recently pointed out by M. Bouvier and called by him *rouge*, has been studied in Germany by Hartig, who has shown that the disease is due to the attack of a parasitic fungus, *Phoma abietina*. The same fungus, for which the authors prefer the name *Fusicoccum abietinum*, attacks the pines in the Vosges and the Jura. The disease is not so grave as has been supposed by M. Bouvier, as the trees are rarely killed by it, certain of the branches only being attacked. The rational treatment is the removal of the dead branches and their destruction by incineration; in this way the fructification of the fungus and the dissemination of its spores are avoided; but this treatment may be too costly, and not justified by the actual losses threatened.—The heat of formation of the oxides of lithium: M. **de Forcrand.** A criticism of the data put forward by various authors for the heat of formation of Li_2O, together with experimental data for the heat of formation of LiOH and Li_2O_2.—Observations of the comet 1907*e* (Mellish) made at the Observatory of Besançon with the bent equatorial: P. **Chofardet.** Apparent positions of the comet, and position of the comparison star for the night of October 17. The comet was of the ninth magnitude, of circular form, without a distinct nucleus. Total diameter about 2′.—Observations of the comet 1907*e* made at the Observatory of Algiers with the 31·8 cm. bent equatorial: MM. **Sy** and **Villatte.** Similar sets of observations for October 18 and 20.—Critical transcendental points and inverse functions of integral functions: Pierre **Boutroux.**—Contribution to the synthesis of precious stones of the family of the aluminides: F. **Bordas** (see p. 17).—A new quantitative measuring instrument for the X-rays: H. **Guilleminot.**—Some iodomercurates: A. **Duboin.** The following double iodides have been isolated in a crystalline form and analysed:—

$FeI_2,2HgI_2,6H_2O$; $HgO,2AlI_3,3HgI_2,15H_2O$; and $2AlI_3,5AgI,2AgO,13H_2O$.

—A new method of determining the atomic weights of precision simultaneously for all the elements present in a single chemical reaction: G. D. **Hinrichs.** The author describes a graphical method of reduction to the experimental data for silver, chlorine, thallium, nitrogen, oxygen, and radium, with the result that all the atomic weights are reduced to multiples of 0·5.—A colloidal solution of arsenic: V. **Auger.** A hydrochloric acid solution of arsenious anhydride reduced by hypophosphorous acid at a low temperature in presence of a large amount of alcohol gives a reddish-brown powder, consisting of metallic arsenic, 68·2 per cent.; phosphorus, 0·97 per cent.; alcohol, 2·5 per cent.; and water, 28·4 per cent. This form of arsenic possesses the property of dissolving immediately in a dilute solution of caustic soda, giving a brown colloidal solution, the properties of which are given in detail.—Some causes of error in the estimation of phosphorus in iron, cast iron, and steel: G. **Chesneau.**—The formation of liquid crystals of two new compounds of cholesterin: Paul **Gaubert.** The two compounds are obtained by heating cholesterol with glycollic acid or with glycerol.—The disease of the pine in the forests of the Jura: E. **Henry.** This disease was first observed in the summer of 1906, and up to the present has not caused the death of a single tree.—A new method of reaction of the skin to tuberculosis, and its utilisation in the diagnosis of tuberculosis: J. **Lignières.** A development of the Pirket reaction in which the tuberculin may be replaced by dead tubercle bacilli. The skin need not be broken, as it is sufficient to rub the dead bacilli or pure tuberculin in until the skin is well reddened. Healthy animals give no specific reaction but with tuberculous animals there is a well-marked reaction.—The explanation of the general mechanism of the transformation of glycogen into glucose by the muscles and the animal tissues: F. **Maignon.** The author concludes from his experiments that the muscles possess an amylase capable of effecting the transformation of glycogen into glucose.—The transparency and colour of sea water in the English Channel: M. **Letaille.**

NEW SOUTH WALES.

Royal Society, August 7.—Mr. H. A. Lenehan, vice-president, in the chair.—Note on copper in andesite from near Lautoka, Fiji: H. I. **Jensen.** This paper describes the occurrence of lumps of copper ore weighing from 1 lb. in andesitic matrix. An analysis of a specimen showed that it contained 53½ per cent. Cu, 7⅜ per cent. Fe, and 21½ per cent. S, the metallic portion being therefore a mixture of bornite and chalcocite. A microscopic examination confirmed the presence of these two minerals. The same minerals were found to occur in many of the normal andesites of the district in smaller quantity. A quantitative estimation revealed 0·034 per cent. of CuO in the normal andesite. It appears from the examination of specimens obtained that either copper ore has segregated out in the consolidation of the lava, or else, in the period of consolidation, magmatic vapours have extracted the copper from portions of the lava and deposited it elsewhere in the mass. The copper distinctly belongs to the andesite magma of the district, and does not constitute a mere xenogenic included product. It is interesting to note that such a differentiation has there taken place in a true volcanic rock.—Analysis of a specimen of sea-water from Coogee, New South Wales: C. J. **White.** Special attention was paid to the specific gravity determinations (for the calculation of which Buchanan's hydrometer No. 6 was used), for this gives the salinity directly, and indirectly gives very valuable indications of the various constituents present (the ratio of dissolved salts to one another being practically constant for all ocean waters).—Notes on some aboriginal tribes: R. H. **Mathews.**—Note on the action of lime on the available soil constituents: F. B. **Guthrie** and L. **Cohen.** The authors have investigated the changes that take place in the amounts of water-soluble and citric-soluble potash and phosphoric acid in limed soils in pots. Three kinds of soil were used, sand, garden loam, and clay. They find that in all cases the amount of mineral plant-food soluble in water had diminished to a considerable extent in the unlimed pots after standing for a month. The effect of liming has been to lessen this loss, but it does not appear to prevent it entirely. There is less water-

soluble plant-food in the limed soils after a month than in the original soils, but more than in the untreated soils after a month. The action of lime is largely to increase the amount of nitrogen as nitrites; the nitrate-nitrogen is almost the same in the limed and the unlimed soils, except with the clay soil, where the nitrates are diminished. The total nitrogen as nitrite and nitrate is increased by liming, and the action of lime would appear to be to favour the development of the nitrous organism in particular.

September 4.—Mr. H. A. Lenehan, vice-president, in the chair.—The one-wheeled car: L. **Hargrave.** The paper points out the adaptability of the gyro-engine, a combination of the gyroscope and revolving cylinder engine, for balancing and driving all sorts of vehicles on one wheel over country that would otherwise be impracticable.—The steady deflection method of current measurement with an electrometer: Prof. J. A. **Pollock.** The steady deflection method of measuring currents with an electrometer consists in arranging that the charge on the ordinarily insulated quadrants shall leak to earth at a suitable rate proportional to the potential difference between the two pairs of quadrants. In the paper two ways which have been proposed for carrying out the method are mentioned and discussed.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 7.

ROYAL SOCIETY, at 4.30.—The Effect of Pressure upon the Arc Spectra of Metals: W. Geoffrey Duffield.—The Electric Discharge in Monatomic Gases: F. Soddy and T. D. Mackenzie.—The Diurnal Variation of Terrestrial Magnetism: Prof. A. Schuster, F.R.S.—On the Measurement of Temperatures in the Cylinder of a Gas Engine: Prof. H. L. Callendar, F.R.S., and Prof. W. E. Dalby.—Note on the Association of Helium and Thorium in Minerals: Hon. R. J. Strutt, F.R.S.—Further Results of the Experimental Treatment of Trypanosomiasis in Rats (Progress Report of Sleeping Sickness Committee of the Royal Society): H. G. Plimmer and J. D. Thomson.

RÖNTGEN SOCIETY, at 8.15.—The Presidential Address, The Production of High Frequency Oscillations, with Demonstrations: W. Duddell, F.R.S.

LINNEAN SOCIETY, at 8.—The Origin of the Di-trimerous Whorls among Flowers of Dicotyledons: Rev. George Henslow.—Unrecorded Acari from New Zealand: Albert D. Michael.—On *Ænigmatistes africanus*, a new Genus and Species of Diptera: R. Shelford.—*Exhibits*:—A copy of Hudson's "Flora Anglica." 1778, with numerous annotations by the Rev. William Kirby: Alexander Stevenson.—Abnormal Stem of *Eucalyptus salmonophloia*, F. Muell., from West Australia: Dr. A. B. Rendle.

CHEMICAL SOCIETY, at 8.30.—Gaseous Nitrogen Trioxide: H. B. Baker and Mrs. M. Baker.—The Atomic Weight of Tellurium: H. B. Baker and A. H. Bennett.—The Isomerism of the Double Sulphites of Sodium and Potassium: M. H. Godby.—Studies in the Camphane Series, Part xxiv, Camphoryldithiocarbamic Acid and Camphorylthiocarbimide: M. O. Forster and T. Jackson.—The Vapour Pressures of Triethylamine, of *sym*-Trimethylpyridine, and their Mixtures with Water: R. T. Lattey.—Liquid Triethylamine: R. T. Lattey.—The Action of Sulphuretted Hydrogen on Solutions of Sodium Hydrosulphite: F. S. Sinnatt.—The Alkyl Compounds of Gold. Diethylauric Bromide. Preliminary Note: W. J. Pope and C. S. Gibson.—Note on the Constitution of Homoeriodictyol: F. B. Power and F. Tutin.—The Interaction of Methylene Chloride and the Sodium Derivative of Ethyl Malonate: F. Tutin.—Preparation of Aliphatic Nitro-compounds by the Interaction of the Alkyl Iodides and Mercurous Nitrite: P. C. Rây and P. Neogi.—Some Mercury Derivatives of Camphor: J. E. Marsh and R. de J. F. Struthers.—Contribution to the Chemistry of the Terpenes. II. The Oxidation of Limonene with Chromylchloride: G. G. Henderson.—The Synthesis of Acridines and Phenonaphthacridines: Tetra- and Hexa-methylacridines: Dimethylphenonaphthacridines: Dixylylmethylenediamines: A. Senier and A. Compton.

FRIDAY, NOVEMBER 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The Nebula H iv. 74 Cygni: Max Wolf.—Note on the Permanency of Some Photo-visual Lenses: W. J. S. Lockyer.—Occultation of the Hyades: Walter Heath.—Disappearance of Saturn's Ring System, 1907 October: R. T. A. Innes.—(1) The Ultra-violet Region in Sun-spot Spectra; (2) The Spectrum of Comet *d* 1907 (Daniel): J. Evershed.—Tables for computing Standard Coordinates on Photographic Plates: A. R. Hinks.

MALACOLOGICAL SOCIETY, at 8.—Description of a New Species of Clathurella, probably from Ceylon: H. B. Preston.—On the Mollusca of Birket-el-Qurun, Egypt: C. A. Smith.—*Turbo granuliratus* (New Guinea); *Sistrum chrysalis*, *Purpura bougei*, *Natica bougei* (New Caledonia); *Urosalpinx walkeri*, *Listra walkeri* (N. W. Australia); *Amalthea coxi* (Port Stephens); *Pitaria elata* (Sierra Leone); all new species: G. B. Sowerby.—Note on the Originals of the Illustrations for E. M. da Costa's "Historia Naturalis Testaceorum Britanniæ," London, 1778: Alex. Reynell.

PHYSICAL SOCIETY, at 8.—Discussion on Mr. Campbell's Paper on the use of Variable Mutual Inductances.—A Graphic Method for Stream-lines and Equipotential Surfaces: L. F. Richardson.—On the Lateral Vibrations of Bars Supported at two Points with one end Overhanging: Dr. J. Morrow.

MONDAY, NOVEMBER 11.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Great Douglas Glacier of New Zealand and its Neighbourhood: J. Mackintosh Bell.

TUESDAY, NOVEMBER 12.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Extension, Widening and Strengthening of Folkestone Pier: H. T. Ker.—The Tranmere Bay Development Works: S. H. Ellis.

ZOOLOGICAL SOCIETY, at 8.30.—On the Scales of Fish: E. S. Goodrich, F.R.S.—The Rudd Exploration of South Africa. VIII., List of Mammals obtained by Mr. Grant at Beira: Oldfield Thomas, F.R.S., and R. C. Wroughton.—Notes on two African Mammals: R. Lydekker, F.R.S.—Notes on the Feeding of Serpents in Captivity: Dr. P. Chalmers Mitchell, F.R.S., and R. I. Pocock.—Descriptions of new Loricariid Fishes from South America: C. Tate Regan.—Notes on Mayer's Pigeon: Lt.-Col. N. Manders.—On some Points in the Structure of *Galidictis striata*: F. E. Beddard, F.R.S.

SOCIOLOGICAL SOCIETY, at 8.—The Genealogical Method in Anthropological Inquiry: Dr. W. H. R. Rivers.

MINERALOGICAL SOCIETY, at 8.—Anniversary meeting.—On Hopaite and other Zinc Phosphates and Associated Minerals from Rhodesia, Broken Hill Mines: L. J. Spencer.—Notes on Zeolites from Cornwall and Devon: A. Russell.—The Question of a Relation between Isomorphous Miscibility and Parallel Growth of Crystals: T. V. Barker.—On Binnite, Anatase, Brookite and Molybdenite from the Binnenthal: R. H. Solly.—Note on the Crystallisation of Potassium Bichromate: H. A. Miers.

THURSDAY, NOVEMBER 14.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—On the Cranial and Facial Characters of the Neanderthal Race: Prof. W. J. Sollas, F.R.S.—Some Features in the Hereditary Transmission of the Self-Black and the "Irish" Coat Characters in Rats: G. P. Mudge.—On the Inheritance of Eye-colour in Man: C. C. Hurst.—On the Result of Crossing Round with Wrinkled Peas, with Special Reference to their Starch Grains: A. D. Darbishire.—On the Rate of the Elimination of Chloroform from the Blood after Anæsthesia: G. A. Buckmaster and J. A. Gardner.—Implantation of Actively Proliferating Epithelium: J. O. Wakelin-Barratt.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Dielectric Strength or Insulating Materials and the Grading of Cables: Alexander Russell.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Election of Council and Officers.—On Hypercomplex Numbers: J. H. Maclagan Wedderburn.—Addendum to a Paper on the Inversion of a Repeated Infinite Integral: T. J. I'A. Bromwich.—Generalisation of a Theorem in the Theory of Divergent Series: G. H. Hardy.—Uniform and Non-uniform Convergence and Divergence of a Series and the Distinction between Right and Left: Dr. W. H. Young.—Application of Quaternions to the Problem of the Infinitesimal Deformation of a Surface: J. E. Campbell.—Nodal Cubics through Eight given Points: J. E. Wright.—The Invariants of a Binary Quintic and the Reality of its Roots: Dr. H. F. Baker.—On a Transformation of Hypergeometric Series: Rev. Dr. E. W. Barnes.—On a Transformation of a Certain Hypergeometric Series: Prof. M. J. M. Hill.—A General Theorem on Integral Functions of Order less than One-half: J. E. Littlewood.

FRIDAY, NOVEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Labour-saving Appliances at the Mines of the New Kleinfontein Co., Transvaal: E. J. Way.

CONTENTS.