THURSDAY, NOVEMBER 26, 1903.

RECENT BOOKS ON NATURAL HISTORY.

Turner on Birds. A Short and Succinct History of the Principal Birds Noticed by Pliny and Aristotle. First published by Doctor William Turner, 1544. Edited, with Introduction, Translation, Notes, and Appendix, by A. H. Evans, M.A. Pp. xviii+223. (Cambridge: At the University Press, 1903.) Price 6*s.* net.

Among the Waterfowl. (The Dainty Nature Series.) By Herbert K. Job. Pp. xxi + 224; illustrated. (London: Wm. Heinemann, 1903.) Price 5*s.* net.

Nature Biographies. (The Dainty Nature Series.) By Clarence Moores Weed. Pp. x+164; illustrated. (London: Wm. Heinemann, 1903.) Price 5*s.* net.

The Brook Book. (The Dainty Nature Series.) By Mary Rogers Miller. Pp. xvi+241; illustrated. (London: Wm. Heinemann, 1903.) Price 5*s.* net.

The Waterfowl Family. By L. C. Stanford, L. B. Bishop, and T. S. Van Dyke. Pp. x+598; illustrated. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1903.) Price 8*s.* 6*d.* net.

Handbook of Nature Study. For Teachers and Pupils in Elementary Schools. By D. Lange. Pp. xvi + 329; illustrated. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1901.)

WILLIAM TURNER, whose strong religious opinions entailed for him a life of many vicissitudes in the days of Henry VIII. and his three successors, had also the makings of a good ornithologist. In his voluntary and enforced absences from England (during which he visited many European countries, and formed a friendship with Conrad Gesner), as well as in his travels in this country, he gained a knowledge of the appearance and habits of many birds which might have enabled him to write a book on the subject which would have been of surpassing interest at the present day. But, like some modern ornithologists, he was more concerned in finding out (often with doubtful success) to what species of birds certain names used by certain ancient authors really applied. So that when in 1544 he published his work on ornithology, his object was primarily to determine the principal kinds of birds named by Aristotle and Pliny.

Fortunately, however, Turner could not wholly restrain his natural bent for original observation, and here and there he added notes from his own experience, some of which form priceless items in the history of the birds of this country. In so doing (as the editor remarks) he produced the first book on birds which treats them in anything like a modern scientific spirit. He usually tells us whether he observed the various species in England or abroad, and thus Turner may fairly be called the father of British ornithology. To him we owe our knowledge of the fact that the crane bred in English fens, while his account of the abundance and audacity of the kite in his day reminds us how easy it would be to increase the remnant of these birds left to us by merely letting them alone. On the other hand, he tells us that the stork was nowhere to be seen in our island. He gives a sufficient answer to those extreme bird-protectionists who contend that the hoopoe was once abundant here and has been exterminated, for he knew the bird well, and states roundly that nowhere in the whole of Britain is the upupa to be found. His knowledge of the habits of various birds, such as the hobby, harrier, dipper, peewit, black tern and grey shrike (which he had seen not oftener than twice in England, though most frequently in Germany) is remarkable.

Turner's treatise has long been a great rarity, and ornithologists are much indebted to the editor and to the Syndics of the Cambridge University Press for making this early bird-book generally accessible.

In an appendix some extracts from a work by John Caius (1570) are added, which show that Caius was a good observer. It is interesting to note that the great rook controversy was precisely in the same condition in the sixteenth century as it is now, and that young rooks were even then appreciated.

The binding, printing, and illustrating of the "Dainty Nature Series" justify its title, although the highly-glazed paper rendered necessary for the reproduction of the numerous photographic illustrations makes the volumes very heavy to hold. Mr. Job relates his personal observations during five-and-twenty years in pursuit (chiefly with a camera) of the ducks, geese, grebes, divers, gulls, petrels, and other seafowl found in the northern and middle States and in Lower Canada, east of the Rocky Mountains. His charming work contains more new and original notes on these birds (both while at their breeding stations and in their less known winter haunts far from the shore) than any other book of this kind we have had the pleasure of reading. The illustrations are in advance of anything else of this kind we have seen. With photographs of nests and eggs we are now familiar. The present series is beautifully done, those of the ducks showing even the pattern of the "down." But it gives us a far better idea of the breeding habits of these birds when we have a view of a huge marshy sheet of water in the Magdalen Islands, where wildfowl breed in crowds; and a bit of a "slough," showing the identical clump of rushes which hides a canvas-back duck's nest, really tells us more of the bird's life-history than a picture of the actual nest and eggs. Again, the author has obtained pictures at close quarters of gulls, guillemots, &c., on or alighting at their nests. As examples of what may be found in these fascinating pages, we may point to the pictures of the great northern diver's floating nests with the surrounding scenery, grebes swimming about near their nests, a Franklin's gull eating the eggs of the eared grebe in the nest, the owner watching, shearwaters at sea fighting over cod livers thrown to them, and a petrel characteristically "walking on the water." No field ornithologist should be without this interesting book.

In "Nature Biographies" the lives of some everyday American butterflies, moths, grasshoppers, and flies are told and depicted in a delightful manner, the camera having been used most successfully in many ways; for instance, in showing the gradual develop-

ment of a butterfly emerging from the chrysalis, caterpillars feeding, the webs or tents woven and leaves curled up by caterpillars for their protection, and various insects in natural attitudes. We hardly think that "mourning-cloak butterfly" (under which name the life-history of this butterfly is ably dealt with) is any more happy than Camberwell Beauty. To read this dainty volume is to get a fair knowledge of the elements of entomology in a very pleasant way.

"The Brook Book," on lighter paper than the two volumes of this series just noticed, consists of a number of chapters describing the plants and live creatures to be met with in rambles along the banks (and in the bed) of brooks. Some of them relate the doings of a college walking party which explored their neighbourhood, and the occasional introduction of a professor or a "visiting geologist" leads to informing chapters, while the adventures of the members themselves add a vein of humour. It is impossible even to state the wide range of subjects so pleasantly dealt with, but they cover the settings and occupants of various kinds of brooks; and the enthusiasm of the writer and her pleasant way of introducing the subjects make the book just the thing to read aloud to elder children, and to instruct oneself with at the same time. The sixteen half-tone plates of brook scenery are very beautiful, and there are nearly seventy line engravings in the text.

We have in a volume of the American Sportsman's Library a capital guide to the waterfowl of North America, at once readable and scientific, and useful alike to the naturalist and the sportsman. Introductory chapters treating of the structure, character of the plumage, migrations, and the use as food and ornament of these groups, and of the necessity of affording them protection in spring, are followed by descriptions of the chief stations for wildfowling and of the various modes of shooting ducks and shore-birds. These chapters are written in the graphic language of an enthusiastic and thorough "workman." The details of actual shooting days and nights, with exciting and amusing incidents, written with a certain amount of expressive "western" words, will appeal strongly to all who have felt the glamour which hangs about "wildfowl." The body of the book is taken up with a scientific description of each species, giving details of the different stages of plumage at all ages and seasons, measurements, eggs, and habitat, followed by a general account of the habits. The waterfowl of the Pacific coast are separately dealt with, and the book closes with diagnoses of the families and genera. It is beautifully, though not profusely, illustrated, and the letterpress is printed on nice light paper, which makes this pleasing volume not too heavy to be held comfortably, despite its six hundred pages.

The object of Mr. Lange's handy volume is to point out to teachers some of the material which may be made the basis of profitable lessons in nature-study, and he has endeavoured to show how this material may be made available, and what the pupils may be taught about it. The plan here advocated is to take the children out into the fields and woods and to show them, and let them examine, various natural objects, or to bring before them prepared and preserved objects and to instruct them in these. The teacher is told how best to do this. The book, indeed, consists of a series of lessons on various natural objects, in which the requisite information is given, and the teacher is told what material is necessary and how to obtain and use it. The author has been successful in producing a valuable manual of work for children whose school years close with the common school course. The numerous woodcuts are useful and to the purpose. Unfortunately for English readers the country for which the book is especially designed is the eastern States of North America. O. V. APLIN.

THE NATURE OF ELECTRICITY AND THE CONSTITUTION OF MATTER.

Conduction of Electricity through Gases. By J. J. Thomson, D.Sc., LL.D., Ph.D., F.R.S. Pp. vi + 566. (Cambridge: University Press, 1903.) Price 16*s*.

THIS book on the newest branch of physics, from the pen of its originator and chief exponent, deals with one of the most rapid and remarkable developments of modern scientific research. The "ionisation theory of gaseous conduction," it is claimed in the preface, not only gives a simple and direct explanation of the electrical properties of gases, but also affords the means of subjecting the fundamental problems of the nature of electricity and the constitution of matter to direct experimental attack. The reason is very clearly set forth.

"The possession of a charge by the ions increases so much the ease with which they can be traced and their properties studied that as the reader will see we know far more about the ion than about the uncharged molecule."

There is food for reflection for both the man of science and the philosopher in this comprehensive remark. Less than a decade ago the possibility of the existence of a gaseous ion was hardly recognised. To-day this volume of very respectable dimensions testifies to the wealth of researches that have followed the inception of Prof. Thomson's theory. The researches of the author and his former pupils, Rutherford, Townsend, C. T. R. Wilson, Zeleny, Strutt, H. A. Wilson, Langevin and many others are brought together in this book and correlated with older researches and with those that have been proceeding simultaneously elsewhere.

In the two opening chapters the fundamental position is developed that the charge carried by the gaseous ion is the same for the ions of all gases, is independent of the ionising agency, and is equal to that carried by the hydrogen ion in electrolysis. This conclusion is arrived at from considerations of the diffusion velocity of the ions, and their velocity in an electric field, and needs only the assumption that the ions behave like the particles of a perfect gas towards pressure.

A second and completely independent determination of e for the same kind of ions is made possible by the application of the condensation experiments of C. T. R.

Wilson to the direct determination of the absolute number of ions present, and therefore of the individual charge carried by each ion. These are discussed in chapter vi., and lead to the same conclusion, that the charge is equal to that of the hydrogen ion in electrolysis. In chapter v. the ratio e/m of the charge to the mass is determined for the rapidly moving charged particles shot out by radium, by metals *in vacuo* under the influence of ultra-violet light, and by the kathode in the form of the kathode ray in the electric discharge through highly rarefied gases. A combination of the values of e found in chapters ii. and vii. with the ratio e/m found in chapter v. leads to the conclusion that m must be of the order of one-thousandth of the mass of the hydrogen atom.

On this is based the author's "corpuscular theory of electricity." The corpuscles—and it is to be noticed that the term *electron* is not used—are the discrete particles of negative electricity the presence or absence of which determines negative and positive electrification, and since the value e/m for the positive ion is never greater than for the hydrogen ion, it is concluded that a positive corpuscle does not exist, and the positive ion consists of the whole atom less one corpuscle.

The reader at this stage of the reasoning will probably question the propriety of thus combining the values found for e and e/m, for the two quantities have been determined for ions of completely different character. An earlier and more consecutive discussion of the dual character of the ion, according as to whether its charge or its energy is its chief experimental characteristic, and the adoption of some distinction in the nomenclature between the ions of the two classes, would no doubt have made the subject more clear. But it must be admitted also that this distinction, and the assumed identity of the charge for the two classes, is a point of weakness in the otherwise strictly consecutive train of reasoning. The critical stage of transition, where the ions of the first class change into the ions of the second—the slow diffusing negative ion in gases at high pressure, for example, acquiring under the action of an electric field, as the pressure of the gas is reduced, the energy and velocity of the kathode ray—seems to need further experimental study; for the conclusion that it is brought about by the ion shedding its attendant cluster of molecules and then travelling free seems mainly a consequence of regarding e as invariable. Although, no doubt, the arguments in favour of doing so are very strong, yet they appear somewhat indirect, and the anomaly that the slower moving ion is less effective as a nucleus for the condensation of moisture (p. 153) shows that the arguments are not all in its favour.

The view expressed in the chapter on ionisation by incandescent solids that the corpuscles exist in free motion inside metals and carbon, from which they escape when their kinetic energy is increased by rise of temperature, is, as the author points out, of great importance in its bearing on the variation of chemical affinity with temperature. Indeed, this book will be read by chemists with interest for the light it throws on the possible causes underlying phenomena often considered simple merely on account of their familiarity.

The chapter on Becquerel rays is the longest in the book, and comprises a brief review of the most important work in radio-activity up to the commencement of the present year. Special prominence is given to the work of Rutherford, whose application of the ionisation theory to the problems of radio-activity has been so fruitful of discoveries. The applications of the theory to the spark discharge, the electric arc and the phenomena of the vacuum tube are treated very fully, and the last chapter includes a discussion of the important results of Kaufmann on the variation of e/m with v for the rapidly moving negatively charged particle from radium. The view is expressed that these results accord with the possibility that the whole of the mass of the corpuscle is electrical in origin.

The treatment, although exhaustive, is confined strictly to the subject-matter of the title, and the recent advances in spectroscopy of the inner constitution of the atom find no place. It is interesting to notice that Prof. Thomson frankly abandons all attempt to distinguish in nomenclature between the two forms of "radiation," the undulatory and the corpuscular, with which modern physics now has to deal. Both are designated "rays," and this extension of meaning, which is practically inevitable, is, of course, in strict accordance with the original Newtonian sense of the word.

F. S.

AN ENGLISH EDITION OF "ASTRONOMY FOR EVERYBODY."

Astronomy for Everybody. A Popular Exposition of the Wonders of the Heavens. By Prof. Simon Newcomb, LL.D., with an introduction by Sir Robert S. Ball, LL.D., F.R.S. Pp. xv+341. (London: Isbister and Co., Ltd., 1903.) Price 7*s.* 6*d.*

WHEN a popular exposition of the wonders of the heavens is written by such a man as the distinguished author of this volume, the reader, and more especially he who is greatly inclined to this science, naturally expects to find not only new ideas in the art of expressing difficult issues in simple language, but judgments on various doubtful points by one who is in the foremost rank of his work. The book before us is intended, as the title indicates, for the general reader, and should therefore be not only clear, concise, and accurate, but should be illustrated with the best diagrams and pictures of the period. The reader will therefore be very disappointed to know that this standard of excellence is by no means reached in these pages.

The general scope of the book is as follows:—First, the general ideas of the motions of the celestial bodies are dealt with, the reader being also briefly introduced to the chief kinds of instruments employed in investigating the motions and physical conditions of these bodies. The sun, moon, earth, planets and their satellites are next each described, then comets and meteors come in for their turn, while a general review of the fixed stars fills up the remaining portion of the book.

The work thus covers the domain of general astronomy, with, however, one notable exception, namely, the omission of all reference to new stars! The reader is thus left entirely ignorant not only of the facts that such bodies as Nova Aurigæ, Nova Persei, Nova Geminorum, &c., ever existed, but of the various hypotheses put forward to explain the sequence of the interesting and important phenomena which are so characteristic of them.

This omission is, however, not the only blot which mars this book, for unfortunately errors of another kind are by no means uncommon.

Those who have taught astronomy know how important it is to give the student a correct idea of the difference between "rotation" and "revolution," so that the beginner may clearly grasp the facts that the former is responsible for our day and the latter for our year.

For a popular work, such as this, the definition of rotation could scarcely be more clearly explained than is done under the heading "rotation" in Webster's Dictionary (1902):—"The act of rotating or turning, as a wheel or a solid body on its axis, as distinguished from the progressive motion of a body round another body or a distant point. Thus, the daily turning of the earth on its axis is a rotation; its annual motion round the sun is a revolution."

With these definitions before us the following extracts from the book under review may be of interest. On p. 11, for instance, the reader is told that "the earth is not at rest, but *revolves* unceasingly around an axis . . .," and on the same page that "this real *revolution* of the earth, with the apparent revolution of the stars which it causes, is called the *diurnal motion*. . . ." Again, on p. 19 we read, "as the earth *revolves* on its axis. . . ."

If the author had expressly stated that his definition of "rotation" referred to *points* on the earth's *surface* and not to the earth as a whole, then the above statements might be valid, but as he makes no mention of this, the beginner will undoubtedly become perplexed as regards these motions.

A little further on (p. 35) a description is given of how the obliquity of the ecliptic produces the changes of seasons. Unfortunately (line 9) the word "orbit" is printed instead of "axis," an error which by no means renders the explanation very clear.

Another difficulty which the beginner will have to overcome occurs on p. 57, where the illustration showing the axes on which a telescope turns is placed on its side. Apropos of the incorrectness of diagrams, an error occurs in the drawing of the path of the rays (p. 68) illustrating the principle of the Newtonian reflecting telescope. Here the "flat" or "secondary mirror" is placed outside the focus of the large reflector, so that the rays which after reflection from the latter fall on it are divergent and not convergent.

In this chapter it is stated that "the largest mirrors so far successfully made and used have been about four feet in diameter." The author does not seem to be aware that the late Dr. Common constructed, mounted, and used a mirror measuring five feet in diameter.

It might also be suggested here that the diagram of the solar spectrum (p. 75) should be placed horizontally and not vertically, as this latter position would tend rather to confuse than to enlighten beginners when they are confronted later with terrestrial or celestial spectra.

On p. 114 a rather perplexing statement is made:—"if we imagine ourselves standing *exactly* on a pole of the earth, with a flagstaff fastened in the ground, we should be carried round the flagstaff by the earth's rotation. . . ."

To the writer of this notice it seems that the flagstaff would travel round the observer if the observer be standing *exactly* on a pole of the earth as is stated; of course, it is meant that the flagstaff should be placed on a pole and the observer near it, but the reader has good cause to be puzzled.

A point which calls for special attention when giving our readers an idea of the contents of this book is the extreme poorness of the illustrations. One would have thought that advantage would be taken of the wealth and excellence of astronomical photographs that are now available, and the facility and accuracy with which they can be reproduced; but this is not the case.

Sun-spots are represented by a single drawing made many years ago; comets are illustrated by four drawings made by G. P. Bond, instead of by some of the beautiful photographs secured at recent appearances. Further, Bond's drawing of Donati's comet is so badly reproduced that probably the original artist would not be able to recognise it; the frontispiece, an impression of the solar corona of 1900, is decidedly feeble. The reader is not shown either a stellar spectrum or a reproduction of Hale's fine spectroheliograph photographs, or even a spectroscope or objective prism telescope.

From the above remarks it will be gathered that the book before us is not the best that could be placed in the hands of a beginner, and it seems a pity that more trouble was not taken in its production.

HISTORY OF ELEMENTARY MATHEMATICS.

Geschichte der Elementar-mathematik in systematischer Darstellung. By Dr. Johannes Tropfke. Erster Band. Pp. viii+332. (Leipzig: Veit and Co., 1902.) Price 8 marks.

THE great work of Moritz Cantor has made him, as it were, the Gibbon of mathematical history. But the extent of his subject has prevented him, as a rule, from entering into detail, and there are many things of great interest about which it is not easy to get information without laborious research. The history of mathematics is being studied, and its value is recognised, not only by those who make it their special domain, but by an increasing number of practical teachers, so that there is both a demand for books dealing with various parts of the subject in different degrees of detail and a school of historians ready to supply them.

Dr. Tropfke's work is not exactly a popular treatise. He has limited himself to the range of elementary

mathematics, and in this volume deals only with arithmetic and algebra; but his treatment is thorough, and his aim has been to give exact references to the original authorities for the statements in the text. The amount of labour that this has involved must have been very great; when the work is complete, with the indexes promised by the author, it will be a valuable repertory for those who wish to learn the facts at first hand. The number of bibliographical footnotes exceeds 1200, and since many of these give more than one reference, it will be seen how great a service the author has rendered to those who are inclined for research.

But the book is far from being a mere dry collection of facts and references. The style is concise, and there is no catchpenny rhetoric, but there is plenty to interest any intelligent reader. The arrangement allows us to trace in detail the development of methods and of notation; we are shown, with explanations, the actual symbols used and the processes employed by our predecessors; most important of all, there is an appendix with a selection of original examples ranging from Alchwarizmi to Leibniz and Newton. Few things are more instructive than an inspection of some of the older methods in arithmetic. Until the end of the fifteenth century, long after the decimal notation and the use of the "Arabic" numerals had become familiar, and when arithmetical calculations were usually worked on paper, the rule for performing long division was of a most complicated character, with rows of figures above the dividend as well as below, and tedious cancellings and substitutions which must have made the operation both laborious and liable to error. It is almost certain that the process is of Indian origin, and it is probable that the figures which, in written examples, we find cancelled by a stroke drawn through them represent digits which were actually obliterated at an earlier period, when the calculation was performed with a stick on a layer of sand.

A striking feature of early European books on arithmetic is the bewildering number of their so-called "rules." One reason for this is simple enough. Many of these books were intended to help business men—bankers, merchants, and so on—in such calculations as their calling obliged them to do. Their interest in arithmetic was purely practical, and all they wanted was a bundle of recipes for getting correct answers to questions of certain special types. Even in our own day we occasionally see such terms as "agricultural book-keeping" or "chemical arithmetic," which show that a demand for this sort of thing is not yet extinct. But even in treatises of a more theoretical kind *duplatio* and *mediatio*, in other words doubling and halving, were reckoned as separate rules. This is a historical survival, a sort of fossil relic of prehistoric times. It appears that the ancient Egyptians performed multiplication by a process practically equivalent to converting the multiplier into the binary scale; thus

$$x \times 13 = x \times 8 + x \times 4 + x,$$

where $x \times 8$ and $x \times 4$ were obtained by successive doubling. When an improved method of multiplication had been discovered, the older process became obsolete; but *duplatio* held its ground as a special rule, in recognition, so to speak, of its former importance.

A considerable portion of this volume is naturally devoted to the theory of surds, and this cannot be separated from the Greek theory of geometrical irrationals. After all that has been written on the subject, *lacunae* remain which will probably never be filled up, unless new documents are discovered. Some undoubted facts are very puzzling when taken in combination. For instance, Euclid says in so many words that incommensurable quantities are not related to each other as numbers, and it really does seem that to a Greek geometer of Euclid's time the relation, as to length, of the diagonal of a square to one side was something different *in kind* from the relation of two commensurable distances. At the same time the Greeks must have been practically acquainted with what we should call rational approximations to $\sqrt{2}$, and it is well known that the irrationalities considered in the tenth book of Euclid's "Elements," when put into an algebraic form, correspond exactly to all the members of a particular group of surds, without omission or redundancy. Did the geometers, who professed to despise "logistic" in public, privately make use of it to help them in their researches?

Other subjects considered under the head of algebra are the development of the idea of number in general, the operations of algebra and their symbols, proportion, and equations. Under the last heading Diophantine analysis is included, and it may be noted as a fact not generally known that Diophantine equations of the form

$$px^2 - qy^2 = r$$

were actually discussed in India at least as early as the time of Brahmagupta—that is to say, more than a thousand years before Fermat proposed the Pellian equation to the English mathematicians. G. B. M.

OUR BOOK SHELF.

La Lutte pour l'Existence et l'Évolution des Sociétés. By J. L. de Lanessan. Pp. 277. (Paris: Félix Alcan, 1903.) Price 6 francs.

THE title of this book is most misleading. The reader naturally expects to find an account of the struggle for existence among primitive men and of the evolution which has resulted from the struggle. The first chapter has quotations from Buffon and Darwin which leave no doubt in one's mind that this is the line which is to be followed. After this comes a description of primitive society or rather the social system which the author assumes to be primitive. The struggle for existence drops out, and is not mentioned. Society begins, he tells us, with a severely patriarchal *régime*. He seems not to have heard of an earlier polyandrous period. Out of the family bond arose the sense of duty. Speaking of the tribe, he lays it down that the chieftain was regarded as the owner of all the land which the tribe possessed.

After this glance at primitive society, we plunge into French history. Many great questions are dealt with, and most of them with remarkable shrewdness. Our author discusses the origin of feudalism. He next decides that Christianity had nothing to do with the abolition of slavery. He traces the growth of the idea of liberty among the peasantry; it showed itself

in the *jacquerie* of the fifteenth century, which was the precursor of the revolution. He has much to say about the power of the clergy, about the national attitude of the Gallican Church followed by its eventual submission to the Pope.

With the revolution we begin to get a glimpse of what was in the author's mind when he gave his book its title. Only for a short time do the plebeians obtain liberty. Power is soon grasped once more by the well-to-do classes. What the revolution gained for the working man was the right to work when and at what work he chose. It introduced, in fact, free competition among individuals. As an individual the workman was free, but associations of workmen had as yet no legal status. Indeed, in 1791 the national assembly forbade combinations, whether among workmen or employers, intended to influence wages or prices. It is against this free competition between individuals that M. de Lanessan preaches. So far from bringing the best and strongest to the top, this Darwinian struggle for existence, as he terms it, causes nothing but misery. But has he any understanding of Darwinism? Darwin recognised not only a struggle between individuals, but a struggle between groups. If France is to hold her own against rivals, there must, no doubt, be mutual help among her citizens. There is nothing un-Darwinian in this. At the opening of the last part of the book, our author gives his views upon heredity, and it turns out that he is so Lamarckian that the struggle for existence seems to find no place in his theory of evolution; it is only a pest to be put an end to. After this, he passes on to the subject of the amount of food required by a workman, thence to alcoholism, which he attributes mainly to want of proper food, thence to the injurious effect of many of the substances employed in manufactures, thence to factory legislation. With all the main evils from which the workman suffers, the Third Republic has made an honest attempt to grapple. Before 1870 the policy of *laissez faire* was in the ascendant. There is much of interest in the book, and the style is clear, but "The Duties of the State" would have been a better title. F. W. H.

Ore Deposits. A Discussion. Pp. 90. (New York: *Engineering and Mining Journal*, 1903.) Price 5*s.* net.

GEOLOGISTS and miners will be grateful to Mr. T. A. Rickard, the editor of the *Engineering and Mining Journal*, for having reprinted the report of a discussion upon ore deposits which took place before the Geological Society of Washington in the early part of the present year. Many leading American geologists, whose names are identified with the study of mineral deposits, were present, and took part in the discussion, so that the mining engineer now has before him, in the form of a small handy volume, a clear and authoritative statement of the views of men well qualified to express opinions upon a very difficult subject.

Geologists are accustomed to frame hypotheses upon the origin of rocks, and naturally they are dissatisfied with a classification of ore deposits dependent upon form, and favour genesis as a basis of arrangement. In this spirit Mr. W. H. Weed put forward his tentative classification of ore deposits, which occupies two and a half pages of the book. He wisely admits that ore deposits may have originated in very many ways, and says that his six classes "have been arranged to show gradation from the magmatic segregation of original igneous rocks to the deposits directly or indirectly due to the emanations from igneous rocks up to those due entirely to aqueous agencies."

Mr. J. E. Spurr followed with another classification, and Mr. C. R. Van Hise with a third. "Who shall decide when doctors disagree?" Until geologists are in harmony among themselves, the humble miner will probably do well to wait, much as he would like to have a purely genetic classification, and rest content in the meantime with his old subdivisions according to form. Besides, the miner wants something broader than a mere classification of ore deposits; he has to deal not only with ores, but also with the so-called "non-metallic" minerals, such as abrasives, borax, diamonds, gypsum, petroleum, phosphates, &c., and he consequently desires a scheme of arrangement of all mineral deposits less narrow than will be found in a treatise upon "Erzlagerstättenlehre."

Storage Battery Engineering. By Lamar Lyndon, B.E., M.E. Pp. viii+382. (New York: McGraw Publishing Co., 1903.) Price 3 dollars.

THIS book aims chiefly at treating the engineering side of storage batteries, such as the design and installation of a battery equipment, the precautions which have to be taken to maintain such an equipment in good working order, and the various accessory devices which have to be used therewith. The chemical side of the subject is treated very briefly; the first chapter, of less than a dozen pages, is all that is allotted to general theory. In the remaining chapters of the first part the characteristics of lead cells are considered in detail; the leading types of cell are described, and there is the usual series of illustrations of different grids. Considering that the book makes no pretence of being a complete treatise on accumulators, we think that much of the matter here included might with advantage have been omitted, and the material sifted with more discrimination. There are also several instances of carelessness; for example, the author speaks of forming Planté plates in a solution of litharge in *potassium*, a mistake repeated three or four times in a couple of pages. The treatment of the electrical and mechanical sides is less open to objection, and many useful suggestions are given as the results of actual experience.

The second part of the book is devoted to auxiliary apparatus; it is concerned with the use of accumulators in connection with distribution systems. The author describes at length the use of end cells or counter E.M.F. cells for voltage regulation, and the most suitable types of switches, hand regulated and automatic, to employ with them. The use of boosters and methods of wiring are considered at considerable length. On the whole the book should prove of value to the practical engineer, as it deals with an aspect of the storage battery which has not hitherto, so far as we are aware, received much systematic consideration. M. S.

Cassell's Popular Science. Edited by Alexander S. Galt. Pp. viii+576. (London: Cassell and Co., Ltd., 1903.) Price 12*s.*

THIS handsome volume is a worthy attempt to popularise the physical, chemical, biological, and geological sciences. As the editor remarks, popular science has too often been synonymous with inexact science, and any attempt to show that scientific knowledge may be presented in an interesting manner, and be at the same time correct, is to be welcomed. The book is profusely illustrated and contains a well-selected series of brightly written essays on various subjects of pure and applied science. The volume may be recommended as a suitable present to boys and girls, who will probably by its means be led to study more deeply one of the many branches of science of which some of the methods and results are described.

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.]*

Engineering Equipment of the Manchester School of Technology.

THE report on engineering work at the British Association Meeting at Southport in your issue of October 29 contains certain criticisms with regard to the engineering equipment of the Manchester School of Technology. The responsibility for the character of this equipment rests ultimately upon me as the professional adviser of the Technical Instruction Committee, and I would therefore seek some space in your valued columns for making reply.

The criticism takes two forms:—(1) that the laboratory equipment is unnecessarily complicated and beyond the capacity of the class of students the school is likely to obtain; and (2) that in any case, even if justifiable as to its nature, it was wrong to put in so much plant at once, but that part of it should have been held back until the growth of students showed a necessity for it.

The reply to both is, that it was in the hope of attracting that very class of student the critic is so sure we are unlikely to secure that so extensive and elaborate a plant was installed.

The great defect of technical education as hitherto conducted in this country has been its restriction to the teaching of elementary engineering science and to a few stock laboratory operations, such as breaking specimens in a testing machine, taking indicator diagrams from steam and gas engines, and making the simpler hydraulic experiments. This restriction was necessary, because the pupil, being a youth fresh from school, who had never seen the inside of an engineering workshop, and had to be taught everything from the commencement, could not be expected to advance very far in engineering knowledge. When he afterwards went into practical work, the knowledge acquired at the technical school being of no immediate use to him, he was no better off than if he had gone straight from school to the works, and his employer was not slow to notice this and draw the inference that the work of the technical school was practically of no value to the engineering industry. This is why the large majority of employers take so little interest in "technical education."

In Manchester, on the other hand, we have broken fresh ground, and are attempting to convince the engineering leaders that if they provide us with only one or two of the best young men out of each of their works, who have spent a few years in the workshop, and who know the elementary parts of geometry, algebra, trigonometry, and mechanics, we can, with two years of study and experimental work, turn out a product superior in every useful respect to even the much vaunted Charlottenburg *diplomé*, and of real and immediate monetary value to the profession.

We propose to prove this by showing those leaders the practical utility and industrial value of the results of our research work, and also by returning to them their young men, not mere beginners without self-confidence (though stuffed with formulæ), but trustworthy observers, resourceful experimenters, and men of imagination, who are able to impart new ideas to those engaging them, and to help them to work these ideas out in a practical way.

Take, as an example, the experimental engine to which you refer as being a huge mistake.

Take it for granted that a large percentage of the waste in steam engines is due to the defective design of valves. If we can show to some of these young designers of the future by experimental research upon this engine how these valves are defective, and in what direction to look for improvement, we are surely aiming at a higher measure of utility than could be attained by demonstrations with any number of varieties of the market article, however modern.

In regard to the remarks made about the equipment becoming obsolete, the scope and object of the plant has again been entirely misunderstood. The laboratories are not intended to serve as museums of modern appliances which the student comes to examine, copy, and store his memory with, but as a collection of machines typical of the various branches of mechanical engineering, specially fitted up for the purpose of studying the action of those working fluids and those moving mechanical elements which are common to all forms of prime movers and energy absorbers, past, present, and to come.

With reference to the question of the size of the individual parts of the equipment, one of the things for which, in my opinion, local engineers must ever feel grateful to the Manchester Technical Instruction Committee is the courage they showed in putting down plant on a true engineering scale. No practical experimental results worthy of attention could otherwise have been obtained. It could hardly be expected, for example, that an engineer, wishing to know the laws of the action of automatic drop valves for a design of large high-speed pump, should rest content to be guided by experiments made with a donkey-pump, however elaborate they might be.

In concluding, may I give expression to my belief that the promise for the future of British engineering lies in practical experimental research, strenuously carried on either in the workshop- or the college-laboratory by men specially trained for the purpose, and that the sooner we get rid of the notion that teaching schoolboys some engineering theory and the making of a few stock laboratory experiments constitutes the proper education for the engineer of to-day, the sooner we shall begin to recover from the reproach of having fallen behind the foreigner.

JOHN T. NICOLSON.

On two Constants A_1 and A_2 in the Kinetic Theory of Gases.

MAXWELL has introduced two constants A_1 and A_2 in the kinetic theory of gases (*Scientific Papers*, vol. ii. p. 41), defined by the integrals

$$A_1 = 4\sqrt{2}\,\pi \int_0^{\frac{\pi}{4}} \frac{\sin^2\theta}{\sin^2 2\phi} d\phi,$$

$$A_2 = \sqrt{2}\,\pi \int_0^{\frac{\pi}{4}} \frac{\sin^2 2\theta}{\sin^2 2\phi} d\phi,$$

where

$$\theta = \frac{\pi}{2} - \sqrt{\cos 2\phi}\, K(\sin \phi),$$

K being the complete elliptic integral of the first kind with modulus $\sin \phi$. These constants enter into the discussion of various properties of gases, on the assumption that the gas molecules repel each other according to the inverse fifth power of the distance. The values of these integrals, as found by mechanical quadrature, are

$$A_1 = 2{\cdot}6595 \qquad A_2 = 1{\cdot}3682.$$

Constructing a graph of $\sin^2\theta/\sin^2 2\phi$, I chanced to notice that the convexity is turned towards the axis of ϕ, so that the quadrature used by Maxwell must make A_1 a little too large. With the second integral, the number of points near the maximum of $\sin^2 2\theta/\sin^2 2\phi$ is insufficient, so that the value of A_2 will turn out to be too small.

Of the different methods of evaluating these two integrals, that of Gauss ("Methodus nova integralium valores per approximationem inveniendi," Werke iii. pp. 163–196) evidently leads to more accurate results than taking a number of equidistant points. This method of quadrature can be applied in two ways. The integrands $\sin^2\theta/\sin^2 2\phi$ and $\sin^2 2\theta/\sin^2 2\phi$ can be expanded either in power series of ϕ or of $q = e^{-\pi\frac{K'}{K}}$, where K and K′ are complete elliptic integrals of the first kind. Since

$$d\phi = 2/\sqrt{q}(1 - 4q + 6q^2 - 8q^3 + 13q^4 - 12q^5 + \ldots)dq,$$

we can effect the approximate integration by finding either the values of ϕ or of $\sqrt{q}$ between the limits of integration, proportional to the roots of zonal harmonics of nth order $P_n(\mu)$, and proceeding according to the method indicated by Gauss.

These tedious calculations were undertaken by Messrs.

K. Aichi and T. Tanukadate, post-graduate students in physics, with the following results :—

Considered as Power Series of ϕ :

For $n=6$: $A_1=2\cdot6512$ $A_2=1\cdot3704$ (Tanukadate)
For $n=7$: $A_1=2\cdot6512$ $A_2=1\cdot3704$ (Aichi)

Considered as Power Series of $\sqrt{q}$:

For $n=4$: $A_1=2\cdot6509$ $A_2=1\cdot3750$ (A. and T.)
For $n=7$: $A_1=2\cdot6511$ $A_2=1\cdot3704$ (A. and T.)

It thus appears that the number of points for $n=4$ is insufficient, but for $n=6$ or 7 the approximation becomes very close, so that the values of these two integrals are :—

$$A_1=2\cdot6512 \qquad A_2=1\cdot3704.$$

Maxwell's value of A_1 is about 1/300 too large, and that of A_2 is about 1/600 too small. Such small differences will not materially affect the theoretical results in which these two integrals enter, but it will be worth while to notice that the actual values are slightly different from those usually given in works on the kinetic theory of gases.

H. NAGAOKA.

Physical Laboratory, Imperial University, Tōkyō, October 8.

Leonid Meteor Shower, 1903.

THE return of the Leonids was clearly observed here on the night of November 15. The night of November 14 was also clear, though at times a dark belt of cloud, which concealed the lower part of Orion, extended itself along the eastern horizon to the foot of Leo, and occasionally also small patches of cloud dimmed or caused a momentary disappearance of stars in or around Gemini. These slight impediments to observation continued also on the next night until between two and three o'clock on the following morning. It had been intended to commence observations here as early as the night of November 11, as the writer had anticipated that the Leonids would put in an early appearance in the present year; cloudy skies, however, prevented the possibility of knowing if these anticipations were realised. During a watch from 10h. 20m. to 12h. 30m. on November 14 (local time) eleven meteors were observed, almost half of which were Leonids as bright as stars of the first or second magnitude. The radiation from Leo was regarded as surprisingly good, considering the hazy or clouded appearance of the horizon, which rendered that constellation invisible until after midnight. In a forecast made by the writer for the present year he found that, so far as the Leonid epoch of November 14–16 was concerned, the maximum would fall between the hours 13 and 14 on November 15; but it was considered that the display on the latter night would be weak, owing partly to the reported insignificance of the Leonid shower on the night of November 15, 1902, the preparations for the due observation of which were generally frustrated by unfavourable atmospheric conditions. When, therefore, the radiation from Leo was found to be so pronounced during the early hours of the night of November 14, the writer found that he had entirely underestimated the probable strength of the shower for 1903. The watch, however, was not prolonged beyond 12h. 30m. on the night of November 14, as there was no possibility of a star shower taking place on this night, though, no doubt, there were manifest signs that the Leonids might be unusually numerous. The first watch on the following night lasted from 9h. 15m. to 10h., during which time four meteors were seen, one of them being a Leonid as bright as a first magnitude star. Its appearance was revealed by the rich streak it left in its wake as it slowly rose from the invisible radiant. The watch was resumed at eleven o'clock, and whatever misgivings might have been felt for abandoning the lookout on the previous night were quickly dissipated by the appearance of as many Leonids in the first quarter of an hour's observations as had been seen during a period about five times as long on the preceding evening. Between 11h. and 11h. 30m. the meteoric rate was twenty-two per hour for one observer facing due east, but by midnight it had fallen to sixteen per hour, though sporadic meteors were included in the count. Between 12h. and 13h. drifting patches of cloud probably prevented several meteors from being observed, and the rate did not rise above thirty per hour, but at 15h., when the sky had become quite clear, Leonids were appearing at the rate of one per minute. During the next half hour forty-one shooting stars were counted, and this high rate was more than maintained for the next two hours; indeed, it was estimated at one time that the meteoric rate was easily 200 per hour for one observer. The brilliancy of the display was as remarkable as its numerical strength. When the shower was at its maximum, few of the shooting stars seen were less bright than the second or third stellar magnitude; indeed, most of them, if observed apart, would have merited individual description, and almost every third or fourth meteor might be called a bolide. To an observer looking eastwards the radiation from Leo was very marked, but a few instances were characterised by a centripetal rather than the usual centrifugal motion as regards the well-known radiant. The most noted of these exceptional cases occurred between one and two o'clock, when a bolide of surpassing splendour passed slowly downwards, leaving a rich trail across the stars ϵ and ζ Leonis. When close to the "Sickle" it exploded with a vividly white flash that imparted to it an almost startling brilliancy, and an instant afterwards a meteor as bright as Sirius made its appearance about twenty degrees further on, shooting down towards the horizon in a path that seemed to be a production of that of its more brilliant predecessor. Another meteor brighter than Jupiter shortly afterwards moved slowly downwards from within the "Sickle," passing between γ and η Leonis one-third nearer the latter than the former star, and pursuing a course parallel to the line joining η and Regulus. This west-to-east motion of the most brilliant members of a meteor display (for it has been noticed on other occasions by the writer) appears very significant. Several shooting stars shot from ϵ Leonis to β Canis Minoris, or slightly below the latter star. There seemed to be a second centre of emanation much lower down in the "Sickle" than that indicated by the foregoing meteors, and there was certainly another radiant altogether far away from Leo, and situated probably in or near Perseus. Several bolides passed out of sight overhead, arresting the attention only by their exploding flashes that momentarily illuminated the whole heavens. The pear-shaped appearance of meteors in the morning hours was very remarkable. These left rich trains which, like the meteors themselves, appeared of a yellowish tinge in the light of the waning moon or in the increasing twilight. Other members of the star shower dissolved in bright streaks, or made their appearance as vivid flashes of light, in the latter case generally at a great distance from Leo, bursting forth at one moment near the Great Bear, and in the next in the neighbourhood of Sirius. The largest number of meteors visible at one time was four. At six o'clock the activity of the shower, though considerably diminished, was still, even in the morning twilight, very noticeable.

The somewhat prolonged duration of the meteor shower affords some measure of its intensity, and it is probable that it has been widely observed, notwithstanding the fact that the notion of the supposed connection of the Leonids with the comet of 1866 precluded the possibility of such a striking meteoric occurrence in 1903, for the present is unquestionably the brightest Leonid display that has been subjected to European, and very probably also American, observation since the brilliant star showers of 1866–8. It is noteworthy that the present shower resembles very much in intensity and also in other particulars a bright display in 1865, in which year it was estimated that one thousand Leonids might have been counted by observers in England on November 13. A lapse of thirty-eight years separates the two events, and this interval suggests the nineteen year-period which has already been noticed (NATURE, April 23) in the case of all the April meteor-displays of the past century, and has also been shown (*English Mechanic*, April 3) to connect several important Leonid star-showers extending over the same time. If this be so, it is possible that the years 1904 and 1905 may be marked by even richer meteoric occurrences than that which has taken place on the present occasion.

JOHN R. HENRY.

Dublin, November 18.

Volcanic Dust, the "New Bishop's Ring," and Atmospheric Absorption.

DR. ROTCH (vol. lxviii. p. 623) may, from experience, know whether this phenomenon is more prominent in the United States than in Europe, and better than can be ascertained by simply collating reports of the sky appearances as seen by different observers in the two continents, but he is mistaken in supposing that the phenomena in question have not been mentioned in European journals, as he will find a full description of the "New Bishop's Ring" in your pages (the issue of December 25 last, p. 174), particularly as observed at Sunderland.

As stated there, there was at first a striking difference from the Krakatoa "Bishop's Ring" in dimensions, but while very variable in size, it was afterwards in general reduced to more nearly the size of the Krakatoa circle.

Since the Krakatoa phenomena this circle has rarely been wholly absent about sunrise and sunset, though for some years was faint, so far as my experience goes, until July, 1902. Whether it existed at all before the autumn of 1883 I cannot say, as one's attention was not directed to it until it became conspicuous. On its recrudescence last year it did not become visible at other times than sunrise or sunset, so far as I noticed, until August 1, and it was not until some months later that it became conspicuous in the full day-time. I can reply to the inquiry of M. Forel in your issue of August 27, p. 396, that the circle is now plainly visible, not intermittently, but always, and not only about sunrise and sunset, but in the day-time; and not only at high altitudes, but at the sea-level also. But my experience so far agrees with M. Forel's that I found in a visit to Switzerland last July and August that the higher one ascended the more conspicuous the circle became—up to a certain point at least; I did not ascend higher than 8100 feet.

In answer to Prof. Langley (p. 5) I may say that I have not noticed a single night this year or last winter when the atmosphere appeared to be normally clear, stars at a low altitude having never been clearly seen here. I had also an impression as to the want of clearness during my visit to Switzerland, but I have not yet made calculations on the observations I made for absorption. During the day-time this want of clearness has not been at all observable, the sky outside of "Bishop's Ring" having been very frequently of a beautiful blue. I note that Prof. Langley makes the abnormal absorption increase towards the violet end of the spectrum. This seems at first sight rather contrary to the circumstance that I have occasionally noticed an unusual paleness of the sun when a few degrees off the horizon; indeed, it has sometimes appeared of a slightly greenish yellow, but possibly the relative clearness shown by Prof. Langley's table at μ 0·60 may have some connection with this.

I am surprised that Prof. Langley does not attribute this condition of the atmosphere to the volcanic dust. This would seem to me much the most probable explanation.

T. W. BACKHOUSE.

West Hendon House, Sunderland, November 23.

Action of Radium on Bacteria.

CONTINUING the experiments of one of us on the action of radium bromide on plants, we have experimented on various bacteria. We find that, in the case of *Bacillus pyocyaneus, B. typhosus, B. prodigiosus,* and *B. anthracis* in agar culture medium the β radiations from radium bromide exercise a marked inhibitory action on growth. Exposure for four days at a distance of 4·5 mm. to 5 mgr. of radium bromide does not appear sufficient to kill the bacteria, but is adequate to arrest their growth and to maintain a patch on an agar plate, inoculated with any of these organisms, sterile. A broth tube, however, inoculated from this patch has in most cases developed the organisms, showing that while the growth is inhibited in the patch all the organisms there are not killed.

HENRY H. DIXON.
J. T. WIGHAM.

Trinity College, Dublin, November 19.

MEDICAL SCIENCE AND THE ANTI-VIVISECTIONISTS.

THE vindication of law and common sense exhibited by the substantial damages awarded to Dr. Bayliss after a trial occupying the Lord Chief Justice and a special jury for four days must afford the greatest satisfaction to everyone who is aware of the long course of systematic persecution which has pursued all those who devote themselves to the scientific side of medicine, and culminated in an attack by Mr. Coleridge on Dr. Bayliss and Prof. Starling, and on University College where they work.

There are many points of interest in this particular battle between a heavily subsidised society and its victim, to some few of which we may briefly refer—but of greater interest in reality are those aspects of this case which illustrate the immemorial conflict between knowledge and ignorance.

It is amazing that in the twentieth century, when it is at length recognised, even in this country, still lagging far behind its Continental rivals, that throughout the whole field of education practical instruction is of paramount importance, we should see one scientific witness after another pressed to explain why it should be necessary for a proper comprehension of the functions of living bodies to see the parts of those bodies in motion. The most intricate machine in the world is simplicity itself compared to any living body, but who could be trusted to repair a watch, a motor car, or a marine engine who had never seen their mechanism in action? Who would trust his life to a pilot who had never been to sea, to a physician who had never studied by the bedside, or to a surgeon who had never witnessed an operation? Would anyone try to teach a child the scent of a violet out of a book? Yet in this case, so happily and justly decided against Mr. Coleridge and his Society, an eminent counsel has asked again and again why students need concern themselves with any more practical physiology (the foundation of all the knowledge they can acquire) than they can learn from the pages of a book, while to support such a plea pseudo-scientific witnesses living and dead were quoted as deliberately asserting that practical instruction is wholly superfluous.

No single error has done more to hinder the progress of medicine in the past than the common attempt to deduce function from structure without direct experimental verification. Yet in the face of the clearest lessons this fallacious method is continually urged upon us as if its utility was self-evident; of this illustrations could be cited almost without limit. The error of Erasistratus that the arteries did not contain blood, apparently supported by anatomical observation, blocked the road to knowledge for 500 years, and was only dispelled at last by Galen's simple experiment of tying an artery in two places in a living animal and opening the vessel between the ligatures. A late obstetric surgeon, whose mischievous prejudices were received with such faith and quoted with such reverence by the anti-vivisectionists, so little understood the information and arguments of the early anatomists that he imagined they had never seen blood flow from an artery, and would have been convinced of their error if they had done so. Another of his "professional convictions" was that the circulation of the blood could easily have been discovered by anyone with a syringe and a dead body, though he must have known that the syringe and the dead body had been in the hands of anatomists from the time of the Pharaohs at least, and that Malpighi, who discovered the capillary circulation by direct observation of the living frog, had previously been entirely misled by attempts to inject the blood vessels in dead animals. Harvey discovered the circulation of the blood by con-

tinual observation of the motions of the heart and blood vessels in living animals, and this epoch-making discovery is always wrongly attributed by anti-vivisectionists to the observation of the valves of the veins, though it must be clear that in that case they would have suggested to Fabricius, their observer, the real meaning of their presence and structure.

Sir Charles Bell, who has been quoted with wearisome reiteration to disparage experiments on living animals, and to exaggerate the exclusive importance of anatomical investigation, not only contradicted himself, but earned his scientific reputation by those experiments on living animals which he later condemned, and when he adhered strictly to "the just views taken from the study of anatomy" he fell into the greatest error which ever misled an eminent man. Two hundred years after Harvey had settled the question of the circulation of the blood for ever, Sir C. Bell, confusing himself with a syringe and a dead body, and unable to allow for the difference between it and a living one, came to the conclusion that the heart had little to do with the circulation of the blood, and adopted Galen's error that the principal force was the attraction of the vessels for the blood, and maintained that the law of gravity was abolished in living animals, but that Providence re-introduced it temporarily (!) for the arrest of hæmorrhage whenever an animal sustained a trifling wound.

Consistent in whole-hearted devotion to their own views, the anti-vivisectionists have misrepresented the lessons of the past and opposed every step of progress in medical knowledge in our own time. They profess to believe that every stage of progress in medicine has been effected, and always must be, by clinical work alone. Yet it is perfectly obvious that from classical times clinical investigation at Alexandria and Cordova and many other places enjoyed as great opportunities as could be desired, yet, until the opening of the renaissance of experimental method with Harvey about 1400 years later, medical knowledge had scarcely moved, for it is impossible to say that the physicians who mobbed Charles the Second to death, and who presumably represented the best talent of that time in England, and Dr. Guy Patin, Dean of the Faculty of Medicine in Paris, an eminent physician of about the same period, who maintained that all medical knowledge was summed up in senna and the lancet, had more real knowledge of physiology and the meaning of symptoms than Galen. And in modern times, when more progress in the knowledge of the causes and nature of disease has been acquired in a few years than in as many centuries formerly, every step of progress which has been obtained by physical science has been opposed by the anti-vivisectionists. Antiseptic surgery, which has brought more immediate relief from pain and death than any single discovery in the history of the human race, the whole science of bacteriology, with the light which has been thrown on tuberculosis, cholera, diphtheria, yellow fever and malaria, and the mysteries of infection and immunity, improvements in the operations of surgery, and the great names of Pasteur, Koch, and Lister, each and all have been assailed by the anti-vivisectionists with every species of abuse and disparagement.

Indeed, the denials or at best the grudging admission of the advances made in recent years in medicine and surgery would suggest that to the anti-vivisectionist they are actually unwelcome, as justifying the very researches which they attack.

It is a commonplace with Mr. Coleridge and his friends that they are actuated by the highest of all motives—love and humanity. The commonplace has been so reiterated that among the public it is taken as a matter of course, and even the Lord Chief Justice would appear to have regarded science and humanity as necessarily to be found in opposing camps. Let us see how far this claim of theirs will bear investigation.

If Mr. Coleridge and his friends were, indeed, the lovers of men and animals they declare themselves to be, no body of individuals in the kingdom would be less ready to receive or believe in stories of cruelties in others which would be incomprehensible and impossible in themselves. They would put them to the strictest tests, only accept them on the clearest proof, and rejoice unfeignedly were such proof not forthcoming.

But what really happened? A scientific man is accused of barbarities which would sicken a savage. The eye-witnesses repeatedly observe in silence tortures which a word would have ended, nay, they even withhold that word because it would have ended them, and yet Mr. Coleridge actually accepts this tale. He adopts it, he declares he has used every possible means to verify its truth, and he gives out this slander to the world, though he might easily have learned that these sufferings were inventions, and that the tortures of the defenceless creatures in whom he professed so deep an interest had never occurred at all. Is this humanity? Is this love, the love that thinketh no evil, or is it the wounded *amour propre* of one who has been worsted many times, whose statements have been refuted over and over again?

It is difficult to understand the secret of the paradoxes we are called upon to reconcile—philanthropists ascribing the basest actions to their fellow men, humanitarians diverting funds from hospitals, moralists supporting calumny by falsehood. The high motives which are claimed should exist, but until those claims rest upon some better foundation than asseverations contradicted by facts, we shall continue (and we should advise all others who are seriously considering this question to continue) to discount them altogether.

NYASALAND.[1]

MR. DUFF has written a very charming and illuminative book on Nyasaland, otherwise known as the British Central Africa Protectorate, where, since the beginning of 1898, he has resided as an official. His acquaintance with the little protectorate of 43,000 square miles was mainly limited to the Shire Province and the west coast of Lake Nyasa, but Mr. Duff is made of the same stuff as the late Prof. Henry Drummond—he is able to take in many salient points at a glance and to see things which do not strike the ordinary traveller or resident. (Whatever may be thought of Henry Drummond's later writings by scientific men, no scientific man acquainted with Africa can fail to regard his little work on Central Africa as one of the most remarkable contributions to the literature of the Dark Continent which has ever been published.)

Mr. Duff's work is illustrated by a few well chosen photographs and several of his own drawings, most of which are excellent, but one or two, perhaps, too sketchy and vague to consort with the general accuracy of the book. There are useful appendices, a sketch-map of the protectorate, and a good index.

The portions of the book which will most appeal to the readers of NATURE are those dealing with the flora, fauna, and human inhabitants, and these subjects occupy more than half of the book.

"If it be spring," writes the author, "the display of flowers will attract the attention of the most indifferent, blooms of every shape and hue being then abundant, from the great clusters of petals adorning certain papilionaceous trees down to the less conspicuous but equally beautiful ground flowers and

[1] "Nyasaland under the Foreign Office." By H. L. Duff (B.C.A.Admn.) Pp. xv + 422. (London: George Bell and Sons, 1903.) Price 12s. net.

creepers. Except, indeed, in the matter of tree-orchids, which are not very well represented, the flowers of Nyasaland are scarcely surpassed either in respect of variety or brilliancy by those of any other part of the world. It is true that, except here and there in the hills, they do not often grow so close together as to present unbroken masses of colour; and therefore the estimate which any particular person may form of them, as a whole, depends to some extent on his powers of observation. Still, short of always travelling in a machilla and always falling asleep in it, there is no possibility of overlooking them entirely. Ground-orchids flourish almost everywhere. Among lilies we have the Crinum, with its long, heavy, pure white blossoms; and a most effective little tiger-lily of bright gold and deep cardinal red; also a tree-lily (Vellozia), so wonderfully beautiful that, as Sir Harry Johnston says, 'even the botanists of Kew were touched, and

FIG. 1.—Wankonde of North Nyasa. From 'Nyasaland," by H. L. Duff.

called it *splendens*.' Then mauve irises spring up in countless thousands during the rains, and pink and crimson gladioli, and pale yellow marguerites, hibiscuses too, anemones, gentians, flowering beans—hundreds of plants, too, whose names are unknown to me, and many others perhaps which have escaped classification at the hands of the very few scientific botanists who have exploited the flora of the country."

The author is incorrect in some of his guesses as to the names of plants and trees. On pp. 111 and 112 the "euphorbiaceous" plant or tree to which he refers is none other than a common form of Dracæna or tree-lily, used throughout many parts of tropical Africa for hedges or enclosures.

The author has many interesting notes and original observations on the fauna. He shows that, contrary to the belief of such authorities as Sir Alfred Sharpe and Sir Harry Johnston, the roan antelope does apparently still exist in parts of the Shire Province. It has been generally supposed that this antelope confined its range within this protectorate to the regions west and north-east of Lake Nyasa, and did not intermingle, so to speak, with the area of its near ally, the sable antelope. Mr. Duff, however, shows that the roan antelope has been shot in the Shire Highlands. He alludes several times to rumours of the striped hyæna existing within the limits of the protectorate. We are, as a matter of fact, very ignorant yet as to the exact number of species or varieties of the hyæna genus existing in Africa, and the limits of the range of each species or variety. The actual range of the true striped hyæna is, of course, northern as compared to the existing southern range of the spotted hyæna. The striped hyæna is the only species of this group which at the present day is found beyond the geographical limits of Africa, its range extending through Syria, parts of Asia Minor and Arabia (? southern Persia) into Baluchistan and India. How far it penetrates into equatorial Africa is not accurately determined at the present time by indisputable evidence. It certainly reaches the Gambia River in West Africa. It is found in Abyssinia and some of the Nile countries, and in Somaliland. It has been *reported* to exist on the slopes of Kilimanjaro, and as far south as Unyamwezi, and also to be found in the eastern part of the Uganda Protectorate; but inasmuch as that curious creature the aard wolf (Proteles) very closely (in the eyes of the natives) resembles a dwarfed form of striped hyæna, and as the aard wolf is found at intervals throughout the whole eastern half of Africa from Cape Colony to Abyssinia, it is possible that some of the stories of striped hyænas existing in British Central Africa, German and British East Africa may refer only to the aard wolf. The brown

hyæna, a distinct form, but one nearly related to the striped, also ranges, as a very scarce animal, from Natal in the south to equatorial East Africa in the north, and may possibly be found here and there within the limits of the British Central Africa Protectorate. The black and white monkey to which the author refers is obviously the Colobus, and not the Mangabey, which ape is nowhere found within the limits of British Central Africa, but is a form confined to the West African fauna, though it reaches as far as the western limits of the Uganda Protectorate.

The author gives a charming and accurate description of one of the Galago lemurs which are so common in this part of Africa. The writer of this review is convinced that the intelligence—the almost Simian intelligence—of most of the lemurs has been greatly underrated, as also their human characteristics, such as their ability (specially marked in the Galagos) of running on the hind feet and using the hands to box with. A Galago surprised and at bay puts his large fists almost into the positions of a human boxer. Of this interesting animal the author writes:—

"This lemur is a charming little thing to look at, with its soft bluish-grey fur, and large, solemn, perfectly circular eyes. It also makes a most engaging pet. I knew one which used to live half wild in the roof of a verandah at Zomba, coming and going without let or hindrance. In disposition he was on the whole very sociable, but inclined at the same time to be somewhat overburdened with a sense of his own dignity. At any rate, it was very easy to offend him; and when this happened he would retire to his coign of vantage in the roof, which nothing would then induce him to quit. At other times he would come out readily when called by his native name of "Changa." Five-o'clock tea was his favourite meal, and he rarely missed it, being accustomed about that time to refresh himself with a saucer of milk, which he drank with elaborate daintiness. His curiosity was infinite, and sometimes overcame his natural good breeding; but lapses of this kind often brought their punishment, as once, when he thrust his head unbidden into a small coffee cup and could not withdraw it. The sight of him thus unexpectedly bonneted I remember to this day. Though a certain sedateness marked his normal bearing, he possessed a truly wonderful reserve fund of activity, and could climb anything and jump anywhere when the humour took him. Moreover, he had a knack of alighting after the most prodigious leap almost as gently as a bird. I have known him to drop suddenly from a high curtain pole on to the edge of a tea tray without upsetting a single cup; but then of course he was a very small animal—smaller in fact than he looked, owing to his thick, fluffy coat."

There are interesting notes on pp. 85, 86, on the fish of Lake Nyasa, in which justice is done to the wonderful colours of the "blue perch."

On p. 124 an excellent description is given of the weird noises in the African bush at night time. The author also is wise enough to illustrate the monotony and stillness of the African landscape in day time and under normal conditions. He discourses on the singular beauties of the flora and the marvellous interest in the fauna, but brings home to his readers that every aspect in all seasons and under all conditions of Central Africa is not wonderful or beautiful or terrifying. Rather, perhaps, have many of these beauties and wonders to be sought for; they are not immediately patent to the eye of the untrained observer.

He still considers that as a game country Nyasaland may almost vie with any other part of tropical Africa where game is varied and abundant, and attributes the fact that no species in the splendid fauna is yet on the verge of extinction to the Game Laws, which have been in existence now for something like eight years, and which the Foreign Office has steadily enforced.

His chapters on the native races are admirable. He has evidently made himself well acquainted with the Chinyanja tongue, and through the medium of this widespread language has been able to get into touch with the natives of the Protectorate, thus collecting much new and valuable information regarding the manners, customs, traditions, beliefs, &c. To their amiable qualities he is fully alive, as also to their weaknesses and simple vices.

The remarks of the author regarding the labour question are well worthy of attention, but are not suited for discussion in the pages of this Journal. The same remark applies to his excellent chapter on the work of the missionaries, which is critical but appreciative.

THE CANADIAN ROCKY MOUNTAINS.[1]

THIS attractive volume is more than a record of mountain climbing. It gives the reader a very good idea of a considerable area of the Great Lone Land, its fine scenery and physical characteristics, introducing him to not a few "untrodden peaks and unfrequented valleys." Between the eastern base of the Canadian Rocky Mountains and the Pacific shore the earth's crust has been crumpled into a zone of parallel folds more than 500 miles in breadth, which have been deeply sculptured by meteoric agencies. South of the American border these mountains are distinguishable into the Rockies proper and the Sierra Nevada, parted one from another by the broad plateau of Utah, the latter chain being flanked on the west by the Coast Range. In Canada the three are practically fused together, the peaks running in successive ranges, almost like waves of the sea. Messrs. Stutfield and Collie selected as their field of work the region on both sides and immediately west of the continental watershed to the north of Hector Pass—that traversed by the Canadian Pacific Railway. This region, so far as they saw, consists entirely of sedimentary rocks—limestone, sometimes dolomitic, with shales or slates. It is, as mountaineers will see from the illustration which we reproduce, not unlike the Western Oberland, between the Blumlis Alp and the Diablerets, greatly enlarged laterally but not vertically, the higher peaks ranging commonly from about 10,500 to rather under 12,000 feet. The mountains, in fact, were less lofty than the authors had anticipated. One of their few predecessors had, indeed, reported the existence, some dozen leagues north of the railway, of two Alpine giants, Mount Brown and Mount Hooker, rising on either side of a pass, the one to an elevation of 16,000 feet, the other only 300 feet lower, and asserted that he had scaled the former. As, however, this indicated an ascent of about 9000 feet in little more than half an early summer's day, experts were sceptical; the more so when Prof. Coleman, of Toronto, ten years ago found a mountain only just more than 9000 feet high where Mount Brown should be. These giants, in the course of the explorers' four journeys, were proved to be as great impostors as the Mont Iseran and Aiguille de la Vanoise of the Graian Alps some half-century ago.

Travel in the Canadian Rockies is anything but easy work. Wood and water are the only necessaries which the country can be trusted to supply. Indians are few, and game is generally scarce, so that a loss

[1] "Climbs and Explorations in the Canadian Rockies." By Hugh E. M. Stutfield and J. Norman Collie, F R.S. Pp. xii+343; with maps and illustrations. (London: Longmans, Green and Co., 1903.) Price 12s. 6d. net.

of supplies might occasionally mean something very like starvation. Where there are any roads, these are but trails, often more than half overgrown, so that progress is apt to be slow and laborious, difficult swamps and swollen rivers have to be crossed, while mordant insects, mosquitoes and flies, are at times almost intolerable. So notwithstanding the charms of the scenery—bold peaks, fine glaciers, forest-clad slopes, and almost numberless lakelets of rare beauty—travel in the Canadian Rockies is not to be recommended to the habitués of Interlaken or Luchon. Until the Switzerland of Canada is developed—as before long it certainly will be—it can only be explored by hardy and vigorous travellers.

Game, as we have said, is scarce, but the bighorn (*Ovis Canadensis*) and the Rocky Mountain goat (*Haploceros montanus*) occur perhaps about as often as chamois in the Swiss Alps, and bears—black, brown and grizzly—are occasionally seen. Geese, ducks, and three kinds of grouse sometimes vary the *menu*, but evidently the district will hardly be tempting to sportsmen who desire "big bags." Neither do the rocks appear attractive to the palæontologist. The specimens brought back by Dr. Collie were rarely fossiliferous, even when examined under the microscope. Mr. Whymper had, on the whole, a similar experience in his explorations near and to the south of the railway, so that either subsequent mineral changes have obliterated the traces of organisms or the region in past ages was not rich in life. Dr. Collie gives an illustration of objects resembling tree trunks high up on Mount Murchison—possibly the stems of some giant alga—and picked up limestone pebbles with corals, probably Devonian or Carboniferous, in the bed of the Bush River. A few specimens contained traces of organisms, some perhaps foraminifera (misprinted foraminiferae), with an ostracod (misprinted ostreod); one slab showed badly preserved trilobites, probably Lower Cambrian, described by Dr. H. Woodward, and the journey of 1901 was rewarded with some remarkable tracks and other markings from Desolation Valley, south of the railway, not far from Laggan (see the *Geological Magazine* for July last).

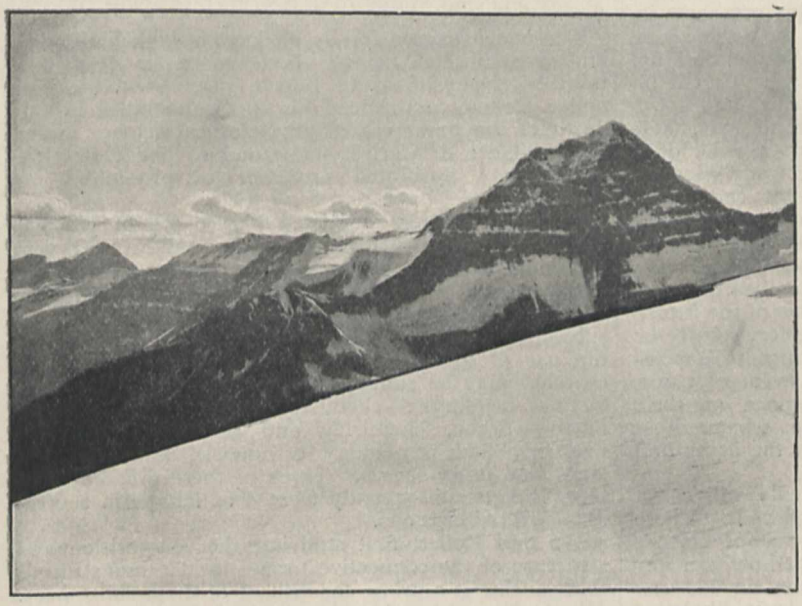

FIG. 1.—Mount Forbes from the East. From "Climbs and Exploration in the Canadian Rockies," by H. E. M. Stutfield and Prof. J. Norman Collie.

The book is well illustrated by numerous reproduced photographs, which enable us to realise the beautiful scenery of this unfrequented land, and its topography is made clear by a map constructed from the authors' surveys. That is such as we might have expected—long troughs parallel with the general trend of the strata being connected by shorter transverse glens, as can be seen, on a smaller scale, in some parts of the Alps. In consequence of this, the Canadian Pacific Railway, as is well known, descends, west of the watershed, into a valley belonging to the Columbia system, then, after crossing a spur, strikes the same river flowing in an opposite direction, and after another mount descends to follow the Fraser River to the coast. Well illustrated and written in an attractive style, the book records a series of journeys, not always without risk, and throws much light on the geography of a region many parts of which have hitherto been very imperfectly known. T. G. BONNEY.

SCIENCE AND THE ARMY.

MANY of our readers may have seen a brief preliminary official notice of the proposals of the War Office for the reform of military education. These proposals are so astonishing, in view of the facts of the case, that we take an early opportunity of directing attention to them.

There is to be, first, a qualifying test. It is intended that this shall take the form of a "leaving certificate," but in view of the probable difficulty of organising a suitable leaving examination for a long while, there seems reason to fear that, at first, this qualifying part may take the form of a special examination, which all must pass, but which will not otherwise affect the final result. This qualifying part is to consist of:—(1) English, (2) history and geography, (3) mathematics, (4) French or German, (5) either (*a*) Latin or Greek, or (*b*) science.

Then there is to be a competitive examination, in which (1) English, (2) French or German, and (3) mathematics i. will be compulsory for Woolwich candidates; and English and either French or German for Sandhurst candidates. In this examination Woolwich candidates may also offer any two of mathematics ii., science, history, French, German, Latin, Greek; and Sandhurst candidates may also offer any two of mathematics i. or mathematics ii., science, history, French, German, Greek, Latin.

The more closely we look into the probable effect of these proposals the more clearly does it appear that, under this new scheme, experimental science seems certain, by the light of past experience, to become a negligible quantity in the training of most officers. Those who read the report of the Army Education Committee published in March, 1902, may remember that the head master of Eton during the examination of a witness expressed confidently the opinion that, if Latin and science should be brought into competition in these examinations, "the science will kill the Latin." Even Dr. Warre, however, does not expect this to happen just yet, for he added, "eventually." Unfortunately for this position, we do not merely want to get a good system of army education eventually, but to get one as soon as possible,

and the figures which we quote below show how unlikely we are to get such a system under the scheme now put forward, if it be admitted, to adopt a statement taken from the report of the same committee, that experimental science, *i.e.* chemistry and physics treated experimentally, is an essential part of a sound general education. In the outlined scheme now before us—as stated above—science comes into the education of the candidates in the qualifying part as an alternative for Latin or Greek, that is to say, practically speaking, for Latin: and again in the competitive part as an alternative for Latin, French, history, &c. Now boys at school begin Latin at say eight or nine years of age. They probably rarely begin the experimental science proposed before thirteen or fourteen. If the candidates are to do a three years' course in chemistry and physics, as suggested, they must begin it at fourteen or sooner, in order to be ready for the qualifying part at, say, seventeen, which seems likely to be about the age at which we may expect most candidates will take this part. This means that at about fourteen the choice must be made between science and Latin.

But at fourteen a candidate will have studied Latin, French, &c., for years. He, his masters and his parents will know a good deal about his prospects in these subjects. Whilst, from what we have said, it is obvious that in most cases they will know nothing about his prospects in science at that age. Can it be doubted that nearly all the cleverer boys, and most even of those whose abilities are second rate, will neglect science at every stage—that, as a rule, only those who are really bad at Latin will get any science? Again, is it reasonable to suppose that candidates whose early education has included no experimental science will at the eleventh hour give up one of the subjects in which they are somewhat advanced, and take to a subject in which they are untried and untrained? Must it not happen that the average officer of the future will know nothing of, and care nothing for, science or its methods, be incapable of appreciating its importance to his profession, and incapable, even, of using the knowledge of others from ignorance of their language and methods of thought? This scheme must result most disastrously in its effect on the army and on the schools.

It has been suggested that the parents will select and insist on the science. We do not believe it. There is a strongly flowing current in favour of science among the parents. That is true. But how can any reasonable parent be expected to insist on his son taking up the subject which seems least likely to conduce to success in a competition of vital importance to him?

But this question is not really a matter of opinion at all.

Some years ago science, in both Woolwich and Sandhurst competitions, had to compete in a somewhat similar way with several other subjects which are begun earlier than the experimental science at schools, and on conditions which were, we think, not so very much more unfavourable than those now proposed. From computations that have been made for us, we find that at that time one successful Sandhurst candidate in twelve ventured to offer experimental science For Woolwich, even, though there were well-known advantages in starting at the Royal Military Academy with a scientific training, which no doubt will still exist, the proportion who offered science was only 22 per cent., or say one in five, of the whole.

As the majority of the candidates will continue for some time to come to be derived from the same classes as in the past, why should we expect a more favourable result now? Some years ago Sir Henry Roscoe and others came forward as the champions of science, and, aided by the head masters of Rugby, Cheltenham, Clifton, and other schools, and by insistently directing attention to these and similar facts, presently secured a more reasonable system in many respects. No doubt the science arrangements made then need revision now in many of their details. But the need for science training among our officers, the need for a fuller appreciation among them of the part it plays, the absolute need to start a training in science, as in languages and mathematics, at an early stage of a boy's training; and, above all, the importance of not teaching young officers to regard it as unimportant by neglecting it at the schools or afterwards, were never greater than at this moment. Who among our leaders in science will come forward in this fresh emergency?

PROF. ALEXANDER ROLLETT.

PROF. ALEXANDER ROLLETT, of the University of Graz, the eminent physiologist, died on October 1 at the age of sixty-nine. His name, though not associated with any particularly brilliant discovery, is well known to science as that of a diligent and successful worker.

Descended from a family of doctors, both his father and grandfather having been more or less distinguished physicians in Baden, near Vienna, Alexander Rollett commenced his medical studies in the dawn of the great era of physiological science under the guidance of Carl Ludwig and of Ernst Brücke, then newly appointed professor of physiology in Vienna.

In 1858, having completed his course of studies, Rollett became Brücke's assistant, and in 1863 was appointed to the professorship in Graz, which he retained until his death. Like his great masters, Rollett's investigations extended to widely different subjects, but by preference to problems that involve the use of histological methods. His principal researches may be summed up under no less than four distinct headings:—chemistry and histology of connective tissue, chemistry and histology of blood, histology and physiology of muscle, and work on sight and other senses. Three of these different subjects Rollett subsequently treated at length in several standard publications.

We find Rollett first studying the composition and structure of the connective tissues, and demonstrating that mucine is a prime constituent of these substances. His work on this subject, and especially on the cornea, he later on embodied in the corresponding chapters of Stricker's "Handbuch der Gewebelehre." He then turned his attention to the chemical and histological properties of the blood, and it was he that first performed the well-known experiment of "laking" blood by alternate freezing and thawing, and by repeated discharges of electricity. The theory of the "stroma" of the red corpuscles is likewise founded largely on Rollett's observations. By these and other discoveries he attained the rank of a prime authority on the physiology of blood, so that when Hermann edited his well-known "Handbuch," the chapter on blood fell to Rollett's share.

On the intricate subject of the structure of striated muscle Rollett brought to bear his powers of histological analysis, and added new comparative data of value by his observations on the muscles of bats, of insects, and of other invertebrates. At a much later period Rollett again approached the study of muscle from a physiological point of view, and published important observations on the velocity of the contraction wave and on exhaustion phenomena. On the

histology and physiology of muscle generally Rollett wrote in Eulenburg's "Encyclopædie." To physiological optics he contributed several papers on spatial perception, on contrast, on the effect of plane parallel glass plates, and various other subjects. He was also one of the first discoverers of sense organs in tendons, and published various observations on the sense of taste, of smell, and on cutaneous sensations.

That Rollett was no less of a teacher than of an observer is proved by the success of many of his pupils. The University of Graz acknowledged his merit by choosing him for rector no less than four different years, including the year of inauguration of the new buildings, when the Emperor and other illustrious guests were to be received. Rollett was also frequently elected as a representative on the local board, and the organisation of the new physiological institute, built under his supervision, testifies to his practical ability.

Most scientific men are naturally diffident to commit themselves in writing to a verdict on the merit of a fellow worker, but it is a curious fact that in verbal conversation this diffidence does not appear. The mere way in which the name of an observer is mentioned is often equivalent to a fairly strong expression of opinion. A careful and conscientious observer commands a degree of admiration and reverence that affects the tone of every chance remark. Judged by this standard, Alexander Rollett was a true follower of science. R. DU BOIS-REYMOND.

NOTES.

A RUMOUR has reached us that at the annual meeting of the Royal Society on Monday next an attempt is to be made by a certain section of the fellows to upset the selection of officers made last week by the council. It appears that the physiologists are under the belief that they have acquired a prescriptive right to hold one of the two secretaryships. It is true that for upwards of forty years they have so held it, but the group of natural sciences includes more than physiology or even biology, and the council, in the exercise of its discretion, has thought that it was high time that one of the other sciences should be represented in this secretaryship. We are further informed that a copy of a letter is being circulated which appears to convey an invitation from the president and council to a certain physiologist to accept the vacant office. That letter was, it is stated, written in error, without the sanction or knowledge of the president and council, but in view of it a special meeting was called to consider the matter, when the council decided to adhere to the decision at which they had already arrived in the ordinary and regular way—a decision which is obviously in the best interests of the Royal Society as a whole, and doubtless the great majority of the fellows will support it by their votes on Monday.

A CORRESPONDENT of the *Times* directs attention to the wise recognition given to science and other branches of learning by Continental nations on all occasions of national importance; and the comparison he makes with our own official customs is not creditable to our dignity. When a monarch or the supreme authority of a State visits the Court of another nation, men of "light and leading" are usually invited as guests to meet him. These are the men who give distinction to a nation; and a people which fosters intellectual accomplishments cannot conceive a State function in which they are not represented. Here, however, there is little pride in the glory which learning brings to a State, and little encouragement is given to the men who devote themselves to the advance of knowledge. Not a single writer, painter, sculptor, architect, musician or man of science of distinguished eminence was invited to Windsor or to the Guildhall to meet the King and Queen of Italy during the recent visit; and the omission, inconceivable to a foreigner, is characteristic of our customs. The *Times* correspondent concludes his letter with the following remark, with which we are entirely in sympathy:—"I believe I shall be expressing the opinion of many of my countrymen if I say that it is much to be regretted that, on great national occasions, persons of titular rank, of great wealth, or of political prominence should be considered adequately representative of the Realm, and that the arts and sciences should be ignored, as though they were non-existent among us."

SINCE the termination of the Bayliss *versus* Coleridge case, which is discussed in another part of this issue, two further communications, which appear to us as striking confirmation of the views expressed in our article, have been received by the daily papers; they are:—(1) a letter from Mr. Coleridge in which he announces that he has paid the damages (which would be interesting, had it been optional) and that he intends to continue on his former courses; (2) a letter from Mr. Bayliss, from which we learn that the large sum which he might, after having personally borne the expense and long months of worry, have used, with perfect justice, for his own advantage, has been devoted by him to the furtherance of that branch of physical science which was the object of the recent attack. Mr. Bayliss's employment of this money as a public trust is in complete consonance with the sense of public duty which has actuated his conduct throughout this matter. It will be endorsed by English physiologists and by the public as forming a worthy and fitting termination to the struggle which has been followed with so widespread an interest.

A REUTER message from Buenos Ayres announces that the Argentine war vessel *Uruguay* has arrived at Rio Gallegos with the members of the Nordenskjöld Antarctic Expedition on board. Two of the missing Swedish explorers were found on Seymour Island on November 8, and others at Snow Hill. The *Uruguay* then proceeded to Paulete Island, where the main body had wintered, and took the remaining members of the expedition on board. Dr. Nordenskjöld's expedition left Falmouth in the steam yacht *Antarctic* in October, 1901, and he expected to be home again early in the present year. From the outset of the voyage the expedition met with countless difficulties owing to the state of the ice. In December, 1902, the vessel reached the north-east coast of Louis Philippe Land, where Dr. Nordenskjöld, Lieutenant Anderson, and two sailors were left at Mount Bransfield. Dr. Nordenskjöld proposed to proceed to Snow Hill in sledges. It was arranged that Mount Bransfield should be the rendezvous for the whole expedition. The *Antarctic* meanwhile made her way to the east of Joinville Island and entered Erebus and Terror Bay. There she was caught in the ice, which finally crushed and sank her. Captain Larsen succeeded in saving all on board, and the party took to three of the ship's boats, which they equipped with provisions. They drifted about for sixteen days, and finally reached Paulete Island, where they established their winter quarters. In September, 1902, Dr. Nordenskjöld, accompanied by Lieutenant Sobral and one sailor, made a sledge journey with two sledges and five dogs in a south-westerly direction. Travelling by way of King Oscar Land, a latitude of 66 degrees was reached, the longitude being 62 degrees west. The party returned to Snow Hill at the beginning

of November, after having made a journey of more than 400 miles, in the course of which new bays and islands were found, and other discoveries were made involving important changes in the existing maps of the region. While awaiting the return of the *Antarctic*, Dr. Nordenskjöld was engaged in geological, magnetic, and meteorological observations, and got together important collections of fossils, plants, and animals. During the first winter the mean temperature was −12° F. below zero, but in August it went down to −42° F.

M. BORDAS, formerly assistant director of the Municipal Laboratory of Paris, has been appointed head of the laboratories of the French Minister of Finance, to succeed M. de Luynes, who is to be styled honorary director.

THE Engineering Standards Committee has appointed Messrs. Crosby Lockwood and Son as official publishers to the committee All the reports and specifications published by the committee may be had from the official publishers or direct from the offices of the committee, 28 Victoria Street, Westminster.

AT the London Institution on Monday Sir John Gunn delivered his presidential address to the members of the Institute of Marine Engineers. The Denny medal was then presented to Mr. C. W. Barnes for his paper on ship electric lighting. The medal was founded by the late Mr. Peter Denny, of the shipbuilding firm of Denny Brothers.

A CORRESPONDENT in Paris writes that another trial of the steerable balloon *Le Jaune* was made on November 20. According to the readings of the Eiffel Tower, the wind was blowing S.S.W. with a mean velocity of 10 metres a second when *Le Jaune* left Champ de Mars at 11.25 a.m., and in a few seconds the balloon rose to a height of about 100 metres. At first the helm alone was used, and then one of the screws. The balloon soon took the direction of Chalais-Meudon, reaching its destination at 11.52 a.m.

IN moving the adoption of the report of the Government Department Committee appointed last year to inquire into the constitution, powers, and duties of the curiously named Board of Manufactures, at the recent annual meeting of the Royal Scottish Geographical Society, Sir John Murray urged the claims of science to more generous treatment. The recommendations of the committee include the reconstruction of the Board of Manufactures and the adoption of a variety of expedients to ensure better instruction in art and the improvement of the art galleries in Edinburgh. During the course of his remarks Sir John Murray said he would have liked a recommendation that certain of the buildings administered by the Board should be devoted to the purposes of science. Arrangements could, he said, be easily made for housing the Royal Geographical Society and other scientific societies, and they should all unite to secure the Edinburgh Royal Institution for science.

A DEPUTATION from the Institution of Electrical Engineers was received at Windsor on Friday last by the King of Italy and presented an address. The deputation consisted of Mr. Robert Kaye Gray, president, Lieut.-Colonel R. E. Crompton, Sir H. Mance, Dr. J. W. Swan, F.R.S., and Prof. Silvanus P. Thompson, F.R.S., accompanied by Mr. W. G. McMillan, secretary of the Institution. Telegrams were dispatched the same evening to the Associazione Elettrotecnica Italiana and to the Milan section of the Associazione, and the following replies were received from them:—"Most sensible to the feelings that inspired your kind telegram. I thank the Institution of Electrical Engineers for the new proof of sympathy, and return most hearty greetings in the name of the Associazione Elettrotecnica Italiana."—(Sd.) Ascoli. "Homage added by Institution of Electrical Engineers to enthusiastic reception to our King by all England was learned with grateful feelings by Milan Section Associazione Elettrotecnica Italiana as a new token of friendship binding Scientific bodies of the two Countries."—(Sd.) Bertini.

THE Berlin correspondent of the *Times* reports that at a meeting of the German Society of Naval Architecture held on November 20 in the technical college at Charlottenburg, a paper was read by Geheimrath Riedler on the revolutionary effect of the invention of the steam turbine upon the future of steam power. A great revolution in steam power was in progress, and the lecturer regretted that Germany lagged far behind in the adoption and development of the new motor. In a paper on the uses of the telephone for naval purposes, Herr D. Zopke, the Government constructor, gave an account of an adaptation of the so-called "stentor microphone" by means of which not only could commands be conveyed to all parts of a vessel, but the men working six guns could be directed simultaneously by a single officer. He discussed experiments made with the microphone with the object of making it give warning of the approach of hostile ships, and concluded by giving some details of the progress which had been made in Germany in the attempts to solve the problem of wireless telephony.

REFERRING to Mr. Douglas Archibald's letter on Bruckner's weather cycle, mentioned in last week's NATURE (p. 62), Dr. H. R. Mill remarks in the *Times* that the cycle does not fit the sequence of weather so satisfactorily in the British Isles as on the continents, but he urges that there must be some way to reconcile the differences, and that the subject should be taken up by some scientific society. In a letter in Tuesday's *Times* Mr. Archibald explains that according to Bruckner's studies this country happens to lie on an axis of a weather see-saw, so that east Britain alone conforms to the continental law. "Dr. Bruckner shows plainly from the past records of British stations how the law which is found to apply all over the Eurasian continent holds with somewhat diminished intensity over the eastern half of Britain, and then, after disappearing over the neutral territory of west Britain and east and middle Ireland, reappears in its opposite phase over north-west Ireland, in common with the Færöes and Iceland." In conclusion, Mr. Archibald gives the following comparison for Brussels and London to show that the Bruckner oscillation loses little in its passage across the Channel.

Total Excess or Defect of Rainfall in the Period.

	Brussels Inches	London Inches
1826-1840[1]	− 7·20 ...	− 6·17
1841-1855	+ 7·16 ...	+ 4·35
1856-1870	−21·25 ...	−11·85
1871-1885	+33·34 ...	+19·65
1886-1902	−25·44 ...	−29·75

[1] For Brussels the period of observation embraces 1833-1901.

WE have received some numbers of the *Journal* of the Meteorological Society of Japan. They contain several valuable papers relating, *e.g.*, to observations in the Inland Sea and North Pacific, articles on the distribution of barometric pressure in Formosa, and reduction tables. At present the text is in Japanese, but it is stated it is intended to insert articles occasionally in English, French or German. This plan will render the *Journal* much more useful to European readers. The Society was founded in 1882, and counts at present more than 260 members.

THE International Aëronautical Committee (president, Dr. Hergesell) has discontinued the publication of the preliminary results of the monthly scientific balloon ascents in view of arrangements made for the speedier issue of the discussion of the definitive results. We have received, however, short summaries of the ascents undertaken by the various countries. In August Mr. Alexander's paper balloon, at Bath, attained a height of 13,000 metres. In September Mr. Dines's kite, at Crinan, N.B., reached an altitude of 2250 metres. The greatest height attained during the last three months was 20,000 metres in an unmanned balloon sent up from Strassburg.

IN the *Sitzungsberichte* der Physikalisch-medicinischen Societät in Erlangen, Herr Fritz Buchner describes an interesting method of measuring the gradual falling off in the intensity of the phosphorescence of bodies excited by kathode rays. This is effected by an arrangement of rotating films, the photographic impression produced by the phosphorescent body as measured by the polarisation photometer of Martens being taken as the measure of the intensity. The author expresses the opinion that the phosphorescent light is a direct consequence of the combination of the ions produced by the action of the kathode rays to form electrically neutral molecules.

A NEW anti-tuberculous serum is stated to have been prepared by Dr. Marmorek, of the Pasteur Institute, Paris. By the use of a special culture medium for the tubercle bacillus, a toxin has been obtained with which horses are inoculated, and after repeated doses their blood-serum acquires antitoxic properties. The serum may then be employed for treatment, and many cases are reported to have been benefited by the injections. Dr. Marmorek is well known for his work in connection with the preparation of an anti-streptococcic serum.

IN the October number of the *Journal of Hygiene* (vol. iii., No. 4) Drs. Hill and Macleod give an elaborate experimental study of caisson disease and diver's palsy, Dr. Newsholme reviews the action of English public health authorities in regard to tuberculosis, and Dr. Barclay discusses the New Zealand birth- and death-rate. The air of the House of Commons has been subjected to chemical examination by Mr. Butterfield, and to bacteriological examination by Dr. Graham Smith, from which it appears that the air breathed by our legislators is exceptionally pure. Dr. Cropper writes on the occurrence of malaria in places usually free from anopheles, and Dr. Nuttall contributes an obituary notice of the late Prof. Nocard, with portrait and list of his published papers.

IN a report to the Home Office, Dr. Haldane gives an account of ankylostomiasis in the Westphalian collieries. This disease, which is due to a parasitic intestinal worm, has, since its introduction in 1895, been spreading considerably, so that in 1902 there were more than thirteen hundred cases in sixty-nine collieries. Official regulations have been drafted in order to stamp out the disease, the chief provisions of which are:—(1) no new hands may be engaged unless proved to be free from infection; (2) in every colliery at least 20 per cent. of the men shall be picked out by a specially instructed doctor, and their dejecta examined microscopically on at least three occasions; (3) any man found to be infected is subjected to a course of treatment, and is not allowed to resume work until completely freed from the worms. In the event of the examination of 20 per cent. of the men showing the mine to be infected, additional measures are taken:—(4) the whole of the men employed underground are examined, and if necessary treated; (5) every man treated is to be re-examined monthly for three months. In addition, regulations have been made for the better sanitation of the mines. The infected men are treated in hospital, and receive sickness allowance during treatment.

A BLUE-BOOK containing the official report of the preliminary conference on wireless telegraphy which was held in Berlin last August has just been published. The decisions arrived at were known some time ago, and in September last we summarised the main points in an article in these columns (NATURE, vol. lxviii. p. 437). There is little to add to what was then said; the final protocol which was drawn up was signed by the delegates from Germany, Austria, Spain, the United States, France, Hungary and Russia. The delegates of Great Britain and Italy agreed to submit the proposals to their Governments with certain reserves. In the case of Italy the agreements made between the Marconi Co. and the Government greatly limit the power of the Italian Government to adopt the proposals of the conference. In Great Britain the difficulty lies in the fact that the Postmaster-General has no power over telegraphic communications beyond the limits of the territorial waters, and special legislation would therefore be required. In most of the other countries the telegraphy monopoly covers the establishment of wireless telegraph stations. When the proposals of the present conference have been considered by the various Governments a further conference will be held to establish an International Conference.

THE third part of Sir C. Le Neve Foster's general report and statistics relating to the output and value of the minerals raised in the United Kingdom, the amount and value of the metals produced, and the exports and imports of minerals, has now been published. This volume deals especially with the output during 1902. The total output of coal was 227,095,042 tons, which is the largest on record; compared with the output of 1901, there is a rise of 8,048,097 tons. We consumed 166,694,908 tons in the United Kingdom, or nearly 4 tons per head of the population. 17,649,137 tons of coal were used in blast furnaces for making pig-iron. The quantity of coal exported, exclusive of coke, patent fuel, and coal shipped for use of steamers engaged in foreign trade, was 43,159,046 tons, an increase of 1,281,965 tons compared with the preceding year. If the quantities shipped for use of steamers engaged in foreign trade are added, the total amount of coal which left our shores was 60,400,134 tons, or about as much as the entire output of the kingdom half a century ago.

IN a recent note (October 15, p. 578) on articles in the October number of the *Century Magazine*, the name of the yellow-fever mosquito was inadvertently given as *Culex aeniatus* instead of *Stegomyia fasciata*.

THE *Transactions* of the Hull Scientific and Field Naturalists' Club for 1903 contain the article on the birds of Bempton Cliffs of which a special notice has already appeared in our columns. In a note on the dispersal of fresh-water shells by beetles, the Rev. E. P. Blackburn records the capture of several water insects with pisidia clinging to their limbs.

THE report of the Albany Museum for 1902 records satisfactory progress on the part of that institution. Special interest attaches to the announcement of the discovery of a small lizard's skull from the Karoo formation, which it is proposed to call *Paliguana whitei*. This is believed to be

the only true lizard from strata of pre-Jurassic age. The specimen is to be described in the first number of a new journal, *Records* of the Albany Museum.

THE National Museum of Dublin was enriched last year by the gift of a very extensive herbarium of Irish plants, collected by the late Mr. Levinge, of Co. Westmeath. In the *Scientific Proceedings* of the Royal Dublin Society Dr. Johnstone and Miss Knowles have published a list of plants, for which the localities furnish new records, whether for the county or for other parts of Ireland.

IN the *Journal of Botany* (November) Dr. Rendle gives a description of the grass *Glyceria festucaeformis*, new to Britain, which was discovered by Mr. Praeger on the north-east coast of Ireland. This is an unexpected locality for a grass which is regarded as a Mediterranean type. In the same journal there appear two lists of mosses and hepatics, the one for Worcestershire recorded by Mr. Bagnall, the other contributed by Canon Lett of collections made in South Donegal.

IN a *Bulletin* issued by the U.S. Department of Agriculture which deals with the diminished flow of the Rock River, Mr. F. G. Schwarz discusses the question how far the water supply of a river is affected by drainage and deforestation. He contends that the actual diminution in amount is unimportant as compared with the resulting fluctuations in the flow of water, especially where the melting snow provides an appreciable source of the supply. As a remedy it is suggested that, in addition to increasing the area of forest, it would probably pay, where the land is valuable, to construct artificial reservoirs for regulating the supply of water.

THE complex series of movements which are carried out by the flowers of *Sparmannia africana*, a well-known greenhouse shrub, from the opening of the buds to the setting of the fruit has been carefully studied by Mrs. D. H. Scott, and is described in the *Annals of Botany*. In the latter part of the paper the writer gives an account of experiments which were carried out in order to show these movements by means of a kinematograph, and in which success was ultimately attained by the use of an instrument called after the maker the Kammatograph. In the Kammatograph, by means of eccentric rotation, exposures are made of successive portions of a film coated on a glass disc, so that a series of spirally arranged negatives is obtained.

THE latest Rationalist Press Association reprints, published by Messrs. Watts and Co., are John Stuart Mill's "On Liberty" and "Haeckel's Critics Answered," by Mr. Joseph McCabe. Both are published at sixpence.

MESSRS. MACMILLAN AND CO., LTD., have published in their sixpenny series "Essays Ethical and Political," by the late Prof. Huxley. The Romanes lecture delivered in 1893 on "Evolution and Ethics" is included, together with the Prolegomena written in the following year.

A NEW edition of Mr. G. Hale Puckle's "Elementary Treatise on Conic Sections and Algebraic Geometry" has been published by Messrs. Macmillan and Co., Ltd., at 7*s*. 6*d*. Alterations in the treatment of the general equation of the second degree have been made, and more simple methods of reduction and of finding the foci, eccentricities and axes are given.

WE have received the fifth half-volume of the "Natural History of Animals," by Prof. J. R. Ainsworth Davis, now being published by the Gresham Publishing Company. Previous volumes of the work have already been reviewed in these columns; the present part deals fully with animal movement in eleven chapters, running to 280 pages, and is illustrated by nearly 250 figures and three coloured plates.

THE second volume of Prof. H. Pellat's "Cours d'Électricité" has been published by M. Gauthier-Villars, of Paris, at 18 francs. The publication of the first volume, which deals with electrostatics, Ohm's law, and thermo-electricity, was announced in these columns in 1901. The present volume is concerned with electrodynamics, magnetism, the phenomena of induction, electromotors, electric oscillations, electromagnetic measurements, and similar subjects. A third volume, yet to be published, will complete the course, and will discuss electrolysis, electrocapillarity, and associated subjects.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*) from West Africa, presented by Mr. J. F. Purser; a Macaque Monkey (*Macacus cynomolgus*, var.) from India, two African Brush-tailed Porcupines (*Atherura africana*) from West Africa, a Rose-Hill Parrakeet (*Platycercus eximius*) from Australia, deposited.

OUR ASTRONOMICAL COLUMN.

SOLAR PHENOMENA AND MAGNETIC STORMS.—In a communication presented to the Paris Academy of Sciences, M. Quenisset directs attention to the fact that, whilst the passage of a large group of sun-spots across the sun's central meridian on October 31 coincided with a terrestrial magnetic storm of exceptional activity, the passage of a much larger group on October 11 was marked by a very faint perturbation of the magnets. In explanation of this apparent anomaly he points out that the smaller group of spots was surrounded by an immense tract of faculæ, so bright that it was found possible to photograph them by the ordinary method, even when they were on the sun's central meridian, whilst scarcely any faculæ attended the larger and earlier group. From this fact M. Quenisset arrives at the conclusion, which is now becoming generally accepted, that it is the prominences and faculæ on the solar surface rather than the spots which are so closely related to terrestrial phenomena, and suggests that the monochromatic photographs of the solar surface obtained by the Hale-Deslandres method, such as are now being taken at Yerkes, South Kensington, and Meudon, will provide valuable data for the discussion of the inter-relation of solar and terrestrial phenomena (*Comptes rendus*, November 9).

OBSERVATIONS OF JUPITER.—In the November number of the *Bulletin* de la Société astronomique de France, M. Ch. Lukacs, of Budapest, publishes the results of his observations of Jovian phenomena during 1902; the following are the principal conclusions derived from the observations:—(1) The Red Spot has totally disappeared except at its eastern extremity; (2) the southern equatorial band shows remarkable activity in its northern parts; (3) the equatorial band, formerly the scene of the greatest activity of Jupiter's atmospheric forces, has now become absolutely uniform; (4) the northern equatorial band is growing gradually fainter from the south towards the north; (5) the south temperate band presents a curious depression just above the eastern extremity of the Great Red Spot, and, on August 6, two very sharply defined deviations in the course of this band were observed, the one at 125°, the other at 175° of Jovian longitude; these deviations were similar to those observed by the late Prof. Keeler on August 28, 1900; (6) the colour of the equatorial bands was a brownish ochre; the zones, generally, appeared to be of a whitish yellow, with the exception of the tropical zones, which were white, and the polar zones, which had a grey tinge mixed with yellow.

In his communication M. Lukacs gives the details of his individual observations and twelve excellent drawings of the planet as it appeared on various occasions during 1902.

THE FORMS OF THE RING AND DUMB-BELL NEBULAS.—In a recent number (539) of the *Astronomical Journal* Prof. J. M. Schaeberle stated that by using a short focus reflector he had obtained photographs of the Ring nebula which plainly showed that this object had a clockwise spiral form. In several fainter photographs obtained since, where faint nebulosities are shown only at the extremities of the major axis of the ellipse, he noticed a decided similitude in shape to the dumb-bell nebula in Vulpecula, and was induced to photograph the latter object in order to see if that, too, was a spiral; the photographs obtained show that it is, but in this case the spiral is counter-clockwise.

From these photographs of the two objects Prof. Schaeberle concludes that they were formed, in each case, by simultaneous emissions of matter from a central mass, several streams leaving the parent body in diametrically opposite directions, and with various velocities, at the same time and forming inner and outer streams of which the inner would travel round the central body several times while the outer streams were making one revolution; where these two streams meet and are superimposed, the nebulosity is much brighter, and exhibits the forms usually attributed to these objects. If we suppose that the outer boundary of the nebula, as it is usually seen, represents the exterior limit of the inner streams, and that the general arrangement of the nebula is due to gravitational forces, this theory demands that the outer streams should extend much further than is generally shown on photographs, and, in proof of this, Prof. Schaeberle has obtained photographs which show that various exterior nebulosities, and many of the adjacent faint stars, are probably part of one huge structure of which the Ring nebula is only the central condensation.

Similar proofs have been obtained to show that the formation of the Dumb-bell nebula may be explained by the same hypothesis, for on several photographs it is plainly seen that various wisps of nebulosity, which are concave towards the Dumb-bell and include several streams of faint stars, are, with the Dumb-bell, probably parts of the same original mass (*Astronomical Journal*, No. 547).

BIOLOGICAL WORK IN SOUTH AFRICA.

THE issue of the report of the Government biologist (Dr. J. D. F. Gilchrist) of the Cape of Good Hope for 1901 affords a favourable opportunity for directing attention to the energy with which biological investigations are being carried on in South Africa. Several volumes of the excellent "Fauna of South Africa," under the editorship and part authorship of Mr. W. L. Sclater, director of the Cape Town Museum, have from time to time been reviewed in our columns, where reference has likewise been made to various papers in *Marine Investigations in South Africa*, the *Annals* of the South African Museum, and other local publications. From some of these notes we venture to repeat extracts on the present occasion. It may be added that, apart from local publications, Mr. O. Thomas, of the British Museum, in papers published in the *Annals and Magazine of Natural History*, has been able to increase our knowledge of the mammals of South Africa, thanks to collections sent to this country by Colonel Slogget, R.A.M.C.

The Government biologist commences his report with an account of the trawling operations recently undertaken off the Natal coast at the request of the Government of that flourishing colony. The Natal coast is by no means promising for trawling, and as much money had been spent on previous occasions with no good results, and the recent trip proved equally unsatisfactory, the Government was advised to devote its attention to the development of line fishing, and to rely on the Cape trawling-grounds for its supply of soles. During the operations many new forms of marine life were procured, which are being investigated by specialists. On the return of the surveying vessel to Cape waters, a new trawling-ground was discovered, which promises to yield a valuable supply of food-fish.

As regards inland-fisheries, breeding operations have been seriously hampered owing to the hindrances inseparable from the institution of martial law in the country, while an unfortunate case of poisoning did not tend to mend matters. Nevertheless, the director is able to report that the rainbow-trout are in a very satisfactory condition, and that carp are likewise flourishing.

The report includes a reprint from *Marine Investigations* of Mr. R. Kirkpatrick's first paper on the sponges obtained during the Natal and Cape cruises. The third part of this contribution (*Marine Investigations*, vol. ii. part iii.) is just to hand. Several genera and many species are described as new, and the author directs attention to a notable resemblance between the sponge-fauna of South Africa and that of Australia.

A second paper reproduced in Dr. Gilchrist's report is one by Mr. G. B. Sowerby on South African molluscs, in which is described a new species of Volutilithes, making the third existing representative of that genus, which was first described from the Barton Clay. Another contribution to this subject by the same author appears in vol. ii. of *Marine Investigations*, where a number of new forms of Pleurotoma and Conus, as well as representatives of other genera, are described.

In the same volume the South African corals of the genus Flabellum receive attention at the hands of Mr. J. S. Gardiner who pays special attention to the anatomy and development of these organisms, and emphasises the importance of studying the polyp as well as the corallum if we hope to gain any real idea of their true relationships.

This volume of *Marine Investigations* also contains some valuable notes by Dr. Gilchrist on the development of South African fishes. These notes have an important bearing on certain disputed points connected with the Cape fisheries. Many fishermen urge, for instance, that the spawn of several of the commoner food-fishes is developed on or near the sea-bottom, and is, in consequence, seriously damaged by trawling. To this the author replies that, since in northern waters it has been demonstrated that only one valuable food-fish, the herring, has deep-lying spawn, and since the Cape seas are the home of only a small species of herring of little or no commercial value, it is probable that the damage done by trawling in South African waters has been overestimated.

Under the title of "Rhynchotal Miscellanea," Mr. W. L. Distant, in the *Annals* of the South African Museum (vol. ii. pt. ix. art. 12 and vol. iii. pt. ii. art. 3), publishes a series of notes on the bugs of the country, with descriptions of some new genera and a large number of new species.

In vol. iii., part iii., of the same publication, Mr. G. A. Boulenger describes six new forms of perch-like fishes from the Natal coast, all of which are illustrated in well executed plates, and belong to previously known generic types.

Part iv. art. 5 of the same volume is devoted to descriptions by Dr. W. F. Purcell of new spiders from South Africa belonging to five families.

We must likewise refer to a communication in the *Agricultural Journal* of the Cape of Good Hope for October last, in which the Government entomologist, Mr. C. P. Lounsbury, records an important discovery in regard to the propagation of the South African sheep and goat disease known as "heartwater." The bont-tick has been found to be the only medium of spreading the disease. A single specimen, if fed on a heartwater-sick animal as a larva or "seed" tick, is capable of transmitting the fatal malady. An animal pastured on veld infested by tick may drop thousands of larvæ during its illness, and thus serve for the extermination of a flock. The mortality amongst flocks brought to the coast where the tick is abundant is thus explained. Pathogenic larvæ retain their dangerous character until adult. They may take their second feeding on an ox or a non-susceptible goat, and in the final stage get on to a susceptible sheep or goat and give it fever. On the other hand, the disease appears non-transmissible through the egg-stage, and the species is normally non-pathogenic in all stages. A farm may be infested with bont-tick, yet be free from heartwater. Since the other common species are innocuous, it is hoped that by keeping down the bont-tick the disease may be stamped out.

By no means the least important memoir in the series before us is one by Mr. A. C. Seward on the fossil floras of Cape Colony, forming part i. art. 1 of the fourth volume of the *Annals*. The first section deals with the flora of the Uitenhage series, which is regarded as of Wealden rather than of Jurassic age. The Stormberg, or upper

division of the Karu, flora, on the other hand, is classed as Rhætic, while the Ecca, or lower Karu, flora is identified with some part of the Permo-Carboniferous. The latter conclusion, it may be mentioned, is rendered practically certain by the recent discovery in Kashmir of Glossopteris below marine Permian strata, as recorded in the report of the Geological Survey of India for 1902–3. The occurrence in the Ecca beds of Vereeniging of Sigillaria and other European Carboniferous types points to a closer connection between the South African Glossopteris flora and the Carboniferous flora of the northern hemisphere than exists between the latter and the Glossopteris flora of the Lower Gondwanas of India. The Ecca beds of Vereeniging appear to be the equivalents of the Karharbari beds of the Gondwanas. Finally, although deprecating a precise identification, Mr. Seward is of opinion that the Witteberg flora is probably Carboniferous or Devonian—more likely the latter than the former.

That so much good work—both strictly scientific and economic—should have been accomplished during and so soon after a great war is a hopeful sign for the future of South African biology. R. L.

EXPERIMENTS ON WHEAT.

WITHIN the last few years it has gradually been recognised that, although our wheat-fields produce a large bulk of grain, it is, if used alone, unsuitable for the manufacture of the light white bread now generally demanded. In consequence, increasing quantities of the harder and more suitable wheats grown in Canada, the United States and other countries are imported yearly, and the price of the inferior home-grown grain has fallen considerably. More or less concurrently with this greatly improved methods of milling have come into vogue, and the farmer, perhaps not unnaturally, associates the two facts, and all too frequently blames the miller for his reduced margin of profit. A little closer examination of this complicated problem shows that the tendency for the last thirty years or so has been for the yield per acre of grain to rise, and the quality, as estimated by the percentage of gluten present, to fall.[1]

Now in some way or other, precisely how we do not know, the capacity of wheat to yield a strong flour, or its "quality," is bound up in this mysterious mixture of proteids grouped together as gluten, so that if the blame must be apportioned, it rests on those who injudiciously selected wheats for cropping power in preference to quality. Meanwhile, such fine old varieties as Golden Drop, Red Lammas, and Nursery wheats are steadily being driven out of cultivation by varieties slightly superior in yield, but far poorer in quality.

The great importance of making the most of our home wheat-supply has been insisted on time after time by the National Association of British and Irish Millers, and one of the methods they have suggested is to raise improved strains of these good varieties, either by hybridising or by selection. Experiments along these lines have been carried out for the last three seasons by the Cambridge University Department of Agriculture. In the first place wheats known to yield a good quality grain have been crossed together with the object of finding more vigorous races among the progeny of the hybrids. Further, varieties selected from a collection of several hundreds for possessing such characters as a strong, resilient straw, a short period of maturation, and freedom from various diseases, have also been used as parent wheats.

So far it is early to predict any results of technical value, but a number of results of scientific interest have already been arrived at in connection with Mendel's laws of inheritance. The flowers of wheat being autogamous are specially advantageous for such work, as Spielman's careful researches on wheat-breeding, carried out without any previous knowledge of Mendel's work, have shown. Spielman has already recognised that lax ears, the lack of awns, velvety chaff, and red colour are dominant characters, while dense ears, the presence of awns, glabrous chaff and white colour are the corresponding recessive characters.

These results have already been amply confirmed.

Thus from crosses between beardless and bearded wheats the resulting hybrids have invariably shown the beardless character, while their progeny have consisted of beardless and bearded forms in the proportion of three to one. Similar results have been obtained on crossing lax and dense eared races, rough and smooth chaffed, and red and white, though in the last case it has so far been impossible, owing to bad ripening, to distinguish clearly enough between red and white chaff to establish their proportions.

At the same time it has been shown that the sharply keeled glumes found in *Triticum turgidum, e.g.* are dominant over the glumes with rounded bases occurring commonly in the varieties of *T. vulgare,* that the grey colour of glumes and paleæ is dominant over red and white, that broad leaves are dominant over narrow, and rough ones over smooth, that certain groups of bristles on the ridges of the stem which distinguish some varieties are dominant over the ridges without bristles, and that hollow stems are dominant over pithy stems. With regard to grain characters, the long and narrow type is dominant over the short and round, and the red over white. At the same time certain complications have been met with which will entail further investigation. Thus the rough-chaffed grey Rivet's wheat, when crossed with a smooth-chaffed white or red wheat, gives hybrids which vary considerably both in the roughness and colour of the chaff, some being almost glabrous and showing decidedly the red or white colour as well as the grey. The same impure dominance of the rough chaff and colour is found in the following generation. Where other rough-chaffed wheats have been made use of in the place of Rivet wheat though this character has been purely dominant.

Further, particularly among the progeny of the hybrids, there is a marked tendency for the various characters to become intensified. Medium lax, for instance, becomes very lax, the grey colour becomes almost black, and the red a deep brown. At the same time, unexpected forms appear in this generation showing characters unrepresented in either parent. The commonest of these, so far, has been a spelt-like wheat with peculiarly lax ears, thick glumes, and the typically closed spikelets of *T. spelta.* Many of these exceptional forms are sterile—probably owing to imperfectly developed pollen.

These botanical characteristics are, however, of little importance technically, the farmer and miller being concerned chiefly with the quality, yield, hardiness, time of ripening, susceptibility to disease, &c., characteristics, at present practically unexamined, which one might term "constitutional."

The quality of the grain can, to a certain extent, be judged by the hardness and translucency of its endosperm, the poor starchy grain being soft and opaque. Accepting this as a guide, then, good quality is a dominant character, at all events so far as an examination of the first generation of the hybrids goes. The late ripening habit is also dominant over the early ripening habit. As an example, *T. Polonicum,* ripening early in August when sown about the middle of March, was crossed with Rivet wheat ripening late in August when autumn sown. The hybrid grains were sown on March 15, and produced plants which ripened their grain about the middle of September—simultaneously with Rivet wheat sown on the same date.

Experiments on the susceptibility to disease are also being carried out. This point is being investigated both with rusts and mildew, the two serious wheat diseases, inasmuch as they are untreatable. For the purpose of the experiment, in 1901 Michigan Bronze and a wheat with the Michigan Bronze strain in it, viz. Red King, both liable to rust, were crossed with Rivet wheat, which is practically immune. Reciprocal crosses were made in each case. The following year the hybrids were the most badly rusted plants among the experimental plots, and there was nothing to choose between the plants with Rivet wheat as male or female. Incidentally, then, it might appear to anyone who accepted Eriksson's views that in the case of Rivet wheat ♀ × Red King or Michigan Bronze ♂, the so-called "mycoplasma" had reached the hybrid grain by way of

[1] The figures are set out in detail in Girard and Lindet's "Le Froment et sa Mouture," p. 101. (Paris, 1903.)

the generative nuclei. But is such an interpretation possible? I think not.

On harvesting the plants the grain was found to be badly shrivelled, the Michigan Bronze crosses only producing three grains, none of which germinated. From about three hundred grains of the Rivet and Red King crosses, two hundred and sixty plants were raised. The rust appeared on these as early as March 16, and by June 15 many plants were orange-coloured even on the highest leaves. On counting out the plot, 78 plants were found to be free from disease, 118 were slightly infected, and 64 were badly attacked. By June 29 the epidemic seemed to be at its height, and a second count showed that the number of disease-free plants was reduced to 64, while 195 were infected, for the most part badly.[1]

These figures seem to be too close an approximation to the Mendelian ratio of 1 : 3 to be a mere accident, especially when taken in conjunction with the results of the first generation. The susceptibility of wheat to the attacks of rust is therefore a definite Mendelian character.

If further researches should show that this capacity for resisting the attacks of disease-producing fungi is in reality a tangible characteristic, the plant-breeder, at all events, will have definite lines to go upon in attempting to solve one of our most important agricultural problems, namely, that of producing disease-resisting strains.

R. H. BIFFEN.

PROBABLE ERROR IN VITAL STATISTICS.

A PAPER on "The Degree of Accuracy of Statistical Data," by Mr. Carl C. Engberg, has been published by the University of Nebraska. "This paper," Mr. Engberg tells us, "is written as a protest against the unnecessary refinement of statistical computations as carried out by the biometricians of to-day." Mr. Engberg complains that the more "prominent biometricians" have worked with five or six figures when they might have worked with three or four with equally good results. He illustrates this by comparing Prof. Pearson's work on enteric fever, published in 1894, with a revision of it by himself using only three places of decimals. He considers that the one is as good as the other. He does not, however, apply the test for relative goodness of fit of observation to theory—*Phil. Mag.*, July, 1900—but discards it without examining the analysis by which it is reached, on the basis of a paradox that he has not been able to see through. He appears to dislike the test because if 16,000 observations are distributed in the same proportions in *n* groups as 1000 observations the former distribution shows a lower probability for the fit than the latter, if the same curve be used in both cases. This, however, must be right. 16,000 observations should give a result nearer a smooth curve than 1000. The percentage error has been discarded for years by trained biometricians; it was merely a temporary *modus vivendi*.

As to the use of a greater or less number of decimal places, to those who work with mechanical calculators the number is practically indifferent, and to trained computators even a 7 or 10 figure table of logarithms is hardly slower in use than a 4 or 5 figure table. But are the decimal places when reached worth having? Very often not, very often they are. Mr. Engberg seems quite incapable of distinguishing between the two classes of cases. The only means of testing is to consider the probable errors of the results. The theory of the probable errors of the constants of frequency curves was not given until 1898, and it was not possible to say in 1894 how many places of decimals were or were not necessary. Mr. Engberg appears to think that because vital statistics are tabled to one or even four year units, it is impossible to ascertain the values of constants to two or three decimal places of those units. He states, vaguely, that "the constants cannot be more accurate than the data upon which they are based." He might well have asked the American actuaries for their views on this point! Practical men do not work to 6 or 10 figures for the mere pleasure of it, and in the particular case cited by Mr. Engberg—"Makeham's *c*"—we have a constant which has often to be raised to the fiftieth power! Does Mr. Engberg believe that the mean age at death of a population of several millions, classified solely by year of age at death, cannot be found to less than the rough year which is the basis of the grouping?

Mr. Engberg says that his "paper has not been written in a fault-finding spirit by a detractor of the new science of biometry, but by a teacher of the science." It seems a pity that Mr. Engberg should not have studied either the history or literature of the science he is teaching, or, apparently, have received a training in mathematical statistics. In the former case he would have known that the method he suggests on p. 9 has been long in use (Yule, *Proceedings* of Royal Statistical Society, vol. lx., part iv., 1897), and the inner meaning of tables of powers for testing the *last* column of high moment tables would have been obvious to him. In the latter case he would have made a valid criticism of over-many decimal places by simply showing that they gave results beyond the probable error of the constant involved, or did not improve the goodness of fit as tested by a legitimate method. We are doubtful whether the growing practice of appointing teachers of biometry in the American universities without preliminary training is really helping the science forward. It leads, it is true, to a multitude of biometric papers, but very few of these are of permanent scientific value.

[1] One plant overlooked.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On Thursday, November 19, an election took place of great importance in relation to the advancement of the study of mental science in Oxford—that of Dr. W. MacDougall to the readership in psychology founded some years ago by Mr. Wilde. The first reader was Mr. Stout, the well-known editor of *Mind*, who last summer resigned the Oxford appointment for a professorship at St. Andrews. His successor will no doubt follow in Mr. Stout's footsteps, but those who appreciate the value of the experimental method in psychology confidently anticipate that opportunity will now be given for this study in Oxford. Dr. MacDougall has himself approached the subject from the experimental side, and is the author of very important researches on the physiology of the nervous system, among which those relating to the theory of colour vision may be taken as examples. As a member of the Cambridge Anthropological Expedition to Torres Straits and Borneo, he conducted experimental researches on the mental processes of savages, which afford substantial evidence of his power as an investigator. When to this it is added that he is no less a master of the older methods than of the new, and is regarded as a man of power alike by physiologists and by philosophers, the university may well be congratulated on so valuable an accession to its intellectual forces. Against any regret that may be felt that the new reader is not an Oxford man, the fact may be set off that one of the most successful and influential of American experimental psychologists—Prof. Titchener—received his training in both sides of the subject at Oxford.

CAMBRIDGE.—Dr. Hobson, F.R.S., has been appointed the first Stokes lecturer, and Dr. Baker, F.R.S., the first Cayley lecturer, in mathematics.

An Isaac Newton Studentship of 200*l.* a year for three years, for research in astronomy and astronomical physics, will be vacant in the Lent term, 1904. Candidates must be bachelors of arts under twenty-five years of age. Applications are to be sent to the Vice-Chancellor by January 26.

The degree of D.Litt. is to be conferred *honoris causa* on Prof. Théophile Homolle, member of the Institute of France, director of the French School of Athens.

Prof. Woodhead, Mr. J. E. Purvis, Dr. Tatham, Dr. Lane Notter, and Dr. R. D. Sweeting have been appointed examiners in State medicine for the diploma in public health.

The scheme for the establishment of a geographical school and the institution of a special examination in geography and a diploma in geography will be submitted to Senate for adoption on December 5.

PROF. WILLIAM F. DURAND, professor of marine engineering, has been appointed acting director of Sibley College, Cornell University, in succession to the late Prof. Thurston.

DR. MORRIS W. TRAVERS has been appointed professor of chemistry in University College, Bristol, in succession to Prof. Sydney Young, F.R.S. Dr. F. E. Francis, lecturer in chemistry, has been promoted to the rank of assistant professor in the college.

SPEAKING at Limerick last week in distributing prizes to the pupils of the Municipal Technical, Science and Art Schools, Sir Horace Plunkett remarked that the whole country had now taken up the work of technical education with a quickness, receptivity, and responsiveness which he was told by educational experts had not been witnessed in any country under similar economic conditions, and in so short a time. There was now scarcely a corner of Ireland where the people were not showing an anxiety and practical interest to take up a scheme which had been introduced under the auspices of the Department of Agriculture and Technical Instruction.

IN the course of an address at Liverpool on Saturday last Sir Philip Magnus remarked that our very existence as a nation depended upon our continued educational advance. There was a startling contrast between the liberal expenditure in America and Germany upon specialised university research and the small sums spent here. This country had little to learn from the method of teaching in American schools, but what we could and must learn if we were to recover lost ground was a changed attitude towards education itself. Few manufacturers in this country yet realised the economy and industrial advantages of attaching to their works intelligence departments staffed with scientific experts. He was glad to say, however, even in this respect the outlook was improving, and there were many signs of brighter days in store.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 19.—"The Sensation of Light produced by Radium Rays, and its Relation to the Visual Purple." By W. B. **Hardy** and H. K. **Anderson.**

When a few milligrammes of radium bromide are brought near the head in the dark a sensation of diffuse light is produced. The authors find that this is not due to any direct response on the part of the retina, the optic nerve, or the brain, but to a fluorescence of the tissues of the eyeball, notably of the lens and of the retina itself, excited by the β and γ rays.

The visual purple of the retina is not bleached by any of the radium rays.

The authors point out in passing the peculiarly high opacity of the eyelid to the rays, as compared with the skin of other parts of the body.

Physical Society, November 13.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Sir Oliver J. **Lodge** read a paper on means for electrifying the atmosphere on a large scale. Twenty years ago the author was engaged with Mr. J. W. Clark on an investigation of the dark spaces seen near hot bodies placed in illuminated smoke. The existence of these dust-free spaces was discovered by Tyndall, and the phenomenon had been investigated by Lord Rayleigh. Tyndall worked with high temperatures, and attributed the effect to the burning of the dust near the hot body. Such, however, cannot be the case, as the spaces exist when inorganic dust, such as oxide of magnesium, is used. The conclusion at which Messrs. Lodge and Clark arrived (see *Phil. Mag.*, 1884) was that the result was due to an aërial bombardment from the hot wire which drove the particles away, and they tried the effect of electrifying the hot body to see if there was any modification of the dark space. A new phenomenon was discovered, the whole of the dust being driven to the sides of the containing vessel. This experiment was shown by the author at the British Association meeting in Montreal in 1884, and subsequently, on a larger scale, at the Royal Institution. In the latter experiment two pieces of wire gauze, connected to the terminals of an electric machine, were placed opposite each other in a smoke-filled chamber, through which a current of smoke was slowly passing. Upon electrifying the plates the smoke ceased passing, the dust particles cohered, hovered in the air, and were either driven to the sides of the chamber or fell to the bottom. In the case of mist, electrification of steam in a bell jar converted it into fine rain. It seems therefore possible that rain might be produced by the electrification of a cloud. Sir Oliver Lodge has tried at Liverpool to disperse fogs by discharging electricity into them. For this purpose a large mast was erected on the roof of the University College buildings. It terminated in a bundle of points, to which electricity was conveyed from a Wimshurst machine by a wire supported by specially constructed insulators. In order to drive electricity from a point far removed from a surface a high potential is necessary, and sometimes a large gas flame was used to supplement the points. Upon one occasion the discharge of electricity from the flame was sufficient to keep a clear space of 50 or 60 yards radius in a dense fog. The author had hoped to induce the Mersey Dock Board to try the principle on a large scale, having a series of positive discharges on one side of the river and a series of negative discharges on the other; but he felt a certain reluctance in recommending the method to practical men so long as it was necessary to derive the current from a Wimshurst machine. A dynamo would be a more suitable generator if it were possible to get a sufficiently high potential. The way out of the difficulty is to rectify a high-tension alternating current, and Sir Oliver Lodge has for some time been considering the possibility of doing this by utilising Cooper-Hewitt mercury lamps. A study of these lamps has led him to believe that their rectifying power is much assisted by the outside metallic coating which surrounds the mercury electrode, and which is connected to the positive terminal of the lamp. In order to rectify an alternating discharge, four lamps are so arranged in the form of a quadrilateral that, when the leads from the terminals of an alternating transformer are connected to two opposite corners, two unidirectional currents are obtained from the other corners. Experiments have been made at Birmingham by sending the current from a high-frequency alternator (3000 ~ per sec.) through the primary of an induction-coil and connecting the terminals of the secondary to the rectifiers. The length of the rectified spark can be increased by putting a number of lamps in series in each arm of the quadrilateral arrangement. Sir Oliver Lodge performed an experiment at the meeting to show the dissipation of fog by electrification. The current from an alternator was passed through the primary of a coil and the terminals of the secondary connected to the rectifiers, twelve lamps in all, three in series in each arm. This arrangement is capable of giving a rectified spark 2 or 3 inches long, the unidirectional nature of which can be proved by passing it through a Crookes or a Röntgen tube. Some magnesium wire having been burnt under a large bell jar to fill it with a cloud of magnesium oxide, the jar was then illuminated by the light from an electric lamp. Passing through the base-piece upon which the bell-jar was placed was a conductor which terminated in a point inside the jar. When the terminals between which the rectified discharge was passing were separated and the other end of this conductor was joined to one of them, the electricity streaming from the point into the clouded atmosphere caused an immediate deposition of the magnesium oxide.—Sir Oliver **Lodge** also described an arrangement for driving mercury pumps, designed by Mr. B. Davies and himself.

Chemical Society, November 5.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The reduction of hydrazoic acid, by Mr. W. T. **Cooke.** The products were hydrazine and ammonia in place of the expected cyclic nitrogen hydride.—Preliminary note on the viscosity of liquid mixtures, by Messrs. A. E. **Dunstan** and W. H. C. **Jemmett.** The viscosity curve of a mixture of two non-associated liquids is a straight line, of a non-associated with an associated liquid, a line convex to the axes, and of two associated liquids, a line concave to the axes.—Contribution to the study of the reactions of hydrogen peroxide, by Mr. J. **McLachlan.** The evolution of oxygen induced by the addition of solutions of hydrogen peroxide to acidified solutions of potassium

bichromate or permanganate is not quantitative. Manganese dioxide reacts with hydrogen peroxide only in presence of sulphuric acid, and even then the reaction is incomplete.—The constitution of certain silicates, by Mr. C. **Simmonds.** The results obtained in a series of reduction experiments made on metallic silicates indicate that in complex silicates the silicon atoms are attached to each other, and each to two atoms of oxygen, the unappropriated oxygen atoms being those by which the metallic oxides are attached to the silica complex.—Constitution of chrysophanic acid and of emodin, by Messrs. H. A. D. **Jowett** and C. E. **Potter.** Chrysophanic acid is shown to be 5 : 8-dihydroxy-1-methylanthraquinone, and emodin either 2 : 5 : 8- or 3 : 5 : 8-trihydroxy-1-methylanthraquinone.—Conductivity of substances dissolved in certain liquefied gases, by Messrs. B. D. **Steele** and D. **McIntosh.** The conductivities of solutions of a number of substances in liquefied hydrogen chloride, bromide, iodide, sulphide, and phosphide have been determined.—The behaviour of metallic oxides towards fused boric anhydride, by Messrs. C. H. **Burgess** and A. **Holt.**—Note on some reactions of vanadium tetrachloride, by Mr. B. D. **Steele.** A description of the results obtained by the use of vanadium tetrachloride as a chlorinating and condensating agent in the synthesis of organic compounds.—Studies on comparative cryoscopy, i., the fatty acids and their derivatives in phenol solution, by Mr. P. W. **Robertson.** It is shown that the rate of association for fatty acids (normal) rises and falls as the series is ascended, and is influenced both by the nature and position of a substituent.—Vapour pressures of sulphuric acid solutions, by Mr. B. C. **Burt.**—Additive compounds of *sym*-trinitrobenzene and alkylated arylamines, by Messrs. H. **Hibbert** and J. J. **Sudborough.**—Interaction between chloric and hydriodic acids, by Mr. J. **McCrae.** A study of this reaction, and especially of the rate at which it progresses.—3 : 5-Dichloro-1 : 1 : 2-trimethyl-$\Delta^{2,4}$-dihydrobenzene. A correction, by Mr. A. W. **Crossley.** This compound is now shown to be the corresponding derivative of unreduced benzene.—The estimation of hydroxylamine, by Messrs. H. O. **Jones** and F. W. **Carpenter.** The method is based on the reduction of alkaline copper solutions by hydroxylamine.—A study of the isomerism and optical activity of quinquevalent nitrogen compounds, by Mr. H. O. **Jones.** A number of derivatives of the type N.R.R′R″X have been prepared, but from these no optically active isomerides could be obtained.—The influence of various substituents on the optical activity of tartramide, by Messrs. P. F. **Frankland** and A. **Slator.**—The influence of cyclic radicles on optical activity; tartaric-*ar*- and *ac*-tetrahydro-β-naphthylamides, furfurylamide and piperidide, by Messrs. P. F. **Frankland** and E. **Ormerod.** Part of a systematic examination of the relationship between rotation and chemical constitution of optically active substances.—The rotatory power of maldiamide, maldi-*n*-propylamide, and maldibenzylamide, by Mr. J. **McCrae.**—Further experiments with phosphorus sesquisulphide, by Mr. E. G. **Clayton.** The results of the application of Mitscherlich's test to specimens of phosphorus sesquisulphide which had been exposed to air under various conditions were given.

Royal Astronomical Society, November 13.—Prof. H. H. Turner, F.R.S., president, in the chair.—Mr. P. H. **Cowell** read a paper on errors in the moon's tabular longitude as affecting the comparison of the Greenwich meridian observations from 1750 with theory.—The **Astronomer Royal** read a paper on the large sun-spots of October and November, and the associated magnetic disturbances, and exhibited photographs of the sun-spots taken at the Royal Observatory, and of the magnetic tracings, showing the most considerable disturbance to have been on October 31.—Mr. Newall showed and described a series of fine spectroheliographs of the great spot-groups, taken by Prof. G. E. **Hale.**—Mr. **Newbegin** showed photographs of the November sun-spots.—Spectroheliographs of the spot-groups taken on October 9 and 31 in K light by Mr. **Evershed,** showing the flocculent masses of faculæ surrounding the spots, were also thrown on the screen.—Dr. **Lockyer** considered the correspondence of magnetic storms with solar prominences was more marked than with sun-spots, and pointed out that magnetic disturbances become more decided as the prominences approach the poles.—Father **Sidgreaves** directed attention to the work at Stonyhurst, and to his conclusion that sun-spots are not the cause of magnetic disturbances, but that both phenomena have a common cause.—Father Sidgreaves then read a paper on a spectrographic study of β Lyræ at the Stonyhurst Observatory; he exhibited slides of a series of spectra taken at different dates, and explained his theory of the changes in the light of the star.—Prof. **Turner** gave an account of a method of photographing the moon with the surrounding stars, the results of which appeared very promising. In order to reduce its light the moon was covered by an opaque screen, in which was a slit; the screen was drawn slowly across the plate, and a sufficient exposure thus given, while images were obtained of stars down to about the ninth magnitude.—Many other papers were taken as read.

CAMBRIDGE.

Philosophical Society, November 9.—Mr. A. C. Seward, vice-president, in the chair.—Exhibition of living *Gongylus gongyloides,* a floral mantis, by Captain C. E. **Williams.** The insects exhibited show the pupal or nymph stage in the development of this mantis. They were hatched from the egg about January 18 of this year, and in the ordinary course should have attained the imago or winged state at the end of October. Development appears to have been arrested by the unsuitable climate of England, and by loss of appetite under confinement. The floral mimicry is effected by the foliaceous expansion of the prothorax around the insertion of the front pair of legs. This expansion is roughly diamond or oval shaped, and on the under side is of a bright azure blue tipped with rose purple at the angles and margins; in the centre of this disc is a deeply pigmented black spot of triangular shape. The front pair of legs are held closely folded together in the front of the coloured disc. The azure coloured disc resembles a small flower, and the black spot mimics the tube of a corolla. The attitude adopted by the insect when at rest and intent on catching its prey is an inverted position below a leaf or spray of leaves, the coloured side of the prothoracic disc being turned to the brightest light available. Insects, especially butterflies, are readily attracted by the floral simulation. The hinder part of the prothorax is drawn out into a long stalk and coloured a light green, enhancing the floral resemblance. The rest of the body is shaped and coloured to resemble a bunch of dead leaves, and is practically undiscernible amid its natural surroundings. The insects exhibited were brought from Rangoon.—Experiments in wheat breeding, by Mr. R. H. **Biffen** (see p. 92).

PARIS.

Academy of Sciences, November 16.—M. Albert Gaudry in the chair.—A new method of preparation of argon, by MM. H. **Moissan** and A. **Rigaut.** The argon is prepared in four stages, the first three of which, the removal of oxygen from the air by heated copper, concentration by passing over a mixture of lime and magnesium, twice, are identical with the processes worked out by Sir W. Ramsay and Lord Rayleigh. In the fourth stage the gas, after passing over a lime-magnesium mixture, is treated with pure metallic calcium at a dull red heat. Since calcium forms a hydride stable at 500° C., this removes at one operation the last traces of nitrogen and hydrogen. The apparatus produces one litre of pure argon in twelve hours.—Mr. G. W. Hill was elected a correspondant in the section of astronomy in the place of M. Schiaparelli, elected foreign associate.—On the analytical nature of the solutions of certain partial differential equations of the second order, by M. S. **Bernstein.**—On the use of the Schrader tacheograph in hydrographic work, by MM. F. **Schrader** and Ch. **Sauerwein.**—On the extraction of oxygen by the partial liquefaction of air, by M. Georges **Claude.** A method is described in which only a portion of the air is liquefied at a low pressure, and this liquid, with any preliminary evaporation, gives a gas containing 92 per cent. oxygen, the apparatus giving about 35 cubic metres of this per hour.—The measurement of very small angles of rotation, by M. Marcel **Brillouin.** Between the two Nicol prisms is introduced a thick plate of Iceland spar with parallel faces, cut at 45° to the axis, a half-wave plate, at 45° to the principal sections of the spar, and a second plate of spar similar to the first. It is possible to measure to

a half-second of arc with this arrangement.—On the determination of maxima and minima of transparency, by M. C. **Camichel.** A modification of the Gouy spectrophotometer, in which the two Nicols are replaced by a rotating disc, partly cut away in sectors.—Some remarks on the magnetic storm of October 31, by M. Em. **Marchand.** The author concludes that during magnetic storms the currents disturbing the earth's field are situated at least partially in the upper regions of the atmosphere. The magnetic storm coincided with the passage of an important group of sun-spots across the central meridian.—On a rigorous separation of the rare earths, by MM. G. **Urbain** and H. **Lacombe.** By the addition of the double nitrate of magnesium and bismuth to the mixture of double nitrates of rare earths, each earth has as its only impurity bismuth, which is readily removed, instead of another rare earth. The method has been applied with success to mixtures of samarium and gadolinum.—On kermes mineral, by M. J. **Bougault.**—On the acetylenic ketones, a new synthesis of the isoxazols, by MM. Ch. **Moureu** and M. **Brachin.** Ketones of the type of acetyl-phenyl-acetylene react quantitatively upon hydroxylamine, giving isoxazols.—On the retrogradation of starch, by M. L. **Maquenne.** The retrogradation is favoured by lowering the temperature and by the presence of minute amounts of mineral acids.—The influence of the nature of the external medium on the organic composition of the plant, by MM. Alex. **Hébert** and E. **Charabot.**—On the relation between the luminous intensity and energy of assimilation in plants belonging to different biological types, by M. Fr. **Weis.**—On the structure of the cotyledons and the disposition of certain adventitious roots in young labiate plants, by M. Réne **Viguer.**—On polymorphism in nitrates, by M. Fréd. **Wallerant.**—On some analogies of geological *facies* between the central zone of the eastern Alps and the internal zone of the western Alps, by M. Pierre **Fermier.**—On artesian wells, by M. D. **Pantanelli.** A consideration of the influence of the pressure exerted by the rock mass upon the subterranean sheet of water upon the well level.—On a new fossil-bearing level in the Keuper beds, by MM. M. **Piroutet** and Arm. **Laurent.**—A comparison of the letters of the alphabet from the point of view of the speed of writing. The formation of a rational alphabet, by MM. André **Broca** and D. **Sulzer.** The present alphabet is badly conceived from a physiological point of view. A series of signs is suggested by means of which the speed of recognition of letters could be increased one-third.—The electrical resistance of the human body, by M. Stéphane **Leduc.** The electrical resistance of the human body is especially the resistance of the skin, and this, like all electrolytes, depends on the nature and concentration of the ions it contains.—Contribution to the treatment of cancer by the X-rays, by M. **Biraud.** The disease was a typical epithelioma, and had recurred after one operation. After four months' treatment with the X-rays the pain disappeared, and the size of the tumour was reduced three-quarters.—Contribution to the study of hydrochloric acid in digestion, by MM. A. **Desgrez** and J. **Adler.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 26.

ROYAL SOCIETY, at 4.30.—Mathematical Contributions to the Theory of Evolution, XII., On a Generalised Theory of Alternative Inheritance, with Special Reference to Mendel's Laws: Prof. K. Pearson, F.R.S.—On the Distribution of Stress and Strain in the Cross-Section of a Beam: J. Morrow.—Some Experiments in Magnetism: T. C. Porter.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Testing of Electric Generators by Air Calorimetry: R. Threlfall, F.R.S.—The Edison Accumulator for Automobiles: W. Hibbert.

FRIDAY, NOVEMBER 27.

PHYSICAL SOCIETY, at 5.—An Electrical Thermostat: Horace Darwin.—On the Occurrence of Cavitation in Lubrication: S. Skinner.—A Lecture Experiment in Electrical Resonance: Dr. W. Watson.

ROYAL ASTRONOMICAL SOCIETY, at 8.—Lecture by the President, Prof. H. H. Turner.

MONDAY, NOVEMBER 30.

SOCIETY OF ARTS, at 8.—The Mining of Non-Metallic Minerals: Bennett H. Brough. (Cantor Lectures. II.)

INSTITUTE OF ACTUARIES, at 5.—On the Comparative Mortality among Assured Lives of Abstainers and Non-Abstainers from Alcoholic Beverages: Mackenzie Moore.

TUESDAY, DECEMBER 1.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Discussion of Paper on the Distribution of Mean and Extreme Annual Rainfall over the British Isles: Dr. H. R. Mill.

ZOOLOGICAL SOCIETY, at 8.30.—Note upon the Tongue and Windpipe of the American Vultures, with Remarks on the Inter-relations of the Genera Sarcorhamphus, Gypagus and Cathartes: F. E. Beddard, F.R.S.—On the Mammals of Cyprus: Miss Dorothy M. A. Bate.—On the Cause of Death of a Polar Bear recently Living in the Society's Gardens.—Dr. R. N. Salaman.

WEDNESDAY, DECEMBER 2.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF ARTS, at 8.—The Fiscal Problem: Sir C. M. Kennedy, K.C.M.G.

GEOLOGICAL SOCIETY, at 8.—Note on the Garnet-bearing and Associated Rocks of the Borrowdale Volcanic Series: (The late) E. E. Walker.—A Contribution to the Glacial Geology of Tasmania: Prof. J. W. Gregory, F.R.S.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Characteristics of some Almond and Allied Oils: Dr. J. Lewkowitsch.—Note on the Quantitative Estimation of Mechanical Wood Pulp in Papers: C. F. Cross and E. J. Bevan.—The Estimation of Aldehydes and Ketones in Essential Oils: H. E. Burgess.—Note on the Estimation of Sperm Oil: L. M. Nash.

THURSDAY, DECEMBER 3.

ROYAL SOCIETY, at 4.30.—*Probable Papers:*—On the Fructification of *Neuropteris heterophylla*, Brongniart: R. Kidston, F.R.S.—Histological Studies on Cerebral Localisation: Dr. A. W. Campbell.

LINNEAN SOCIETY, at 8.—On Littoral Polychæta from the Cape of Good Hope: Dr. Arthur Willey, F.R.S.—Notes on *Myriactis Areschougii* and *Coilodesme californica*: Miss May Rathbone.

RÖNTGEN SOCIETY, at 8.30.—A New Jointless Section Wound Induction Coil, and a Flat Spiral High Frequency Apparatus: Leslie Miller.

AËRONAUTICAL SOCIETY, at 8.—Report of the International Kite Competition—(1) Mathematical Portion: Prof. C. V. Boys, F.R.S.; (2) Descriptive Portion: Eric Stuart Bruce.—Preliminary Communication on the Longitudinal Stability of Aëroplane Machines: Prof. G. H. Bryan, F.R.S., and W. E. Williams.—The Balloon Ascents made by the late Mr. James Glaisher, F.R.S., for Scientific Purposes: W. Marriott.—The Mechanical Imitation of Bird Flight: W. Cochrane.

CHEMICAL SOCIETY, at 8.—On the Molecular Formulæ of some Fused Salts as Determined by their Molecular Surface Energy: J. F. Bottomley.—Acid Salts of Monobasic Acids: R. C. Farmer.—The Atmospheric Corrosion of Zinc: G. T. Moody.—The Solubilities of the Hydrates of Nickel Sulphate: B. D. Steele and F. M. G. Johnson.

FRIDAY, DECEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—On Land, Freshwater and Estuarine Deposits, with Special Reference to Recent Excursions; Lecture by the President, Mr. H. W. Monckton.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Artificial Draught, as Applied by Fans to Steam Boilers: W. H. A. Robertson.

CONTENTS.