THURSDAY, DECEMBER 31, 1903.

SIR H. JOHNSTON'S BRITISH MAMMALS.

British Mammals; an Attempt to Describe and Illustrate the Mammalian Fauna of the British Islands from the Commencement of the Pleistocene Period to the Present Day. By Sir H. Johnston. Woburn Library. Pp. xvi+405; illustrated. (London: Hutchinson and Co., 1903.) Price 12*s.* 6*d.*

UNLIKE the birds, the mammals of our islands have not been "written out," and there was accordingly abundant room for a thoroughly up-to-date and trustworthy work on this section of the British fauna, which should record all that has been accomplished in connection with the subject during the last ten years or so, and especially with regard to local races, or subspecies, of well-known types. Whether the author has been successful in satisfactorily filling the gap that lay before him it is our purpose to inquire.

In the first place, it may be candidly admitted that in this handsome and strikingly illustrated addition to the "Woburn Library" the author has succeeded in producing an extremely interesting and attractive volume, as, indeed, from his well-known literary skill and experience it might have been confidently predicted that he would do. The selection of a writer of the type of Sir H. Johnston to undertake such an important and difficult task reflects, however, to a certain extent on the methods and ways of professed naturalists. Had one of the latter class been entrusted with the work, it is only too likely that he would have produced a volume of the dry-as-dust style, wanting in literary skill and picturesqueness, and therefore practically unreadable by the general public. All such danger has been avoided by the selection of such a famous amateur as Sir H. Johnston, whose work is in many respects well suited to the needs of a popular *clientèle*, although we think there is somewhat too much of such "blessed words" as "alisphenoid canals," "entepicondylar foramina," &c., the significance of which will scarcely be appreciated by the class of readers the author is likely to attract.

As regards the general character and scope of his work, Sir Harry Johnston has made British mammals a peg on which to hang a long and somewhat discursive account of mammals in general, and extinct ones in particular, and it must be confessed that on many occasions he gets decidedly far away from his proper subject. In this connection it may be noticed that, although Sir Harry alludes to his work as a compilation, from the absence of references to authorities (which is a conspicuous feature throughout the volume) it might easily be imagined by the uninitiated reader that many of the theories (often alluded to as though they were facts) were the author's own, a case in point being the presumed African origin of certain elements in the South American fauna.

For our own part, we confess that we do not like the plan of mixing up the later extinct forms with those still living, as it tends to confusion and to give an exaggerated idea of the extent of the British fauna, which is now essentially of an island type. This, however, is purely a matter of opinion, and the author has a perfect right to follow his own inclinations in this respect. Even here, however, he makes a serious blunder at starting. For in the table of "epochs," on p. 16, he includes the Pleistocene in the "Tertiary" instead of in the "Quaternary."

Although confessedly an amateur, and to a great extent, therefore, unacquainted with the *technique* and details of his subject, Sir H. Johnston has apparently such overweening confidence in his own abilities and knowledge that he has scorned specialist aid in the revision of his proofs, which are consequently disfigured by a host of blunders and omissions. That the study of British mammals has not been advanced by his labours is a mild way of putting the matter. It might be urged, indeed, that in a popular work this was not to be expected, and were it not for the ambitious and comprehensive style in which the task has been attempted, there might be some justification for this plea. As it is, there is none.

To justify this indictment, we proceed to quote a selection from the errors and omissions.

Firstly, as regards mammals in general, we notice on p. 19 that Platanistid dolphins are stated to occur only in the Amazon and Ganges. On p. 48 a vague theory of the use of the folds in the throat of the rorquals is alluded to in a foot-note, but no reference at all is made to the main use of these structures, namely, to form a dilatable pouch for the temporary reception of prey. On p. 84 we find the term *calcaneum* employed instead of *calcar* for the supporting style in a bat's flying membrane. Three pages earlier (p. 81) we find it confidently stated that bats never produce more than two young at a birth, whereas the occurrence of three or four in an American family was announced early in 1902 by Mr. Thomas, and later on in the same year by Mr. Lyon. On p. 135 the astounding suggestion is made that the British fossil panda (*Ælurus anglicus*) may have been more nearly allied to *Æluropus* than to the members of the genus in which it is placed. Apparently the author has no conception of the differences between the molar teeth of the two genera. On p. 166 it is stated that hyænas have only one pair of lower premolars, while, on the next page, the lower carnassial tooth of the spotted hyæna is said to be "reduced in size" as compared with that of the striped species, whereas precisely the reverse of this is the case. These are not all the instances of the author's lack of knowledge concerning mammalian dentition, for on p. 115 we find no reference to the opinion that the functional dentition of marsupials represents the milk series, or to a paper published a few years ago in the Zoological Society's *Proceedings* in which it was attempted to show that the number of premolars in the same group is four instead of three. We should also much like to know what authority there is for the statement (p. 353) that the Indian nilgai is the nearest living ally of the oxen. Even more astonishing is the assertion, on the next page, that the bisons take their origin from the Oriental bibovine group of cattle, as represented by the gaur and banting. Apparently the author is un-

acquainted with the fact that the conformation of the skull and the position of the horns are quite enough to refute this, apart from the circumstance that the "bibovines" exhibit a specialised, and the bisons the primitive, type of coloration. Again, on p. 351, we are told that the ewes of the European muflon are invariably hornless.

Many remarks might be made with regard to the author's knowledge of extinct mammals, but perhaps it will suffice to indicate the extent of this by reference to a passage on p. 270, where we are calmly told that the Pliocene brachydont *Rhinoceros etruscus* is identical with the Pleistocene hypsodont *R. leptorhinus*! If this be not enough, we may refer to p. 291, where it is suggested that the extinct Sedgwick's deer may be allied to the Oriental rusine group. Evidently the author does not know the difference between a "brow-tined" and a "fork-tined" antler, as, indeed, may be gathered from certain statements in regard to supposed roe-antlers later on in the work.

Passing on to the modern British fauna, a few lines may be devoted, in the first place, to the author's nomenclature. We are glad to see that, in the case of the generic names of the bats, modern usage is followed. We also note that in this group the author follows the "*Scomber-scomber*" usage, thus calling one species *Myotis myotis*. This being so, we fail to see why the otter and the badger are not respectively termed *Lutra lutra* and *Meles meles*, in place of *Lutra vulgaris* and *Meles taxus*. It is well to be consistent even in nomenclature! Still more surprised are we to find the weasel designated *Putorius vulgaris* on p. 161 and *P. nivalis* in the illustration on p. 163.

In the notice of Bechstein's bat, the author states that Mr. Millais took a specimen in 1902, whereas he should have written 1901, and he seems unaware that in the former year a note was published in regard to a specimen taken in 1886. In treating of the smaller rodents, the author has totally ignored the work of modern specialists. For instance, in the case of the squirrel, there is no mention of the fact that the British animal is regarded by specialists as a distinct form, which should be known as *Sciurus leucurus* if ranked as a species, or as *S. vulgaris leucurus* if a subspecies. Again, although mention is made of its seasonal colour-changes, the important fact that there is a curious difference in regard to the shedding of the coat on the body and on the tail is left unrecorded. Full reference should have been made to the paper by Mr. Thomas on this subject. Worse remains to be told in the case of the mice. In describing the wood-mouse, the author records and names five local races. Evidently, therefore, he considers such races worthy of notice. On turning, however, to the common mouse, we find no mention of the Hebridean wild form described by Captain Barrett-Hamilton as *Mus muralis* in 1899, while there is an equal lack of reference to the local forms of the harvest-mouse named by the same writer in that and the following year, and consequently the omission of the full title of the British race, namely *M. minutus minimus*. Neither is there any reference to the fact that the British short-tailed field-vole should be known as *M. agrestis neglectus*, as pointed out by Captain Hamilton in 1896. Bearing in mind what has been said with regard to the local races of the wood-mouse, we can only attribute these omissions to ignorance on the part of the author—ignorance for which there is not the faintest shadow of an excuse in these days of up-to-date Zoological Records.

Other instances of this type might be quoted. We pass on to notice, however, that on p. 296 the author has actually reproduced figures of certain antlers from Scotland, published by Mr. Millais as those of the roe-buck, although it has long since been shown that the specimens in question are antlers of the South American pampas-deer which by some means had got into Scotland. Not content with this, Sir Harry proceeds to argue that these "fork-tined" antlers approximate to the red deer type. Evidently his lack of knowledge of antlers is on a par with that shown in connection with zoological literature.

After so much fault-finding, we are glad to record that the author calls the ancient wild ox by its proper name of aurochs, although, here again, if he would but take the trouble to read the descriptive label in the Natural History Museum he would find that his views as to the relationship of the white park cattle (which he will persist in calling wild) are far from being up to the level of those who know anything about the subject, and are acquainted with the meaning of albinism.

Among the most attractive features of the work are the coloured plates, all of which have been reproduced from original water-colour sketches by the author himself, whose artistic taste and powers are well known. Unlike the pictures of animals which we are accustomed to see in zoological publications, these sketches are designed from a decidedly artistic standpoint, and are admirably suited to a work of this nature. Many of the illustrations in black and white are also by the author, and are, for the most part, both life-like and artistic. We should, however, like to know what authority there is for depicting the long-eared bat (p. 105) with the ears depressed, while the wings are extended.

In conclusion, we may say that, had the author contented himself with writing a book of a less pretentious style, and ignored anatomy and subspecies, we should have had less cause to find fault with his effort. As it is, a thoroughly accurate, complete, and up-to-date book on British mammals has yet to be written.

R. L.

THERMODYNAMICS.

Treatise on Thermodynamics. By Dr. Max Planck. Translated by Alexander Ogg, M.A. Pp. xii+272. (London: Longmans, Green and Co., 1903.) Price 7*s.* 6*d.* net.

THE important part played by thermodynamics in modern physics, and especially in chemistry, is a sure guarantee that an English translation of Prof. Planck's work will receive a warm welcome in this country. It deals with the first and second laws, changes of state, systems defined by any number of

variables, the phase law, gaseous systems, dissociation, and dilute solutions.

As is well known to specialists in thermodynamics, Prof. Planck, instead of using the thermodynamic potentials of the majority of writers, prefers to deduce the conditions of equilibrium from the study of the function

$$\frac{(\text{energy})-(\text{temp.})(\text{entropy})+(\text{pressure})(\text{vol.})}{-(\text{temperature})}$$

i.e. the ordinary thermodynamic potential corresponding to temperature and pressure as independent variables, divided by temperature and reversed in sign. While this function has not the advantage of being an exact analogue of the potential functions in statics, the differential coefficients of which with respect to the position-coordinates are equal to the corresponding generalised force-components, its introduction undoubtedly serves to bring the conditions of equilibrium and stability of thermodynamic systems into closer connection with the entropy properties. We should prefer to see the principle of degradation of energy instead of the entropy principle adopted as the basis of thermodynamics. This would obviate the introduction of Planck's function, the ordinary thermodynamic potentials taking its place. The compensating drawback is that the available energy of a system is not a definite measurable quantity, but is dependent on the surrounding media.

The method of introducing such notions as temperature and entropy cannot be regarded as satisfactory. We find in chapter i. the usual juggling with the terms "perfect gas" and "absolute temperature." Thus absolute temperature is defined in § 9 by the expansion of gases, while in § 24 these gases are shown to obey laws which are not rigorously consistent with this definition of temperature. The term "perfect gas" is introduced in a vague sort of way in this chapter, but without sufficiently definite statements being made as to what is a perfect gas and what is not. To define absolute temperature by means of a perfect gas and then define a perfect gas by means of its laws of expansion referred to absolute temperature is merely working round in a circle.

Moreover, the *entropy* of unit mass of a substance is defined, in the first instance, by the formula

$$\phi = c_v \log \theta + \mathrm{R}/m \log v + \text{const.},$$

applicable to the case of a perfect gas. This definition is suggestive of the definitions of *pole* and *polar* given in many text-books, according to which "the line $xx'+yy'=c^2$ is called the polar of the point $x'y'$ with respect to the circle $x^2+y^2=c^2$." But while the effects of the latter definitions are made patent by the absurd answers sent up by a large proportion of examination candidates to pole and polar questions on (*e.g.*) a so-called "general conic," opportunities at present do not occur so frequently in this country of testing how an average student, after reading such a treatment, would "define entropy." To define a physical quantity in the first instance by means of its value in a particular case, when the definition is not valid in the more general case, is certain to be misleading, and no amount of subsequent discussion, such as Prof. Planck admittedly gives, can set matters right. We have marked instances of the same thing in the old-fashioned treatment of electrostatics and magnetism, in which bodies were stated without reservation to attract one another according to the law of the inverse square, and when dielectrics were subsequently introduced there seemed something wrong about the whole theory which the writer of this review never cleared up until after his undergraduate days.

From this it will be seen that if Prof. Planck's treatise is no worse than many others on the same subject, it is in some essential points no better. It is a book which will be read with great interest by the physicist, generally in conjunction with other books on the same subject, but it is scarcely the book for an engineer to refer to for information on the nature of "entropy." G. H. B.

GEOGRAPHY AS A SCIENCE.

The Teaching of Geography. By Prof. J. W. Gregory, D.Sc., F.R.S. (Melbourne and London: Whitcombe and Tombs, Ltd.)

The Austral Geographies. Classes ii., iii., iv., v. and vi. Same Author and Publishers.

PROF. J. W. GREGORY is taking an active part in the promotion of sound geographical instruction in the land of his adoption. In a lecture recently published he sets forth the scope of geography and the way in which it should be applied to education. In a series of school-books he shows practically how he would do this for Australian children.

For Prof. Gregory geography is not a science, but a branch of knowledge which may be taught scientifically—its subject-matter is "description drawn from observation; it is not a search for underlying principles, nor a discovery of ultimate causes." In applying this descriptive knowledge to education Prof. Gregory points out that descriptions must glide into explanations and awaken interests which cannot be satisfied without understanding this world of ours. The geographer must not hesitate to borrow from literature, history, or science that which will make his appeal to his pupil's imaginations most stimulating. Prof. Gregory's scheme, as developed in the "Austral Geographies," is to begin with a plan of table, school-room, school, &c., leading to a map, directions, seasons, clouds, rivers, land forms (in the first stage these are definitions), a brief description of Victoria, and a few lines about other Australian States and the continents. In each succeeding book some sections of physiography are discussed, and are followed by a description of (*a*) Australasia in Class iii., (*b*) the continents ending with Australia in Class iv., (*c*) the British Empire in Class v., (*d*) Europe, U.S.A., Japan, Pacific Archipelagoes, and world trade routes in Class vi. Both the physiographical and the geographical parts are so planned that each year more advanced conceptions, as well as greater details, are given. The books, in the hands of a good teacher who applies the hints given in Prof. Gregory's lecture, should yield useful results, and teach the pupil much about land forms and climate and descriptive topography.

The physiographical part is the better, but the limitations which Prof. Gregory applies to geography have hampered his treatment of the rest of the book. The land forms (a better term than earth forms) are accurately described, but although in his lecture he vigorously insists on "the fact of facts in geography is the circulation of water by its evaporation from the sea, its movement through the air, as invisible aqueous vapour, its concentration in clouds, and its fall as rain," he practically ignores climate in his descriptions of the different countries. He loses more than half the educational value through this neglect. Climate and configuration are equally indispensable fundamental factors in geography.

We agree with him when he protests against the idea that anthropology, zoology, botany, astronomy and geology are but branches of geography. This is not the geographer's point of view. The misconception is due to the confusion of the old South Kensington physiography—a useful introduction to elementary science, mainly physical, especially in its cosmical and terrestrial aspects—with geography. This physiography, as Prof. Gregory points out in his preface, gave a valuable training to many a teacher of geography, and helped to expel deep-rooted fallacies and misleading expressions which were (and to some extent still are) to be found in many geographical textbooks. We fear that Prof. Gregory believes that geography consists of two parts, a physiographical part which is scientific, and a topographical part which is purely descriptive.

We have no wish to undervalue the descriptive aspect of geography, but this does not involve a rejection of geography as a branch of science. Prof. Gregory, and those who think as he does, have not yet shaken off the effects of their own schoolboy experiences. They have not seen the world as composed of a number of very complex associations of rock, water, air, plant, and animal, including man, which may be classified generically and specifically as readily as the organisms which they contain. The aim of the geographer, like that of the botanist or zoologist, is not confined to observing and describing phenomena, but includes comparison, classification and interpretation. It is a science, a science of forms which have not hitherto been generally recognised as such, and the activities within and around them. The educational value of geography is as much in its scientific discipline as in its appeal to the imagination and sympathy. Prof. Gregory's books fall short of the ideal in so far as he excludes scientific geography from his descriptive pages. He has not yet recognised these higher groupings of phenomena connected by a specific topography. We venture to think that the first part of the twentieth century will be as noted for the recognition and study of these macro-organisms as the latter part of the nineteenth century was for the recognition and study of micro-organisms, and we believe that the beneficial effect on the body politic will be as great in the one case as it has been in the case of the individual in the other.

A. J. HERBERTSON.

LIQUID FUEL.

Liquid Fuel and its Combustion. By W. H. Booth. Pp. xx+411. (Westminster: Archibald Constable and Co., Ltd., 1903.) Price 24*s.* net.

IN view of the great interest taken at the present time in the subject of liquid fuel and the part it is likely to play in the future, Mr. Booth's book comes as a welcome record of the work done in the past, and would have been enormously enhanced in value had the references to the original papers been fully quoted.

The first part of the work deals with the general properties and advantages of liquid fuel, and a good deal of this portion of the book might with advantage be omitted in a future edition, as, for instance, the chapter on water, its properties and purification, which are certainly out of place in a book devoted to a special subject and not likely to be used as a manual for boiler practice.

Mr. Booth's ideas on the subject of combustion are open to criticism, as he is evidently a strong believer in the preferential combustion of the hydrogen in hydrocarbons being the cause of the liberation of carbon in the form of smoke and soot when there is insufficient air for complete combustion in the boiler furnace, but a consideration of the actions taking place in a water gas generator may shake his belief in this, as, if at such temperatures any preferential action exists, the fact that steam passed through red-hot carbon yields carbon monoxide, carbon dioxide, and hydrogen would certainly point to carbon and not hydrogen as the element most favoured by the attentions of the oxygen at the temperature of the furnace.

On p. 105 the author breaks into amusing diatribes against the man of science, and comes to the conclusion that "when the most important industrial operations are absolutely neglected by our supposed teachers and leaders of scientific practice, it devolves upon those to whom science is less familiar, but more attractive, to step into the breach." This sentence probably explains a good deal of the vagueness to be found in the author's speculations on liquid and gaseous carbon and solid hydrogen in the portion of the work devoted to calorific value and combustion.

In the second part of the book practical engineering questions are dealt with, such as oil storage, the atomising of oil for combustion, and the work which has been done with liquid fuel, both on the Continent and in America, and here the author is thoroughly at home.

The engineering side of the question is admirably handled, and the collection of data which is given will render this part of the work of exceptional value to those dealing with this important subject.

The chapters on compressed air, flue gas analysis, and calorimeters will be welcome to many practical men, and the appendix is of special value as containing a report of the United States Naval Bureau on tests of liquid fuel for naval purposes.

There is no question that the time has now been reached when the methods of burning liquid fuel are

sufficiently advanced to ensure a very considerable advantage over solid fuel, and that the great point that remains to be solved is the oil supply, which at the present time is so completely in the hands of big commercial combinations that any development of its use at once leads to an increase in price that renders its employment impossible. It must also be clearly borne in mind that the total oil production of the world is but a small fraction of that which would be needed if liquid fuel became universally adopted, and that of this quantity only a small proportion would be of the quality fitted for fuel purposes on board ship.

Mr. Booth's book is one which will be welcomed by all interested in this very important subject.

OUR BOOK SHELF.

Die "Seele" als elementarer Naturfaktor. Studien über die Bewegungen der Organismen. By Hans Driesch. Pp. vi + 97. (Leipzig: Wilhelm Engelmann; London: Williams and Norgate, 1903.) Price 1*s.* 9*d.*

THE relation of soul to body is sometimes formulated as a "parallelism," sometimes as "interaction," and difference of theory depends, as a rule, on differences of standpoint. There is, however, another point of view in some ways more promising; it deals primarily with the organism as a whole, and posits the problem, "How must we conceive organisms which present the phenomena of purposive action?" The position is promising, because it appears free from the presuppositions involved in the direct question, How is mind related to body? but it really has an equally ambiguous element, because it involves placing on one scale forms of life which cannot be shown to possess the required continuous gradation. None the less, the method is interesting, and this book is an interesting example of it.

First, the author argues that mechanical explanations of life are inadequate; they fail to account for complicated readjustments; they fail, above all, to account for reactions which are not simple reflex movements, but imply choice and trial of means. The criticism establishing this deals with the older theories of reflex action, instinct, and the "Zentrum." This "Zentrum," in any sense in which it subserves merely mechanical combination, must be rejected; for it the author has to substitute some conception which admits of "free combination." This conception suffers rather from brevity of exposition, and is defined chiefly by negation; some points emerge clearly; the physical elements (nervo-cerebral system) are not themselves final, but an intermediary factor; there is over and above these the system of what the author calls psychoids, apparently gradated (Oberpsychoid, Unterpsychoid, &c.); the structural basis of, *e.g.*, association does not contain in itself the regularity required, but is a means to it. In addition to the mechanical factors, autonomous factors are asserted; the "outer factors" condition, but do not make experience; the gap which a physicochemical theory leaves is filled by the "Psychoid-Theorie" (p. 66).

The author does not err on the side of dogmatism; his exposition is interesting, and its relations to cognate psychological and metaphysical doctrines are carefully indicated; but is there any proof that "Bio-autonomie" has only this explanation? and is the solution by means of the "Psychoid" (supposing we know exactly what that is) more than an old problem in a new form? G. S. B.

Indians of the South-west. By George A. Dorsey, Ph.D. (Chicago: Passenger Department, Atchison, Topeka and Santa Fe Railway System.)

IT IS characteristic of American enterprise that the Passenger Department of the Atchison, Topeka and Santa Fe Railway System should issue a concise handbook on the Indians of the south-west by a distinguished field anthropologist. This most fascinating and important ethnological area has been investigated by many distinguished American ethnologists, whose results have appeared in various publications. The disjointed character of these memoirs, although they are often presented with a great thoroughness, has rendered it difficult for students, on this side of the Atlantic at least, to gain a clear conception of the various Indian groups, and of the significance of their complex rituals. The time is therefore ripe for a succinct presentation of the main facts already published concerning these peoples. Dr. G. A. Dorsey, of the Field Columbian Museum, Chicago, has travelled extensively in the south-west, and readers of NATURE have frequently been informed of his valuable contributions to American ethnology. He is therefore eminently qualified to undertake the task, and in the 223 pages of this book he has condensed a vast amount of trustworthy information regarding the daily life, industries, and religious ceremonial of the natives.

The following subjects are dealt with:—the tribes, linguistic stocks and industries of the south-west peoples; the Pueblos of the Upper and Lower Rio Grande; the homes of the ancients; Zuñi and the seven cities of Cibola; domestic life of the Hopi; Flute, Antelope, Snake, and other ceremonies; ancient home of the Hopi; the Navaho, the Apache; tribes of the Yuman and Piman stock, and the tribes of south-eastern California. The book is illustrated with a profusion of beautiful and instructive illustrations, and a valuable bibliography is appended. Doubtless the publication of this book, of which 15,000 copies have been issued, will lead to the south-west becoming a popular resort for tourists.

This will rapidly hasten the Europeanising and vulgarising of the most picturesque and unspoilt of the existing pagan peoples of North America; indeed, traces of this decay are not already wanting. If this book succeeds in the purpose for which it was brought out, it will materially, though unintentionally, help to destroy the last surviving relic of advanced pre-Columbian culture in North America.

The Butterflies and Moths of Europe. By W. F. Kirby, F.L.S., &c. Pp. lii+432. (London: Cassell and Co., Ltd., 1903.) Price 21*s.* net.

THIS book was originally published in 1882, and then comprised all the species that were included in the catalogue of Staudinger and Wocke (1871). The present volume brings the subject much more up to present knowledge, as it now contains descriptions of all the species of strictly European butterflies and larger moths enumerated in the great catalogue of Palæarctic Lepidoptera published by Staudinger and Rebel in 1901. The few species found in Madeira and the Canary Islands, but not met with on the Continent of Europe, have also been included, so that the work will afford an excellent help to any entomological Continental tourist, or those who perforce escape the rigour of our winter months in the Atlantic islands. Mr. Kirby has also brought our knowledge of the larvæ of these species up to date by the description of those discovered since the publication of his previous volume.

The author has achieved considerable success in the difficult task of writing a popular guide without pro-

ducing a non-scientific volume, which is embellished with fifty-four plates, fifty-three of which are coloured, and contains a full and useful introduction. With this, among the many other popular works on natural history recently published, we may look forward to a prospective time, when the general reading public, and lovers of animal life, will be sufficiently acquainted with the main aspects of general zoology as to enable them better to grasp the real import of the many conclusions and theories—philosophical and otherwise—which have followed the great Darwinian conception. It may also be hoped that the narrative of life-histories of insects, now so frequently detailed and so easily consulted, may incite a further cultivation of economic entomology, a subject in which our American cousins still hold the field.

Grandeurs Géométriques. By J. Pionchon. Pp. 128. (Paris: Gauthier-Villars, 1903.) Price 3.50 francs.

EXPERIENCE in the teaching of young engineers at Grenoble has induced Prof. Pionchon to undertake the task of publishing some seventy little volumes presenting in a clear outline the fundamental notions, theoretical and practical, which should form the basis for further study. The collection includes sections on mathematics, mechanics, physics, electricity, and economics, and the present volume is the fourth of the first section. It explains in an elementary way the nature of the different geometrical entities and the methods by which they are measured. There is no attempt to dip beneath the surface and introduce any of the philosophy of the subject, but some passages in smaller print give rather more advanced considerations and analytical formulæ without proof.

If the book stood alone it could perhaps be passed without comment, but the prospect of seventy others of the same kind compels a word of criticism. It must be admitted that the contents appear to be perfectly sound, but beyond this we have little praise to bestow. Whatever it contains of value ought to be in the notebook of every engineering student who has had the minimum necessary instruction in mathematics, and if it is not already there, the reading of this volume will only lead to that undesirable sort of knowledge which too often forms the main part of the mathematical equipment of engineers, and is unfortunately encouraged by some of their teachers. The appearance of the pages suggests that they are designed to compensate physical as well as intellectual myopia, and this emphasises the inanity of many of the propositions. The author must be singularly devoid of the sense of humour. R. W. H. T. H.

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.*]

Secondary Radiation produced by Radium Rays.

I LATELY had occasion to produce some radium radiographs of two partially overlapping pennies contained in a paper envelope which was laid directly upon the photographic plate. A print from one of the results shows that the shadow of the upper coin is blurred and diminished where the rays pass through air from the edge of this coin to the plate, but that it is sharp and of the correct size where the rays pass to the plate through the lower coin. This seems to point to the production of a considerable secondary radiation by the rays in their passage through air. L. R. WILBERFORCE.

University of Liverpool, December 22.

An Interesting Yucca.

IT frequently happens that facts of much general interest are published in systematic monographs and other taxonomic works, and are in consequence overlooked by many of those to whom they would be most valuable. Turning over the pages of the revision of the Liliaceous group Yucceæ, published with superb illustrations in the 1902 report of the Missouri Botanical Garden, I came across some statements which seem to deserve wider circulation and comment. The whole of the work referred to, by Dr. Wm. Trelease, is exceptionally well worth reading on account of the extremely lucid presentation of the facts, but the statements which especially interested me are as follows:—

The subgenus Chænoyucca contains thirteen species, some of which have the style green while others have it white. *Yucca glauca* is the very common narrow-leaved green-styled species of Colorado and northern New Mexico, extending to South Dakota and central Kansas. The inflorescence is simple, or with an occasional branch. *Yucca constricta* is a white-styled species, very similar to *Y. glauca*, found from the Pecos River region of Texas to Seward County, Kansas, where it meets the range of *Y. glauca*. It has the inflorescence rather amply branched at the top. A few years ago Mr. James Gurney, head gardener of the Missouri Botanical Garden, "was struck with the variety of foliage and difference of vigour of growth" shown by the Yuccas of Seward County, Kansas, all being ostensibly *Y. glauca*. He collected a considerable number of these plants to show the differences, and they were transferred to the Missouri Garden, where some of them have bloomed. Among them was one which had practically the foliage of *Y. glauca*, but it produced "a rather ample long-pedunculate panicle of pure white flowers, with white styles," which began to expand at the end of the flowering period of *Y. glauca*. This specimen was by no means to be separated from *Y. constricta*. Other specimens exhibited the normal flowers of *Y. glauca*, and still others had flowers like those of *glauca*, but with a conspicuously branched inflorescence. This last form agrees with the long-lost *Yucca stricta* of Sims, but is placed by Dr. Trelease as a variety of *Y. glauca*. In addition to these differences in the flowers, the foliage varied in breadth and flexibility.

No suggestion is made by the author that the phenomena described are the result of hybridisation, but it is well known that Yuccas are frequently crossed in cultivation, and Dr. Trelease presents an extended discussion of Yucca hybridisation in another part of his paper. In the case of the Seward County plants, we have an unexpected and great mutability developing locally in an ordinarily stable species of wide distribution; and is it not suggestive, to say the least, that this should occur just where the ranges of *Y. glauca* and *Y. constricta* overlap, and that the so-called *stricta* should have more or less intermediate characters taken as a whole, while the features taken separately are nevertheless pure? May this not be a case conforming with the Mendelian laws? In any event, it seems well worth consideration, for the mutability has to be explained somehow or other, that is to say, there must be a reason for it.

Granting the supposed hybrid origin of *Y. stricta*, the case is curiously parallel to that of the perplexing woodpeckers of the genus Colaptes inhabiting the same region, which are intermediate between the eastern yellow-shafted and western red-shafted species.

The only other Yucca which could be involved in the above discussion is the green-styled *Yucca mollis* (*Y. angustifolia mollis*, Engelmann, 1873),[1] but this is not known to extend so far west as to meet the range of *Y. glauca*.

T. D. A. COCKERELL.

Colorado Springs, Colorado, U.S.A., December 13.

[1] Dr. Trelease names this *Y. arkansana*, "in deference to the prevalent American practice in nomenclature," whereby *mollis* is held untenable because of Carrière's prior *Y. gloriosa mollis*, applied to a garden form. A practice which permits a name proposed for a garden variety of a different species to stand in the way of an otherwise valid specific name should surely be condemned.

SOKOTRA.[1]

ALTHOUGH the island of Sokotra is often seen by passengers on the great ocean steamers which pass by the Sokotran Archipelago on their voyages to and from India, eastern Asia and Australia, the fauna had been very imperfectly investigated when, in 1898, a party was dispatched by the joint exertions of the British and Liverpool Museums for the purpose of collecting specimens of the animals, vertebrate and invertebrate. The botany of Sokotra itself had been previously studied by Prof. Bayley Balfour and by Dr. Schweinfurth in 1879–81, and some collections of the animals occurring had been made by them and by other visitors to the islands, but the zoology was still incompletely known.

The party of 1898 consisted of Dr. H. O. Forbes himself, Mr. W. R. Ogilvie Grant, of the British Museum, and a taxidermist. Native assistants and servants were engaged at Aden, and valuable aid was given by the Government of India, which supplied means of transport between Aden and the islands, and lent camp equipage for the use of the explorers.

The Sokotran Archipelago consists of (1) the large island of Sokotra, about eighty-five miles in length, lying 150 miles to the eastward of Cape Gardafui in Africa and about 230 miles S.E. of Ras Fartak in Arabia; (2) Abd-el-Kuri, a much smaller island, lying about half way between Sokotra and Cape Gardafui; and (3 and 4) two islets, Semha and Darsi or Darzi, known as the Brothers, between Abd-el-Kuri and Sokotra. The two larger islands are separated by a submarine valley, 100 fathoms deep, whilst a channel several hundreds of fathoms in depth intervenes between Abd-el-Kuri and Cape Gardafui, and the sea between the islands and the Arabian coast is still deeper.

Dr. Forbes's party landed and made collections on Abd-el-Kuri, and they spent about two months in the hilly region of eastern Sokotra, but were unable to visit the smaller islets. The expedition was much delayed, first by some trivial political difficulties with the Sultan of Sokotra, and secondly, and more seriously, by severe attacks of fever.

Simultaneously with Dr. Forbes's expedition, an Austrian scientific party which, under the direction of Count Lambert, was engaged in exploring the archæology, geology, and natural history of southern Arabia, visited the Sokotran Islands. This party was larger and better equipped than Dr. Forbes's modest expedition, it had a steam vessel, the *Gottfried*, at its disposal, and was able to visit the islet of Semha as well as Sokotra and Abd-el-Kuri. Amongst the members of the Austrian party were Prof. Müller, Dr. Kossmat the geologist, and Prof. Simony the naturalist. At a time when Dr. Forbes's party was suffering severely from fever, and had almost been brought to a standstill by illness, most valuable medical assistance was given to them by the Austrians.

The finely illustrated volume now published contains the results of the expedition, and owes its appearance to the Museums Committee of the Corporation of Liverpool, which has provided the funds, and authorised the publication of the work as a special bulletin of the Liverpool Museums. The book is edited by Dr. Forbes, and comprises a narrative of the journey from his pen, and descriptions by various naturalists of the different groups of animals, vertebrate and invertebrate, collected by the expedition. The list of authors is too long to quote in full, but it comprises, besides Dr. Forbes and Mr. Grant, several eminent zoologists, amongst whom are Mr. Boulenger, Mr. E. A. Smith, Mr. R. I. Pocock, Sir G. Hampson, and Mr. W. F. Kirby, of the British Museum staff, besides Colonel Godwin Austen, Mr.

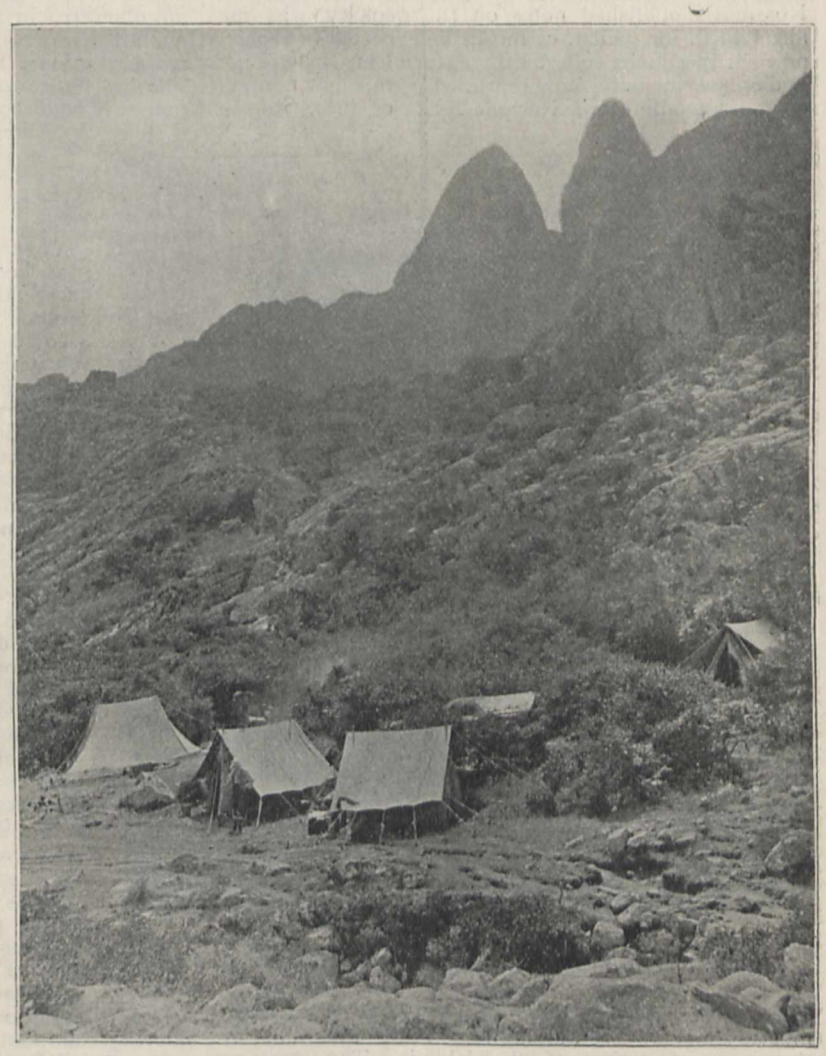

FIG. 1.—Camp at Adho-Dimellus. (From "The Natural History of Sokotra.")

[1] "The Natural History of Sokotra and Abd-el-Kuri." Edited by Henry O. Forbes, LL.D., Director of the Liverpool Museums, &c. Pp. xlvii+598; 30 plates and numerous figures in the text. (Liverpool: The Free Public Museums; Hy. Young and Sons; London: R. H. Porter.)

McLachlan, Lord Walsingham, and several others. A complete list of the plants of Sokotra and Abd-el-Kuri, inclusive of important additions obtained by Dr. Forbes, is furnished by Prof. Bayley Balfour, whilst a note by Prof. J. W. Gregory on the geology is a reprint of a short paper published in the *Geological Magazine* for 1899. This paper, which was founded on a collection of rock specimens brought back by Dr. Forbes's expedition, is supplemented by an extract from a report by Prof. Bonney on a similar collection made by Prof. Bayley Balfour in 1880. It is very much to be regretted that a translation of some of Dr. Kossmat's published notes on the geology was not also added, for whilst, as might be expected in reports on rock specimens collected by naturalists who are not geologists, the notes now reprinted give a fair account of the crystalline and volcanic rocks of the Sokotran group, they afford a very imperfect idea of the sedimentary formations, although the latter occupy by far the greater portion of the islands. The massive Nummulitic, Alveolina, and Hippuritic limestones, of which the islands chiefly consist, and which are of much greater geological importance than the granitic formations underlying them, are only mentioned vaguely as Cretaceous and Eocene limestones. No notice naturally is taken of one curious discrepancy between the collected specimens and Dr. Kossmat's statements. Both Prof. Balfour's and Dr. Forbes's collections from Sokotra contained comparatively modern volcanic rocks resembling those of Aden, whilst Dr. Kossmat states that no such rocks occur in Sokotra. ("Jungvulcanische Bildungen fehlen auf Sokotra—ganz im gegensatze zur gegenüberliegenden Küste Arabiens—vollständing," Sitz. math. nat. Cl. K. Akad. Wiss. Wien, 1899, p. 77.) The absence of Prof. Gregory in Australia is probably the reason why a fuller account of the geology as now known is not supplied.

FIG. 2.—Dragon's-Blood Tree. (From "The Natural History of Sokotra.")

The work is well illustrated with coloured plates and figures in the text. Amongst the plates, the representations of the wild ass (introduced by man but now feral), of some of the birds (especially a new goat-sucker, *Caprimulgus Jonesi*), and of the land mollusca, spiders and insects (butterflies, moths, microlepidoptera, wasps and bees, beetles, &c.), are good examples of chromolithography. The text figures of mollusca and beetles, each surrounded by a grey rectangular area in which the actual shell or insect does not always occupy the central position, though good representations, have a somewhat unpleasing effect. The few figures of plants are good, and especial attention may be directed to the remarkable Euphorbia discovered by Dr. Forbes in Abd-el-Kuri.

As is usually the case in books like that now before us, some curious illustrations of zoological nomenclature are conspicuous. For instance, Mr. Kirkaldy, to whom we are indebted for an account of the Rhynchota, has invented a generic name which he spells *Klinophilos*. Naturalists in general who follow the old rules of Latin orthography would have written *Clinophilus*, but orthographical heterodoxy is by no means the most extraordinary feature of the case, for the new name is given to a genus the type of which appears, according to the rules of Linnæus himself, to be also the type of the Linnæan genus Cimex.

Again, in the two sections dealing with the land mollusca, each of the two authors quotes a generic name, Achatinelloides, given, not by themselves, but by another writer. It is difficult to understand why so absurd a term as this, derived from a double Latin diminutive of dubious accuracy by the addition of a Greek adjectival termination, should be preserved instead of being simply ignored. Some explanation, too, might have been vouchsafed why the same families of mollusca are termed Pomatiidæ and Pupidæ by one author, Cyclostomidæ and Helicidæ by the other.

The discussion of the "distribution of land and water in the Indian Ocean as indicated by a study of the fauna and flora of the islands" is one of the subjects mentioned in the preface as having been left over for a future publication. It is to be regretted that a general summary of the results obtained, so as to afford an idea of the zoological relations between Sokotra and the neighbouring continents, has not been added to the present volume, and it must be hoped that Dr. Forbes, who has already contributed to our knowledge of the distribution of animal life in the islands of the Indian Ocean, will before long publish his views on the results of his investigation of the Sokotran fauna.

The principal features of Sokotran zoology are the following. There are, as already remarked, no indigenous mammals, no batrachians or freshwater fishes. Amongst sixty-seven species of birds recorded from Sokotra, eleven appear to be peculiar to the island, and of the twenty-two birds from Abd-el-Kuri three are unknown elsewhere. Of twenty Sokotran land reptiles no less than fifteen are peculiar, and three genera out of thirteen; the number known from Abd-el-Kuri is only three, of which two are peculiar to the island, whilst one is rather widely dis-

tributed. The forty-eight species of land mollusca inhabiting Sokotra are all, so far as known, restricted to the island, and the same is the case with the nine species from Abd-el-Kuri, whilst it appears very doubtful whether the Cyclostomaceous genus Lithidion, common to the two islands, ranges beyond the Archipelago. In arachnids, myriopods and insects, a large proportion of the species are peculiar, though not always to the same extent. As regards the relationship of the fauna in general, several of the naturalists direct attention to the presence of Mediterranean types, and in the case of the characteristic arachnids, Mr. R. I. Pocock shows that Mediterranean and Ethiopian elements prevail. Zoologically the Sokotran islands may be placed in the great semi-desert region or subregion that extends from the Atlantic to the Indus, but there is a considerable admixture in the fauna of Ethiopian representatives.

Geologically the islands consist of the remains of a plateau composed of almost undisturbed Upper Cretaceous and Eocene strata, resting upon granitoid Archæan rocks which protrude through their sedimentary covering in places and form peaks. The most conspicuous of the sedimentary formations are Nummulitic and Alveolina limestones, and "Rudistenkalk" with Radiolites, as in many other parts of the ancient Mediterranean area. According to the British observers, volcanic rocks of the Aden series are intrusive in the limestones.

It is clear, and on this all are agreed, that the Sokotran islands, although separated from Somaliland and Arabia by sea several hundreds of fathoms in depth, were once a part of the continent, and probably were connected with both Asia and Africa, but it is equally clear that the peculiarity of the fauna indicates long isolation, probably since Pliocene, if not from Miocene times.

In conclusion, whilst it is easy to point out omissions, it is only justice to say that in the publication of the present volume a difficult undertaking has been brought to a successful conclusion, and that all concerned in the production of the work deserve congratulation for having contributed so important an addition to zoological science. The present volume is much more nearly complete than most works of its kind, and has been brought out with praiseworthy despatch.

Of the two accompanying illustrations taken from Dr. Forbes's narrative of the journey, one affords an idea of the characteristic scenery in the Archæan Sokotran hills, and the other is an example of the peculiar vegetation of the island. W. T. B.

THE FOOD AND DRUGS ACTS.[1]

THE consideration of the circumstances which occasioned the epidemic of arsenical poisoning in the latter part of 1900, arising from the consumption of beer brewed from materials which were subsequently proved to contain large quantities of arsenic, and of the facts which resulted from their inquiry into the conditions under which other articles of food are actually prepared on a manufacturing scale, has led the Commissioners to direct attention to the extremely limited official control possessed by local authorities who are charged with the administration of the Acts relating to public health and the sale of food over the operations of manufacturers. The Commissioners point out that the existing machinery of public health administration provides little, if any, system of official control over the proceedings of manufacturers of food or of food ingredients. An individual or a company may start the manufacture of some new composition of food, to be sold under a "fancy" name, but there is no obligation to satisfy the local or any other public authority that the composition or the ingredients are wholesome, or that the conditions of preparation preclude the possibility of contamination by deleterious substances. The sanitary authorities of certain districts have obtained powers, under local Acts, to supervise the conditions of manufacture of ice-cream, but the principle is of extremely limited application in effect, and, broadly speaking, the control which can be exercised becomes available only after the food is on sale to the public. But even then the power possessed by the local authority under the Sale of Food and Drugs Acts is extremely circumscribed. Section 3 of the 1875 Act was drawn with the object of preventing adulteration of food with substances injurious to health, but it is so worded that it is almost impossible to obtain convictions under it, and as a consequence local authorities seldom proceed under it. A notable illustration of the impotence of the section was seen in the cases of prosecutions against publicans for selling arsenicated beer, where the proceedings were almost invariably laid under Section 6. Most persons are agreed that arsenic is a deleterious substance, but it was much easier to convict the publican of selling beer to the prejudice of the purchaser which was not of the nature, substance, or quality demanded than of selling beer containing a poisonous ingredient, to wit, arsenic. The irony of the situation is accentuated by the fact that whereas the fines under Section 3 have some relation to the gravity of the offence, and are sufficiently large to be deterrent, under Section 6, which was aimed at an entirely different class, they may be, and frequently are, wholly trivial.

Another illustration of the inadequacy of the section is seen in the case of "preservatives" in food. A departmental committee appointed by the Local Government Board has reported that in its opinion certain "preservatives" are noxious and deleterious, and has recommended their prohibition in articles of food. The Local Government Board has, as yet, done nothing with the report, but various local authorities, finding their hands strengthened by the body of evidence which the committee accumulated, have been emboldened to take steps to check the widespread use of such substances as boracic acid and formalin in connection with milk, but their action is seldom, if ever, brought under the section which imposes a stringent penalty on any person "who mixes . . . any article of food with any ingredient or so as to render the article injurious to health with intent that the same may be sold in that state," but under the section which affords a chance of the magistrate saying that milk *plus* preservative contains more than the purchaser bargained for, and was therefore not of the nature, substance, and quality demanded.

The difficulty, of course, in Section 3 is to prove knowledge and "intent" on the part of the seller, but there is very little doubt that if convictions could be more readily gained under Section 3 the use of preservatives would receive a much needed check.

A public department may, however, be spurred into activity when its interests are jeopardised, and here again beer supplies us with a notable illustration. Beer, as we all know, furnishes much of the revenue of this country, and anything which affects the interests of beer may *pro tanto* be held to affect the

[1] See the article in last week's NATURE, p. 179. The papers referred to are (1) Final Report of the Royal Commission appointed to inquire into Arsenical Poisoning from the Consumption of Beer and other Articles of Food or Drink. (Parliamentary Paper. Cd. 1848. 1903.) (2) Final Report of the Departmental Committee appointed to inquire and report upon the desirability of Regulations under Section 4 of the Sale of Food and Drugs Act 1899 for Butter. (Parliamentary Paper. Cd. 1749. 1903.).

interests of the Revenue. Accordingly the Revenue authorities look pretty sharply after the brewers, and exercise considerable powers with regard to the ingredients which may be used by them. By the Customs and Revenue Act of 1888 the Commissioners of the Treasury have power to prohibit, by issue of an order published in the *London Gazette*, the use in the manufacture or preparation for sale of any article of excise, of any "substance or liquor of a noxious or detrimental nature," or which, "being a chemical or artificial extract or product, may affect prejudicially the interests of the Revenue," and it was in terms of this Act that the Commissioners of the Treasury, acting under the advice of the Commissioners of Inland Revenue, prohibited in 1901 the use of arsenicated glucose and "invert" sugar in the manufacture of beer under a penalty of 50*l*. To the plain man there is an element of humour—grim humour, it must be admitted—about this procedure. Apparently such is the condition of the Statute Book with respect to official control in the interests of public health of the manufacture of articles of food and drink that this is the only known administrative method of arresting a grave public danger—unless, indeed, the incriminated material is of such a character that it may be taken in transit, and that the whole of it may be brought before a magistrate in a police court by direction of a medical officer of health. The action of the Treasury is, it will be observed, restricted to articles of excise, and is exercised ostensibly solely in the interests of the Revenue. No action was, or apparently could be, taken by the local authority in the district in which the works of Bostock and Co. were situated to seize or otherwise deal with the large quantity of contaminated glucose, "invert" sugar, and table syrup stored at these works after their poisonous nature was discovered.

Apart from the injunctions they have laid upon the excise authorities to extend the application of the powers they already possess to ensure the purity of beer, the chief outcome of the Commissioners' protracted inquiry has been to formulate a series of recommendations, or rather propositions, as to the necessity for more extended administration by the Local Government Board; as to the necessity for official "standards" for purposes of the Sale of Food and Drugs Acts; as to the responsibility of the manufacturer or intermediate vendor—that is, apart from the retailer—under the Sale of Food and Drugs Acts; and as to the extension of the powers of local authorities to prevent the sale of suspected foods pending analysis.

With respect to the Local Government Board, the Commissioners are of opinion that this department ought to have the services of a special officer with scientific knowledge, who should be in relation with the Government Laboratory, and be able to institute the necessary chemical inquiries, and in other ways (for instance, where physiological investigations are necessary) have adequate assistance In this way the Commissioners think that full and authoritative investigation could be made where risks to health are suspected, or where new colouring matters, preservatives, or other chemical additions to food are introduced. The officer ought not only to have the duty of collecting information from public analysts and other local officers, and of advising how the Sale of Food and Drugs Acts may be efficiently worked, but he should be required to make inspections and inquiries as to conditions of food-manufacture at home and abroad. Under the improved condition thus contemplated, the Local Government Board should for such purposes be in touch with other public departments which might be able to render assistance in special directions, *e.g.* the Board of Inland Revenue in the case of excisable articles, the Board of Customs in the case of imported foods, and the Patent Office in the case of patented processes of food preparation.

The Commissioners are of opinion that the Local Government Board should be the authority to prescribe and from time to time vary "standards" for the purpose of the Sale of Food and Drugs Acts. By the Act of 1899 the Board of Agriculture has been empowered to make regulations, which may imply "standards," with respect to milk, cream, butter, or cheese, articles which—and especially the first-named—are more frequently the subject of prosecutions under the Acts than any other food substances. There is a slight difference of opinion as to the manner in which these "standards" should be arrived at. The majority of the Commissioners favour the establishment of a so-called Board of Reference, which they define to be a permanent body consisting of a small number of scientific men nominated by the Crown or departmentally. The principal of the Government Laboratory, who, apparently, does not dissent from the idea of a consultative board to advise on points connected with the Sale of Food and Drugs Acts, thinks that it would be preferable to follow the procedure of the Board of Agriculture and to entrust the consideration of the propriety of fixing a standard, or standards in the case of particular groups of allied substances, to specially constituted committees, appointed *ad hoc* and for the occasion, in which manufacturers and technical experts were represented. There is, no doubt, much to be said on both sides of this question, but considering the very large and legitimate commercial interests involved, it is questionable whether public opinion would be wholly satisfied by the exclusion from the board of persons of special knowledge and experience of the article for which a "standard" is required.

After all, the number of substances, or groups of allied substances, for which "standards" would be required is not inordinately large.

A matter of more immediate importance is the nature of the amendment which is required to bring home to the real offender the responsibility for a contravention of the Acts. At present the actual manufacturer of an adulterated article is too frequently allowed to escape, and owing to the difficulty of reaching him, local authorities are often unwilling to take action, on the ground that they do not regard the retailer, who has had nothing to do with the contamination and is frequently not in a position to know that it exists, as the really culpable person. Warranties are very difficult to take action upon, and the conditions which have to be complied with under the Statutes are so numerous and so exacting that it is well nigh hopeless to proceed. If a warrantor states that at the time of giving a warranty "he had reason to believe that the statements contained therein were true," he has a good defence. As the law stands at present it is rarely worth while to attach the manufacturer or middleman to the prosecution.

The particular method of arriving at a food-standard advocated by Dr. Thorpe is well exemplified by the second of the two Parliamentary papers under review. In July, 1901, the departments concerned appointed a committee to inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act 1899 for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter or proportion of water in any sample of butter shall for the purposes of the Sale of Food and Drugs Acts raise

a presumption that the butter is not genuine. In its first report the committee, which was a large and representative one, consisting of analysts, producers, vendors, and public officials connected with the English and Irish Boards of Agriculture, under the chairmanship of Sir Horace Plunkett, after hearing evidence in this country and in Ireland, unanimously recommended the adoption of a limit of 16 per cent. for the proportion of water, and this recommendation was promptly given effect to in the Sale of Butter Regulations 1902.

In the present report the committee deals with the other matters referred to it. These questions have led it to inquire into the chemical nature of butter, to ascertain how far the composition of butter-fat is dependent upon conditions of production and within what limits it may vary. It has also had to inquire into the nature of the substances which may be used for the purpose of adulterating butter, and what methods are open to analysts to detect and determine the extent of such adulteration.

The space at our disposal precludes any attempt to deal in detail with the many interesting points connected with the chemical nature of butter which have come out in the course of the inquiry. Observation has shown that the chemical constitution of butter-fat is dependent to a certain extent upon climatic conditions, period of lactation, nature and amount of food, breed and idiosyncrasy of the cow. The extent to which its composition may vary from these several causes is shown in the evidence which was taken, and which is summarised in the report.

The majority—one member, a butter vendor, alone dissenting—were of opinion that for the purposes of the Sale of Food and Drugs Act 1899 it was expedient to recommend a limit or "standard" based on a deficiency in the normal constituents of butter, and that it was desirable that the limit should have regard to what all authorities are agreed are the characteristic constituents of butter-fat, namely, the volatile acids, which by general consent is by far the most important criterion in butter analysis. They recommend, therefore, that if the amount of the volatile acids in any sample of butter, as determined by the Reichert-Wollny method—a description of which is appended in a schedule to the report—should fall below the number 24, a presumption should be raised that the butter is not genuine. Two members of the committee are disposed to place the limit at 23.

The committee is strongly impressed with the necessity of taking such steps as would directly identify margarine if present in butter, and with this view it recommends that all margarine made or imported into this country should be "ear-marked," as is done in Germany, Austria, and Belgium, and as it is proposed should be done in France, by the addition of 10 per cent. of sesamé oil during its manufacture.

It further suggests that steps should be taken to give effect to the recommendations of the Dairy Congress held at Brussels on April 27 and 28, 1902, to secure international agreement on the subject of control of the manufacture of butter and margarine. In a large number of the countries producing butter for sale in this country a system of control more or less well organised and under State authority already exists, and there ought to be little difficulty in securing by international cooperation and agreement that the system should be uniform and effective.

It remains to be seen what the Minister of Agriculture will do with a report which is particularly interesting as a contribution to the literature of a subject of great importance to the community, and is evidently the carefully digested result of an exhaustive and complicated inquiry.

THE JANUARY METEORS.

THESE meteors shoot from a point at about 230°+53° in Bode's modern constellation Quadrans Muralis, placed in the barren region between Boötes, Draco, and Hercules. But the former constellation has never been generally recognised and admitted into recent star-maps. The name "Boötids" has, in fact, been sometimes suggested as preferable to "Quadrantids" for this new-year meteor-shower.

In 1904 the meteors will probably return in their greatest abundance on the nights following January 3 and 4, but the moon will unfortunately be full, and only the brighter members of the shower will be visible. But watches of the sky should be maintained on the early evenings of January 3 and 4, and also on the mornings of those dates (between about 5 and 7 a.m.) if the weather is sufficiently clear. A few large meteors are sure to be visible, notwithstanding the strong moonlight. In some years, when all the conditions are favourable, the display of January meteors is as plentiful as that observed during an average Perseid shower. The really active period of the Quadrantids (or Boötids) is usually very brief, being confined to a few hours. Meteors in the front of the stream begin to appear on about December 28, and the display seems practically exhausted on January 5 or 6. The radiant has a very low northerly position during the greater part of the night, and the meteors exhibit long flights and moderately swift motions.

W. F. DENNING.

NOTES.

M. ALPHONSE ROBERT, the energetic natural history collector who accompanied Dr. Forsyth Major some years ago in his expedition to Madagascar, and who only returned to England a few months ago from a three years' sojourn in Brazil, has just started on another collecting trip to the latter country, where his first destination is Para. The expenses of both the previous and the present expedition, which are undertaken in the interests of the British Museum, are borne by Mrs. Percy Sladen. M. Robert, we understand, intends to spend some time collecting at Para, and thence to ascend the Amazons into Peruvian territory. The specimens collected by M. Robert during his last trip have done much to increase our knowledge of the mammalian fauna of the Matto Grosso and adjacent districts of Brazil, and the novelties obtained have been from time to time recorded by Mr. O. Thomas in the *Annals of Natural History*. Among these are several new bats (one indicating a new generic type), a squirrel, and a new race of the crab-eating fox (*Canis thous angulensis*). M. Robert has also obtained a fine series of skins of the large and handsome brown woolly spider-monkey (*Brachyteles arachnoides*), a pair of which are now being set up by Mr. Rowland Ward for the British (Natural History) Museum.

THE report submitted at the second annual meeting of the trustees of the Carnegie Institution, held in Washington recently, shows that sixty-six grants were made by the executive committee for scientific research, amounting to an aggregate sum of 30,000*l*., the recipients of which represent every part of the United States and the smaller colleges as well as the large universities, observatories and laboratories. Twenty-five research assistants were appointed. These sums are exclusive of administrative and incidental expenses of the Institution. Arrangements have been made for publication at an early day of eleven scientific papers,

most of them making large and costly volumes. Among the subjects now under consideration by the Institution in connection with grants are a solar observatory, southern observatory, geophysical laboratory, Transcaspian exploration and archæological exploration, exploration in the south Pacific, establishment of biological experiment laboratories and international magnetic researches. The trustees authorised an aggregate expenditure of 75,000*l.* in grants for scientific researches and 8000*l.* for publications during the ensuing year.

THE large gold medal for services rendered to art and science has been awarded by the German Government to Prof. Ehrlich.

THE French Minister of Public Instruction has been authorised, says *La Nature*, to prepare a Bill arranging for the creation of a chair of general physics in connection with the science faculty of the University of Paris. This chair is intended for M. Curie.

A REUTER message from Stockholm announces that Baron Erland Nordenskjöld's expedition to Peru and Bolivia will leave for Southampton on January 6. It will proceed thence to Panama, and will arrive about February 15 at La Paz, the capital of Bolivia, which will be the departing point for the expedition to Lake Titicaca.

THE Brothers Kearton have arranged to hold an exhibition of enlarged photographs of birds, beasts, reptiles, and insects at the Modern Gallery, Bond Street, W., on January 2–12, 1904, inclusive. The Gallery will be open from 10 a.m. until 9 p.m., and Mr. R. Kearton will deliver limelight lectures to children each afternoon, and to adults in the evening.

THE death on December 19 at Hove of Mr. John Henry Brown recalls the little-known fact that, as the inventor of the iris diaphragm, he has laid the scientific world under a considerable obligation. "In the early seventies," Dr. Hollis writes from Hove, "he took his home-made model to Smith and Beck, the predecessors of the well-known firm of opticians in Cornhill. This model he showed me, many years ago, and although roughly constructed it differed in no important detail from the type of apparatus at present in the market. As he did not patent the little contrivance he reaped no pecuniary reward for his ingenuity. Although frail in body and physically somewhat infirm, Mr. Brown by indomitable energy made and retained for many years a large practice as a dental surgeon. He was a fellow of the Royal Astronomical Society, and died aged sixty-seven much respected."

THE President of the Board of Agriculture and Fisheries has appointed a departmental committee to inquire into and report upon the present position of fruit culture in Great Britain, and to consider whether any further measures might with advantage be taken for its promotion and encouragement. The committee is constituted as follows:—Mr. A. G. Boscawen, M.P., chairman, Mr. C. W. Radcliffe Cooke, Mr. J. M. Hodge, Colonel Charles W. Long, M.P., Mr. George Monro, Mr. P. Spencer Pickering, F.R.S., Dr. W. Somerville, an assistant secretary of the Board of Agriculture and Fisheries, Mr. Edwin Vinson, and Rev. W. Wilks, secretary of the Royal Horticultural Society. Mr. Ernest Garnsey, of the Board of Agriculture and Fisheries, will act as secretary to the committee.

AT the meeting of the Institution of Civil Engineers on December 22, Dr. T. E. Stanton described experiments made in the engineering department of the National Physical Laboratory on the distribution and intensity of the pressure on thin plates and combinations of plates placed in a uniform current of air. The results show that, under the given experimental conditions, a definite relation existed and may be stated thus:—For similar and similarly situated plates or combinations of plates in a uniform current of air, the intensity of pressure is the same for the same velocity of current and general atmospheric conditions. On the assumption that the motion of the wind approximates to that of a uniform current, the distribution and intensity of the pressure of the wind on structures may be studied experimentally by means of models of the structures set up in a current of air produced by means of a fan. In illustration of this, the results of experiments made on models of roofs and lattice girders of simple form were given. Tabulated results are also given for the cases of parallel plates at varying distances apart, plates inclined at varying angles to the direction of the current, and rectangular plates of varying ratio of length to width.

MR. R. G. CARRUTHERS and Mr. G. W. Grabham have been appointed geologists on the Geological Survey of the United Kingdom.

MR. L. M. LAMBE has given a description of the lower jaw of Dryptosaurus obtained from the Cretaceous strata of north-western Canada (*Ottawa Naturalist*, xvii., November).

IN our brief notice of Mr. R. B. Newton's article on fossils from Borneo (NATURE, December 10, p. 139) it should have been distinctly stated that Trigonia was for the first time recorded from the Jurassic rocks of that island. The genus had previously been recorded from the Cretaceous strata of Borneo.

IN the *Annals* of the South African Museum (vol. iv., part ii., November) there is a series of articles by Dr. R. Broom on fossil reptilian remains collected by officers of the Geological Survey of Cape Colony. He describes an almost perfect skeleton of *Pareiasaurus serridens*, some new theriodonts, including three new genera, also a new and primitive rhynchocephalian from the Karroo beds. This last reptile is named Proterosuchus, and it shows a considerable degree of specialisation along the line which gave rise to the early crocodiles and dinosaurs.

IN the *Proceedings* of the Cotteswold Naturalists' Field Club (vol. xiv. part iii., November) there is an interesting historical and geographical article on the Cotteswold Hills by Mr. S. S. Buckman, who deals with the origin of the name and the area to which it should properly be restricted. Messrs. T. Pears and L. Richardson describe some alluvial deposits at Clifton Hampden, near Oxford, and Messrs. A. S. Kennard and B. B. Woodward contribute notes on the land and fresh-water Mollusca found in the deposits. Among the species it is interesting to note *Dreissensia polymorpha*, as the occurrence of this mollusc in Britain was first observed in 1824, when living examples were found in the Commercial Docks, and it was held that the species had been imported.

IN the *American Journal of Science* (December) Mr. G. R. Wieland discusses Polar climate in reference to the evolution of plants and animals, expressing the view that the northern circumpolar area has probably been, ever since the older Palæozoic era, the main evolutionary centre from which animal and plant life have radiated. In the same journal Mr. J. C. Branner directs attention to the resemblance between the Peak of Fernando de Noronha and the intrusive plug or obelisk of Mont Pelée, in Martinique,

described by Dr. Hovey. He also quotes an interesting passage from Darwin's "Journal," in which the author remarked of the Fernando Peak that "at first one is inclined to believe that it has been suddenly pushed up in a semi-fluid state."

THE veteran traveller, Baron F. von Richthofen, selected a geographical subject for his inaugural address as rector of the University of Berlin (*Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1903, p. 655). In dealing with the motives and course of geographical inquiry in the nineteenth century, he includes a considerable review of the work of early explorers. Twenty pages, indeed, have passed before we come to the final fourteen in which his true subject is discussed. The personal aims and influence of the rector are thus somewhat modestly and rigidly suppressed, and the address assumes a strictly academic character. It is well pointed out that tales of fabulous gold have prompted a large part of exploration. Yet geographical discovery, from whatever motive, has ended in that widening of the field of view which forms the essential feature of human progress. The promoters of colonial enterprise, it is urged, commonly overlook this incalculable result of their endeavours. The author traces the rise of scientific geography from the stage of mere universal description, and points out how the culture of Germany has allotted its proper place in the university curriculum to a subject so intimately connected with the search after truth and the welfare of mankind.

IN the *Physical Review* for October Mr. Edgar Buckingham gives a concise deduction of Stefan's law, according to which the total temperature radiation of a black body is proportional to the fourth power of the absolute temperature. This deduction, which is a modification of Boltzmann's, is based on the free energy principle, but the corresponding reciprocal thermodynamical relation can be used instead if preferred.

DR. MARAGE publishes a series of observations on the artificial development and measurement of the sense of hearing in deaf mute subjects. A considerable number of cases were experimented on, a vowel-syren producing the sounds ou, o, a, é, i being adopted for the purpose, and curves were drawn showing the intensity of sound audible to the patients at different stages of the treatment, as measured by the air pressure necessary to render the sounds of the syren audible. The author maintains that there are but few subjects who are deaf and dumb beyond all cure, and that the use of the syren will often restore the power of hearing, even in cases of complete deafness, usually within about six weeks. The sounds, so far from being fatiguing or painful to the subjects, appear to give them genuine pleasure.

PROF. GIACOMO CIAMICIAN has published his inaugural address delivered in the University of Bologna on November 7, dealing with the problems of chemistry of the new century. After giving a general survey of recent advances in chemistry and physics, the author turns his attention to the problem of developing chemical industries in Italy. Already enormous strides have been made in the manufacture of iron and steel, of sulphuric acid (the production of which has increased fivefold in ten years), of sugar (in which the increase in five years has been from 50 to 800 thousand quintals), and of calcium carbide. Among the obstacles to further progress mentioned by the author are the action of the Government in checking the growth of new industries by excessive taxation, the timidity of capitalists, and the want of educational institutions for training an efficient army of expert chemists.

AT the meeting of the Asiatic Society of Bengal at Calcutta on December 2, Mr. T. H. Holland exhibited a meteorite which fell with the meteor seen in eastern Bengal on October 22. The stone weighs 622 grammes, and is covered with a thin black crust formed by the fusion of the rock during its rapid flight through the air. Several stones were known to have fallen with this meteor, and the complete investment with fused crust of the one exhibited shows that fusion of the surface occurred after the break-up of the meteorite. Besides the complete proof that the meteor resulted in an actual fall of stones, special interest attaches to this occurrence on account of the observations made from so many points of view permitting the actual path and speed of the object to be calculated. At the same meeting Mr. D. Prain read papers on an undescribed Indian Musa and on an undescribed araliaceous genus from Upper Burma.

THE October number of the *Journal* of the Royal Horticultural Society contains a brief description, with some illustrations, of a number of trees and shrubs recently introduced from China by Mr. Veitch, which seem to be suited to our climate, and may prove to be important acquisitions to our garden plants. As Mr. Veitch states, they have been chosen from the collections made by his agent, Mr. E. H. Wilson, and bear testimony to the latter's energy and assiduity. In the same volume the practice of watering cucumbers and tomatoes with copper sulphate in order to ward off fungal diseases is recommended by Mr. G. Massee.

THE primary function of the park and garden committees in our cities and towns is to provide ornamental and open spaces. The members of the Bradford Parks Committee have recognised that it is within their province to afford educational facilities, and have set apart a plot of land in Lister Park to be converted into a botanical garden in which to present a systematic grouping of plants, and also to grow trees, and local or economic plants which will serve for the purpose of identification. It is within the scope of this scheme to provide material for teachers' use and to establish informal public lectures at which more interesting specimens can be shown and discussed.

IN No. 6 of the *Publications* of the Conseil Permanent International pour l'Exploration de la Mer, issued at Copenhagen, Mr. H. M. Kyle describes a trawl-net designed to work in mid-water as well as on the sea-bed. This net, which is constructed on the umbrella principle, has been tried on one occasion at Grimsby, and, although the results were not entirely successful, may quite possibly prove efficient.

WE have to acknowledge the receipt of the second part of Mr. J. Macoun's "Catalogue of Canadian Birds," published by the Geological Survey of Canada. This part includes the diurnal birds of prey, together with the woodpeckers, flycatchers, crows, jays, and American blackbirds (Agelæus). Three years have elapsed since the publication of part i. (which was noticed at the time in our columns), during which period much additional information has been acquired with regard to the distribution of Canadian birds; consequently this portion of the subject is somewhat more amplified in the present part than was the case in its predecessor. Otherwise, the mode of treatment follows the original lines.

WE have received copies of the first six numbers of a series of circulars on agricultural economic entomology, in course of issue by the Trustees of the Indian Museum, Calcutta. Each number is devoted to a single species of

insect, of which it contains an illustration. In each instance the general appearance and mode of work of the insect are described, after which we have its distribution, food, and ravages, followed by a brief account of its general habits, and concluding with suggestions for remedial measures. No. 4 deals with the date-palm, or Indian rhinoceros-beetle, of which both the grub and the adult insect inflict very serious damage on the tree after which the species is named. The next part treats of the north-west, or migratory, locust, of which the distribution within the limits of the Indian Empire is shown on a map.

In the December issue of the *Quarterly Journal of Microscopical Science* Prof. Ray Lankester figures for the first time a couple of small blind crabs of the genus Cymonomus (or Ethusa) taken so long ago as the cruise of the *Porcupine* (1869–70), and described by Canon Norman in 1873. The main reason for bringing these specimens into prominence is owing to a statement in a popular work that they belong to a species of which the form inhabiting shallow water has functional eyes, while as we proceed deeper and deeper the eye-stalks are found to be more degenerate. The statement that an eyed form exists is apparently a misconception, while the idea that the one in which the eye-stalks are the most modified inhabits deeper water than the other is likewise not well founded. As a matter of fact, Prof. Lankester believes the two specimens to indicate distinct species. The other contents of this serial include a discussion on the origin of the green cells found in a turbellarian worm (*Convoluta roscoffensis*) peculiar to Brittany, by Messrs. Gamble and Keeble, and a note by Dr. Hanna on the presence of Trypanosoma parasites in the blood of certain Indian birds. In a third article, Mr. H. M. Bernard continues the account of his investigations into the structure of the retina, dealing in this instance with the continuity of the retinal nerves throughout the Vertebrata.

In 1902 Mr. R. Lydekker, F.R.S., read before the Zoological Society (see *Proceedings* Zoological Society, 1902, p. 981) the description of a new antelope from the neighbourhood of Lake Mwero, in northern Rhodesia. Mr. Lydekker supposed it to belong to the genus Cobus, although, as the only specimen consisted of a flat skin without head and feet, he was not quite certain where it should be placed, and named it *Cobus smithemani*, after Mr. F. Smitheman, who had obtained the specimen. Fresh and more perfect examples of this antelope have lately been received by Mr. Walter Rothschild, who has presented one of them to the British Museum. This specimen, which may now be seen mounted in the gallery, shows that Mr. Lydekker was quite correct in his judgment, and that Smitheman's antelope is a strongly marked new form of the "Kob" group, easily distinguished from the Poku or Vardon's antelope by its black neck and dark chestnut sides.

The re-introduction of cotton cultivation into the British possessions on the Spanish Main is regarded as of sufficient importance to justify the devoting of the whole of the third part of vol. iv. of the *West Indian Bulletin* to the subject. One-third of the number contains reprints of articles, or portions of articles, in the "Encyclopædia Britannica" and in various publications of the United States Department of Agriculture. The remaining two-thirds gives much useful information bearing upon the cultivation of cotton in St. Kitts, Antigua, Montserrat, Barbados, and Carriacou; an article by Prof. d'Albuquerque on the agricultural chemistry of cotton; one by Mr. Lewton-Brain on the fungoid diseases of cotton; and an illustrated article by Mr. Henry A. Ballou on insects attacking cotton in the West Indies. Sir Daniel Morris, accompanied by Mr. Bovell, has spent the autumn in the southern States of America making an exhaustive examination of the methods of cultivation, and the preparation for market, of the Sea Island variety of cotton. The results of the investigation will be published as an extra number of the *West Indian Bulletin*, Sea Island cotton being thought to be the most suitable for the islands

Under the title of "The Case for Vaccination," Mr. C. E. A. Winslow gives an admirable survey of the statistical data in favour of the efficacy of vaccination (*Science*, July 24, p. 101). It points out that a single vaccination greatly reduces the probability of an attack of small-pox, postpones it to a later period of life, and renders it less dangerous if it does ensue. To ensure absolute protection revaccination is required. During the small-pox epidemic of 1871, of 734 nurses and attendants in the Metropolitan Asylums Board Hospitals 79 were survivors from small-pox attack, and escaped infection; 645 were revaccinated on entrance, and all escaped; 10 were not revaccinated, and all took small-pox. Mr. Winslow concludes, "if statistics ever proved anything, those quoted prove the protective influence of vaccination. If any fact in science is certain, it is that a successful vaccination absolutely prevents small-pox for a period of from seven to ten years, that after that period it renders the disease less fatal, and that its complete protective effect may be renewed by revaccination. The conclusion is obvious not only that the State should oblige primary vaccination, but that a second vaccination at the age of twelve ought to be made compulsory."

The latest addition to the convenient little scientific memoirs published in the "Scientia" series by M. C. Naud, of Paris, is a translation of two papers by Prof. J. Willard Gibbs which appeared in 1873 in the *Transactions* of the Connecticut Academy, and have become scientific classics. "Diagrammes et Surfaces thermodynamiques," as the book is entitled, is by M. G. Roy, of the University of Dijon, and the translation is preceded by a biographical notice of Prof. Gibbs by M. B. Brunhes, of the University of Clermont.

Mr. William Taylor has recently circulated a pamphlet with the title "The Science of the Engineering Workshop," in which he urges the need for making scientific knowledge readily available to those at work in engineering shops. He then proceeds to trace—under the three headings, materials, processes, and tools—the foundation and outline of this science of the workshop. The publication concludes with the syllabus of a course of instruction, largely the work of an advisory committee of engineers, in the science of the workshop which is in use at the Leicester Municipal Technical Schools.

The annual report of the Smithsonian Institution for the year ending June 30, 1902, has reached us, and an examination of the volume shows it to be of the same valuable character as its predecessors. The proceedings of the Board of Regents, the report of the executive committee, and the annual report of the secretary are followed by the usual interesting general appendix. The appendix constitutes nearly five-sixths of the whole contents of the volume, and comprises brief accounts of scientific discoveries in particular directions during the year with which the report is concerned, and the method adopted is to present a miscellaneous selection of papers embracing a considerable range of scientific investigation and discussion. Many of these contributions are familiar to readers of Nature, since some of the papers have already appeared in these columns,

and others have been published in the *Transactions* of British scientific societies. Among the reprinted articles we notice—to name a few—Prof. Dewar's British Association presidential address on the history of cold and the absolute zero; Prof. J. G. McKendrick's contribution to the study of experimental phonetics; Dr. J. J. H. Teall's address on the evolution of petrological ideas; and Mr. H. G. Wells's Royal Institution lecture on the discovery of the future. There are several translations from French and German of important papers also included, such as Prof. A. Dastre's article in the *Revue des deux Mondes* on the life of matter; Dr. Georg Jacob's "Oriental Elements of Culture in the Occident" from the German; and Herr Oscar Israel's appreciation of Virchow from the *Deutsche Rundschau*. Like all similar publications from the Smithsonian Institution, the volume is provided with many excellent illustrations.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JANUARY, 1904:—

Jan. 3-4. Epoch of the January meteors (Radiant 230° +53°).
5. 10h. 13m. to 11h. 9m. Moon occults *o* Leonis (mag. 3·8).
12. 10h. 11m. Minimum of Algol (*β* Persei).
,, 15h. 0m. Ceres in conjunction with moon. Ceres 0° 58′ N.
15. Venus. Illuminated portion of disc = 0·707.
,, 6h. 58m. Minimum of Algol (*β* Persei).
27. 0h. 0m. Vesta in conjunction with moon. Vesta 0° 21′ N.
28. 4h. 55m. to 8h. 8m. Transit of Jupiter's Sat. III. (Ganymede).
,, 8h. 0m. Venus in conjunction with Uranus. Venus 1° 47′ N.

EPHEMERIS FOR WINNECKE'S COMET.—A second part of the ephemeris for the 1903-4 appearance of Winnecke's comet is published by Herr C. Hillebrand in No. 3916 of the *Astronomische Nachrichten*, from which the following has been taken:—

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

1904	α app. h. m. s.	δ app. ° ′ ″	log. *r*	log. Δ
Jan. 0	17 30 51	−17 46 46	9·988836	0·272241
,, 4	17 50 44	−18 39 19	9·981012	0·270012
,, 8	18 10 59	−19 24 20	9·974601	0·268606
,, 12	18 31 32	−20 1 5	9·969782	0·268027
,, 16	18 52 16	−20 28 58	9·966085	0·268248
,, 20	19 13 4	−20 47 33	9·965417	0·269255
,, 24	19 33 50	−20 56 41	9·966004	0·271006
,, 28	19 54 27	−20 56 24	9·968430	0·273468
Feb. 1	20 14 47	−20 46 57	9·972633	0·276601
,, 5	20 34 46	−20 28 49	9·978474	0·280344
,, 9	20 54 18	−20 2 38	9·985794	0·284645
,, 13	21 13 19	−19 29 13	9·994414	0·289439
,, 17	21 31 45	−18 49 25	0·004129	0·294662
,, 21	21 49 35	−18 4 11	0·014739	0·300253
,, 25	22 6 47	−17 14 26	0·026059	0·306155
,, 29	22 23 20	−16 21 3	0·037913	0·312312

SPECTRUM OF MIRA CETI.—In No. 5, vol. xviii., of the *Astrophysical Journal*, Mr. Joel Stebbins, of the Lick Observatory, gives the results of a study of the spectrum of *o* Ceti made with the 36-inch refractor during the period June, 1902, to January, 1903, in which period the magnitude of the star decreased from 3·8 to 9·0. The spectra were obtained with spectrograph i.—which is the Mills spectrograph converted into a one-prism instrument—attached to the 36-inch, and a spark between iron poles was always used as the light source of the comparison spectrum.

The absorption spectrum obtained is not very like the solar spectrum, but the calcium lines *g*, H and K are all present, *g* being comparatively much more intense than in the solar spectrum; the iron lines are not prominent, and even the strongest do not appear when a small dispersion is employed. The *g* line undoubtedly becomes broader as the star grows fainter, for on June 27 (mag. = 3·8) its width was 2 t.m., whilst on September 6 (mag. = 7·0) it was 9 t.m. The lines at λλ 3990·64, 4045·16, 4093·55 and 4097·08 respectively, which are apparently not coincident with solar lines, appeared at successive intervals during the diminution of magnitude.

A comparison of the several spectra shows that with the decrease in the star's magnitude the continuous spectrum from λ 4300 to λ 5000 becomes relatively fainter than that between λ 4000 and λ 4300.

The bright hydrogen lines are very prominent, and Hβ and Hε, which have been reported as absent by other observers, appear on all the dense negatives, and they appear to grow relatively stronger than the other hydrogen lines, and the continuous spectrum, as the star's magnitude decreases. In addition to the hydrogen lines, bright lines of Si, Mg and Fe are probably present, and numerous changes took place in their relative intensities during the interval covered by the spectrograms. For example, the line at λ 4007 undoubtedly disappeared altogether, whilst the line at λ 4571—possibly due to magnesium—developed in a remarkable manner. The latter did not appear at all until the star's magnitude had fallen to 5·4, and afterwards it became the most prominent feature of the whole spectrum. The evidence obtained supports the conclusion that the bright hydrogen lines disappear at minimum.

Determinations of the star's radial velocity showed that it remains constant at about +66 km., and this is held to be a strong argument against the theory that the light-changes are due to the existence of a companion. The abnormal changes in the relative intensities of the hydrogen lines—which are displaced from their normal positions towards the violet, apparently by other causes than radial velocity and pressure—lead Mr. Stebbins to the conclusion that the light changes are due to internal causes which produce effects that are, as yet, unfamiliar to us.

THE "COMPANION TO THE OBSERVATORY," 1904.—The 1904 edition of the well-known annual compendium of astronomical data, the "Companion to the Observatory," is very similar to that of 1903. It contains, amongst other information, the usual tables for solar, lunar and planetary observations, ephemerides for the various satellites, and minute data regarding a large number of variable stars.

Mr. Denning has contributed a set of notes regarding the principal meteor showers, and Mr. Maw has supplied a list of double-star observations, whilst the numerous variable star ephemerides have been taken from advance proofs supplied by M. Loewy.

OXFORD AND SCIENCE.[1]

WHEN I am tired I sometimes go by train to Reading and cycle over here swiftly in the afternoon, and then I dress and dine comfortably at the *Mitre* and go out for a stroll. Perfect rest is not possible unless there is moonlight, but Oxford is always wonderful and satisfying and restful to an engineer like me. It is not because of its age, of the great men who have studied and worked in its colleges, of its almost unique character and high rank among universities, of the sacred beauty of its colleges and streets. It is because that to me it represents what is most persistent in the constitution of the British Empire. The Houses of Parliament, Westminster Abbey, the Temple and City of London, Windsor, the great mansions of our English nobles, each of these suggests much to any man who is fond of reading, but each suggests only a small part of what Oxford represents.

Now the thing that pervades all my thoughts of Oxford is that more than half of the most distinguished Englishmen during four hundred years have been educated here. And if, as I sometimes do, I include Cambridge when I say Oxford, all the most distinguished Englishmen during four hundred years have been educated here.

Whether we like it or not, it is a fact that England is an aristocratic republic with the King at the head of the

[1] An address delivered by Prof. John Perry, F.R.S., at a public meeting in Oxford, arranged jointly by the Ashmolean Natural History Society of Oxfordshire and the Oxford Mathematical Society.

aristocracy. There is a disadvantage in almost all our rulers being selected from a limited class. But in the democratic republics of America and Europe there is the far greater disadvantage that the nation seldom commands the public services of rich or cultured men or men of family. Here there is no man so high in rank, or so rich or so intellectual, that the nation cannot command his willing services. Again, there never in the history of the world was an aristocracy like ours, admitting new men in every generation, allowing a constant flow of its younger sons downwards. Americans may gibe, and some of the younger of us may rail, but this system of government is beloved of all people in England, rich or poor; it is so much a part of the English constitution that no student of history can imagine an England governed in a different way, and this aristocracy will retain its power over a believing people until the time comes when it ceases to believe in its own self. At any one time it is only a minority of undergraduates who belong to the ruling caste, but the important thing to think of is that practically every member of the ruling class of England passes the four most important years of his life in Oxford (or Cambridge). All the rest of his life he looks at things through Oxford spectacles. His father and his father's friends were Oxford men. His mother and his aunts have always been under the influence of Oxford clergymen; even the lighter literature and journalism of the household are from Oxford pens. Until he leaves his nursery, under his earliest tutors, in his preparatory school, in a public school, every tutor he has had, every influence round him, have been dominated by Oxford feelings.

When at an age of from twenty-one to twenty-four a young man enters Parliament or diplomacy, or any of the reserved parts of our public services, his character is formed; all his ways of thinking and his prejudices are on the models most revered in Oxford. His early youth has been influenced by Oxford of the past, his undergraduate ways have influenced and been influenced by Oxford of the present, and his prejudices, kept strong by loving memories, exercise an influence against all changes in Oxford for the future.

I have often thought that Darius and his companions, the sons of the ruling families of Persia, had a most delightful education. We do not hear much of their love for literature or what we should call school-book work. Their education was in companionship with each other and with their wise fathers and their friends; in military exercises and in sports. Young gentlemen of England have always had that sort of education. It was probably best in Plantagenet times, when, indeed, a well trained young gentleman was not only very healthy and courageous, but he had not much chance of becoming lazy; he had the opportunity, denied to the lower classes, of becoming fit to lead in warfare, fit to assist in all that then constituted the government of his country. But when the positions hitherto monopolised by great ecclesiastics became possible for laymen, if these laymen possessed the necessary learning, youths of the higher class began to go to Oxford, and in the times of Queen Elizabeth and James there was real liberal culture among them such as had never been before and has never been since. To go to the university then became fashionable, and remains fashionable with youths of our higher classes.

What is the nature of the education now given to one of these young men? His father, a man of consequence in his county, perhaps in the legislature, probably experienced in public duties, with much knowledge of men, has played with him in his infancy, and keeps in touch with him always. Even from infancy he has been in contact with the great people of his time. No book work, no lectures were needed in teaching him the manners of his class. He cannot help acquiring the virtues of the aristocrat; his personal honour is dear to him, he always speaks the truth, he scorns all meanness, he respects the rights of others of his own class, and, indeed, of all others in so far as he understands that they have any rights. He shoots well and rides well. For some generations back he has been cleanly in his person, and he has been temperate and keeps healthy of body. Whatever becomes a custom of his class he follows as a law. Loyalty to his class and to the head of it are his creed. On the other side, he is ignorant of all knowledge that has not come to him by actual observation. His sympathies outside his own class are very limited and conventional. His traditions are to the effect that only one man in a hundred takes heartily to school work, to book work, to learning; that the average man of his class does not go to Oxford for learning. He goes to finish his education, to meet and make friends with men who are to share with him later on in the government of the country. Healthy as an otter, unflinching as a fighting cock, faithful and courageous as a bulldog, clean as a cat, in far more intimate companionship with men than he ever will be again, he admires or makes close friendship with or mildly dislikes these equals. His connection with the university is small; his college is everything; tutors were created for him. He learns the value of public opinion; he learns that ginger may be hot in the mouth, and yet he is surrounded by such police arrangements that he is guarded from ruin even when he is most reckless. Truly it is a wonderful experience, a valuable education, and it is never through book work or lectures, but from actual experiment and observation that the average young Englishman ever has or had any kind of education. Darius and his young companions were well fitted to rule, but they probably could neither read nor write. The average young man who leaves Oxford with or without a pass degree forgets very soon what book work, what learning, he ever had, and he dislikes reading. He has always been laconic in speech, and finds a small vocabulary quite large enough for his needs. He has successfully cultivated an appearance of want of vulgar interest in anything, so that want of practice begins to tell upon his powers of observation, and his resourcefulness tends towards that of the ostrich. It is fondly assumed by his tutors that, although he soon forgets his Latin and Greek, yet his study of these was the medium of much mental training; that the study of Euclid and logic have given him a logical mind. I cannot deny that there may have been some mental training through Latin, but I assert—it is, of course, mere assertion—that it has not been much. On the other hand, I assert that much harm has been done, for his hereditary prejudices against all book work, all learning and literature have been deepened. For the few men of his own class who take kindly to literary studies he has a respect not untinged with doubt. Between him and the real student not of his own class there is a great gulf fixed, like what there is between him and clergymen.

Observe that I am not here referring to the education of the real students. For them, it is true in a very limited range of subjects, but for them there is the most wonderful education ever known.[1] They also make friends for life, they take fire at each other's ideals as only young men can, they meet every day the great scholars of their age who are also students, and there is always a fine education in the mere contact with men worthy of young worship. Young men like this need but little teaching; they are fond of books and educate themselves.

It is easy for an outsider to overpraise this education, because the glamour of the beautiful college life is on all his thoughts; he does not at once observe how narrow the culture has always been, and how now the examination system is cramping it more and more. Oxford is hard, unspiritual and idolatrous, and the absence of scientific method is evident everywhere. Oxford is like a technical school, training these better men for the higher posts in the Church, in the Civil Services, in journalism, at the Bar, and in boys' schools. And it is found that these successful men have dwarfed imaginations and no power to think for themselves in any subjects outside their narrow professional grooves. The barrister who seems inspired in the Law Courts is mute and inglorious in the House of Commons. The readers of the hundreds of newspaper

[1] Just nine days ago I gave a short address on the twentieth anniversary of the opening of College Hall, London. It is a hall which Lady Lockyer, her sister and her friends started for women students attending medical and other college courses where they might have that companionship without which there can really be no higher education. It is curious that this should be the only college hall in London, that London should be so well provided with university professors and lecture rooms and laboratories, and that the equally important colleges of residence should be non-existent. A great city like London needs such halls far more than Oxford did when William of Durham and Walter de Merton began to build.

articles of any morning—as like one another as herrings—are awed with their display of culture, of depth of thought, of knowledge, and with what is more astounding than anything else, an infinitely perfect Oxford polish. Watching the performances of an Oxford man of letters is like watching a good billiard player or a skilled musician. His mind is filled with the thoughts of other men, pigeonholed, ready for use. He thinks those thoughts to be his own, and he never takes in the real meaning of the fable of Diogenes and the lantern. He does really think for himself in that part of his trade which is personal to himself, and he has an abundance of all learning except what concerns those natural sciences the applications of which are shaking the social and intellectual world. He is never grossly unfair to other men who follow the rules of the game recognised by Oxford; against men of new ideas his struggle oft availeth. In dealing with some questions he is a genius towering to the heavens, in others he is like that same spirit imprisoned in a little bottle, sealed up magically by the mere name of some wise man of antiquity.

It is very noticeable that the Oxford man has retreated from the renaissance position and has gone back to the mediæval. He believes in his soul that there is no new thing under the sun; truth is not a thing to be discovered, it is something already revealed in Hebrew and Greek books. Even if a man is doing research it is after the poison has entered his system; his individuality has been practically destroyed. But for the present I am neglecting these real students. I am confining my attention to the average men of caste. These men are educated in the sense in which Darius and his friends were educated, excepting in this, that Oxford men do not know living foreign tongues, whereas the other barbarians did, and Oxford men pretend to know something of certain tongues that are dead. Every attempt to teach them by actual observation, actual experiment, actual trial, actual research, has succeeded well; every attempt to teach them by mere talk, by abstract reasoning, has failed.

And the world now to be governed is getting more and more complex. Man is utilising the energies of nature in thousands of ways unknown to the ancients. Common people are all getting educated. Where the ancients wondered and trembled, we understand and give orders to nature. The average unit of any population was compelled to be what we now call an unskilled labourer.

Now our labour is becoming more and more skilled. Are you aware that from one ton of coal there is as much energy, as much actual work, as may be done by forty thousand good labourers in a ten hours' day? Our best steam engines utilise only one-tenth of this energy at the present time. But even now we know that the cost of the most unskilled work done by man is one thousand times the cost of the same work wherever it may be done by the best steam engines. One fact of this kind properly considered is worth many long essays about the effect of the engineer in altering all the character of our civilisation. It is labour that is the true standard of wealth. The steam engine has added incalculably to the wealth of the world. We forget that man is no longer needed for unskilled labour, so that when we use unskilled labour we are using the materials which God has given us in the most inefficient manner possible. Furthermore, it becomes sweated labour, it unduly taxes skilled labour, it starves invention, and it brings up base, ill-fed families.

I do not think that a fact of this kind would have been neglected by the philosophers of Greece or the learned men of Rome, but when some of us direct attention to it and its neglect by modern philosophers, we are sneered at as Philistines; when we say that the nation which does not pay great attention to the practical application of scientific knowledge of nature must cease to exist, we are jeered at. We are low mechanical persons enacting the part of the fat boy in "Pickwick," "I'se goin' to make your flesh creep!" It is a curious kind of culture which scorns the lessons of history, the study of man in his relation to nature, the study of the enormous new forces which are now affecting the relations of nations to one another. Are you learned misers going for ever to gloat in secret over your learning or to edit for ever the same Greek texts, or for ever to spin new metaphysical philosophies out of your inner consciousness?

Are you for ever to labour over phrases and dogmas that have been endlessly discussed by the most acute intellects of all time? If through a practical study of palæontology or biology you could get really to understand the great discovery of Darwin (and you cannot possibly get to understand it from books alone), you would see that the oldest puzzles of children and philosophers, from the shepherds of ancient Idumea to the dons of Oxford, have been solved for ever. Have you for one moment any idea of the magnificent new problems that are now before us, of the wide outlook on the universe, the comprehensive grasp of what is great and what is little, which is possessed by naturalists? For one man who knows his English literature, who revels in Shakespeare, are there not ten in Oxford who scorn all literature which is not at least 1800 years old? If you must meditate about your thoughts and emotions, why not begin with some experimental psychology? Why is there so little research of any kind in any subject going on in Oxford? The study of the Greek language through Herodotus is called *history*. The study of the Greek language through the early fathers is called *theology*. The New Testament is degraded into a Greek text-book. The Iliad and Odyssey are only Greek exercise books. The clear gushing spring of the desert beloved of Erasmus and More is now trampled into dirt by innumerable dromedaries. Is it any wonder that the average healthy young Englishman whose common sense has been developed through observation and trial should leave Oxford ignorant of your sand-ploughing scholastic exercise work? You have thought him stupid, and made him believe himself to be stupid, when he was only showing his wisdom. The mental training that he might have had, that he needs in life, that kind of training which his ancient Persian education cannot give him, where is it? When he was a very young boy you tried to teach him arithmetic for years, a cruel exercise. Now he does not know what a decimal is; when he borrows money at 5 per cent. per month he does not know that he is paying 60 per cent. per annum. If you had let him experiment, play at keeping shop, actually weigh things in ounces and pounds, or pay for them in shillings and pence, if you had let him measure things in inches and tenths of an inch, it would have been a pleasure for him to learn. If he had spoken French and German, and had been encouraged to chatter in those languages, he would not now be so ignorant. If you had encouraged him to read stories, if later you had not made all reading a school task, if you had encouraged him to describe things, to write accounts of what he had seen; if you knew how to teach anybody English, the language of his country, if you had refrained from putting geography and history and other English subjects all in water-tight school class compartments, he would now be fond of reading, he could use books, and he would go on educating himself for the rest of his life. You made him wear his soul out in learning off Euclid by heart—why did it not strike you that he ought to draw and measure, weigh and experiment, long before you tried to give him abstract reasoning of any kind? How is a boy to reason about things unknown to him? In the nursery he got mental training through everything he saw, everything he clutched. Oxford took charge of him scholastically at the age of seven, and from that time onwards his higher mental powers ceased to grow. His mental equipment suggests the item for bread in Falstaff's famous tavern account.

And he becomes a ruler of this great nation, his duty during war and peace being that of a scientific administrator. Times of actual war are few and short; in those times the people and property of unprepared nations are destroyed with a rapidity never known in the past. In all old times England was unprepared for war, but this did not then so much matter; in future the nation that has not prepared during peace for possible war, by the exercise of the highest scientific faculty, will certainly be destroyed.

I am afraid that Von Moltke would have laughed at the kind of education of Darius and his friends being regarded as sufficient in these modern days. Also the war between nations is quite intense in times of peace. The rulers of nations have to take care that their laws do not destroy

industries, that they develop the right sort of education of the people; that the people shall be so educated as to become resourceful, full of initiative and invention, capable of learning from experience, people of character. Again, if our rulers set a fashion of gibing at scientific things, at technical education, for example, through ignorance, it is not unimportant to know that the complete loss of trades like the coal tar industries may be more serious evils than the loss of several campaigns in war used to be. If the Prime Minister, or any other minister, gives an important post to a non-scientific man, it may not be harmful, but sometimes it may be very harmful indeed; it may lead to the appointment of many unscientific men or the disgrace of the scientific men already engaged in some department where science is all important. But the evil is very much more far reaching than one can describe in words. Want of science in the rulers means neglect of scientific education and method throughout the whole country.

For your man of caste is an Oxford man, and as a ruler of his country he regulates all sorts of courses of instruction and examinations for the army, the navy, the Civil Service, the Indian Civil, the Colonial, and all sorts of other services, and he takes care that all these shall be on Oxford lines. The higher permanent officials are chosen by Oxford standards. The members of scientific committees appointed to assist Government departments are chosen by Oxford standards. Do educational experts suggest reforms in education, it is Oxford that determines whether the reform is received sympathetically or otherwise. Probably nowhere is the influence of Oxford felt more than in the primary schools of the country.

I know you are proud that Oxford should have so great an influence, and I do not suppose you will pay any attention when I suggest that it may lead to national misfortune. If Oxford scholars were merely like so many monks in their monastery, living the lives, following the studies which they love, I would say nothing. The revenues so used up are, I think, of no great importance to the country, and busy men elsewhere can only be benefited in knowing that there are these lovely lamaseries where men are living in serene air apart from the struggles of the world, living what they think to be the higher kind of life, that of the amateur copying the lives of the scholars of Constantinople before they were so mercifully scattered in 1453, copying the meditative ways of the divines and hermits of the fourth and fifth centuries.

But the Oxford hermit is also a ruler of an empire in the twentieth century. Edward the Confessor was a saint, but some of us think that he was not a very wise ruler of England. Louis XVI., too, was an amiable man. The downfall of nations has generally come from the too great power of some quite amiable amateur persons or corporations. It is mainly through her too great influence on the ruling families of England that I consider Oxford to be dangerous.

What, then, is it that we want? We affirm that all so good as the development of the faculties of the average Oxford man may be, it might be enormously increased. He learns by observation and experiment; he and his forefathers have never learnt anything otherwise. Why not, then, increase for him these chances of observation and trial? Frankly confess that to develop his reasoning faculties through mere repetition of the text of Simpson's Euclid is an absurdity, that he cannot at all take in abstract reasoning; that the academic methods of teaching mathematics and its applications are what we all know them to be, mere frauds. Some of our Chancellors of the Exchequer are known to have been ignorant of arithmetic. There are fine jokes—jokes understood even by board school children—told about Foreign and War Ministers of England who were quite ignorant of geography. "Bless my soul, you don't say so—Actually Cape Breton is an island—actually. I must go to the King at once and tell him that our great expedition has been sent to an island!"

These are no longer jokes to me; I merely feel that it is extraordinary that a man can have been so educated as to be a good debater, to be able to make a fine speech, that he may have taken a degree at Oxford, that he may have passed examinations in classics, philosophy and mathematics, and yet be exceedingly ignorant, illogical, unscientific, and unable to do easy computation. Some of us say that it is only through the experimental study of natural science, and not at all through the classics, that the brain of the average Englishman can be educated on that side which is never educated at the present time. We say that he is never taught English, yet history and English literature are finer mediums for his education than ancient classics. We say that if when young he was taught to be fond of reading English—and every child may be made fond of reading—later on he would be able, and very willing, to use books, and that a man who is fond of reading and is able to use books keeps educating himself all his life long. But books alone at Oxford are not enough. They are not wise the men who think that lectures and books alone, and observing lecture-table experiments, can give men an acquaintance with the great discoveries in natural knowledge which are revolutionising the world.

Do you know the ballad about the Count Arnaldos who envied the old helmsman his weird and wondrous powers?

> "Would'st thou, thus the helmsman answered,
> Learn the secret of the sea,
> Only th se that brave its dangers
> Comprehend its mystery."

I know there are many men in Oxford who think, like the wistful Count, that they can get all things easily or from mere reading. But, in truth, to read "The Origin of Species," or treatises on geology or astronomy or physics or chemistry is a misleading performance unless the reader brings to the study that kind of mind which has been developed already by his own observation and his own experiment. My classical friends laugh at me when I say that I know much Greek literature through translations, and yet they pretend to be able to weigh scientific arguments without having made any practical study of science. At all events I know my defects. I know that although a translation may give me in every particular the meaning of a Greek author, it cannot give me the music of the old language; the reasoning and facts are mine, but not the emotion. And when my classical friends say that they can weigh scientific arguments I laugh, for there are parts of those arguments as much beyond their comprehension as scientific evidence is beyond the comprehension of a Chancery Court. Who can compete with a barrister in reading, in extracting the meaning of a written document? and yet barristers fail utterly in getting scientific knowledge from books.

Besides the aristocratic undergraduates you have a larger number of middle class men at Oxford who will succeed their fathers in the management, not merely of landed estates, but of much more valuable estates in the distribution and manufacture of things. The education of these men from infancy has been on the same lines as that of their superiors, but it has been much more artificial, and remains much less thorough to the end of the Oxford course. There is, however, the same contempt for books, for learning, and the same absence, not merely of knowledge of natural science, but of those scientific habits of thought and methods of approaching problems which experimental research tends to produce. They are proud of being Oxford men, and are even more strongly imbued than the others with Oxford utilitarian prejudices. They have studied mathematics—mathematics is useless in business. Natural science was said to be taught at Oxford, and no man seemed one bit the better for having studied it—natural science is useless in business. These men become the owners of factories the spirit of which ought to be scientific research; the competing factories in Germany, France and America are run by men of scientific method, and our men discourage reform in every possible way. The rule of thumb of their fathers and grandfathers is good enough for them. Their factories are so badly arranged that the works cost of any manufacture is twice what it ought to be, and the time taken is twice as great. They take eagerly to all sorts of quack remedies for bad trade; they are easy victims to fraudulent persons. These are the men who discourage all education in the people employed by them, managers, foremen, and workmen. They are what I call unskilled workmen, that is, unskilled owners of works, and it is Oxford which is to blame for their unskilfulness. It is astounding how quickly the thriving businesses of the fathers are decaying, how quickly unskilled owners of works are being eliminated,

but there is a new crop of them every year. The want of education of these men is very harmful to the country, and Huxley, Lockyer, Armstrong, Ayrton, Magnus, and other educational experts have written at great length upon the subject over and over again. If I thought that the expression *technical education* were understood at Oxford, I might, perhaps, try to ventilate this part of my subject, but it is quite misunderstood, and as these writers have failed to make any impression I think it better to let it alone.

Fifty years ago the Prince Consort started many good things agoing, and probably the most important was the Science and Art Department, the science classes of which under Sir John Donnelly forty years ago, greatly developed by Sir William Abney since, have given a better education in natural science to hundreds of thousands of poor boys than Oxford gives even now. I feel sure that it is this that has saved our industries from the jealous, hungry, persistent scientific foreigner. Wherever there is an owner of works whose common sense triumphs over his defective education, he gives a free hand to a manager who has been taught in these classes or in one of the technical colleges now springing up. These technical colleges are the natural outcome of Sir John Donnelly's work. I am glad to think that their methods are far removed from the soul-destroying methods of Germany; they are gradually becoming more and more perfect as British institutions. They illustrate the British experimental method of tackling an important problem. The one bar to their success is that the boys from all the schools of this country, primary and secondary, but particularly from those schools which are more immediately under Oxford influence, are quite unfitted by their school training to benefit by technical college teaching. The time of the professors and instructors is greatly wasted in correcting evils that are due to the schools. I think on the whole, however, that middle class England is slowly waking up to the importance of education. Every kind of education she has seen in the past has seemed to her not worth striving for, and her sleep has been very sound and very prolonged. But a kind of education is now being exhibited to her which seems as if it might give a fine sort of mental training, and as soon as middle class England sees this matter clearly as a thing worth having, the rule of old Oxford over many of our schools will cease. For Oxford has not merely induced neglect of science; she has been its active enemy pretending friendship. What schoolmaster from Oxford is there who does not see his existence threatened by science? Consequently, middle class England has been paying large premiums with its sons and yet seeing them fail to obtain employment, whereas board school boys are successful enough in reaching lucrative positions, although they have paid no premiums, and have been earning wages all their lives.

It is not the schoolmasters, it is the engineers who have been educating England. The engineer is always thinking of utility, of the value of time, of the fact that a man has only one life in which to do what good it is possible for him to do. So he reads novels and poetry and history; he enjoys painting and music; he travels and sees other people, other nations and their monuments. He cultivates and exercises the whole of his mental and emotional machinery so that he may become more perfect as a student of what Goethe called "the living mantle of God."

Everybody speaks of how the engineer has created what is called modern civilisation, has given luxuries of all kinds to the poorest people, has provided engines to do all the slave labour of the world, has given leisure and freedom from drudgery, and chances of refinement and high thought and high emotion to thousands instead of units. But few seem to see that the engineer is educating the imagination and poetic faculty of England. Every unit of the population is becoming familiar with scientific ideas, for he can hardly take a step without becoming acquainted with romantic steam engines and electromotors, with telegraphs and telephones and steamships, with drainage and waterworks, with railways, electric tramways and motor-cars. Every shop window is filled with the products of engineering enterprise. It is getting to be rather difficult for people to have any belief in evil spirits and witchcraft, and this is probably the most enormous intellectual stride that the great body of the human race has ever made in any half-century. It has been made in spite of the persistent opposition of Oxford.

It is due to Oxford that the interest taken in natural science by the richer classes, by men of expensive education, does not seem to be much greater now than it was thirty years ago. Some of them are called scientific if they go to hear lectures illustrated with fireworks, or if they assume as their eyes glance over a quasi-scientific article in a magazine that they are taking an interest in science. But among the less rich classes, the people who work with their brains, there is an interest now in science which is increasing in amount by the compound interest law. This new interest is recognised in the fine idea of Sir Norman Lockyer, so well talked about this summer, to form a great British Guild of Science the members of which might include almost every adult man or woman of brains in our Empire. His object is to organise the efforts now being made everywhere to interest people in science, to develop education in scientific method in every school in the country. I feel sure that this Guild will some time be formed successfully, and that it will do enormous service to the world. Its being successful in our own time depends mainly, I think, on the energy and persistence of Sir Norman Lockyer himself, and he certainly is an energetic man. May I ask if Oxford means, in her place of fancied security, merely to look on at great scientific movements? Or may it even be that she will use her autocratic authority to put all these movements down? Will she, in her pride, champion another lost cause? Or has she a sufficient number of young able men rich in the sort of enthusiasm possessed by William of Waynflete or William of Wykeham, by the pupils of Grocyn who did not lecture to Erasmus, or of Colet, the Dean of Eastminster. Just think of it you Oxford men, you who have entered on such an enormous heritage, you who have been supposed to stand for centuries at the head of the intellect of England. Are you now going to stand aside or are you going to oppose the greatest intellectual movement that has ever taken place in this world—or are you going to take your natural places in the foremost files of time?

If Oxford taught science through a student's own research, if Oxford gave a broad general culture suitable for all sorts of men of all sorts of minds, there is hardly any middle class man in England who would not be glad to send his son to Oxford. Even now the prestige of Oxford and the social advantages that it offers overweigh in the mind of many a parent all the intellectual disadvantages.

A man must be very impudent or very bold, or he must have much of the martyr in him, to criticise corporations like those which exist in Oxford. He must feel his cause to be infinitely right, because Oxford men have always been famous for their command of rhetorical weapons. There is hardly a man worthy the name of scholar in Oxford who has not a better command of such weapons than I. Think of the time when Oxford had fallen from her high estate in scholarship, so that Boyle and Atterbury had the same sort of ignorance of Greek which Oxford men now have of natural science; yet were these impostors so clever that they set all the world laughing at Bentley, the greatest scholar of a hundred years. Am I to be the fresh victim of the Bull of Phalaris?

Call it impudence if you please, but Oxford ought to be told what some outsiders think in this matter. She that represents all that is best in England, does indeed in some respects represent what is worst. Every young Oxford man is like a knight who sees only how beautiful is the lady whose colour he wears, and he forgets that the lovely body does not always cover the soul of Una; sometimes it hides the evil witch Duessa.

I do not address average men. I speak to those clever young men whose names are known now only in Oxford, whose names will in the future be carried on trumpet blasts over the world and for long time to come. Surely you aim at the study of those great eternal truths about man and nature which are hidden from the common view by prejudices; and surely you know that Oxford prejudices, however consoling they may be to your self-respect, however secure they keep you now from adverse criticism, are after all mere formulas and of only limited application, both in time and place.

You will say that I also have my prejudices, which urge me to ask if you wish for ever to look at man and nature through Greek spectacles. Well, I certainly cannot worship at Greek shrines. If Jowett's translation is the real Plato I can see none of the infinite depth of thought that my friends rave about; he seems to me pretentious and shallow; and when Aristotle speaks about things of which I happen to have some special knowledge, he seems to me so unscientific as to be maudlin. Macaulay somewhere says that the account by Thucydides of the retreat of the Athenians from Syracuse is the most affecting episode in history. Well, I have a great respect for Macaulay, and I have tried to cultivate a love for the people of the city of the Violet Crown, but I know some crimson patches of Macaulay's own which seem to me to be to Thucydides what Swinburne is to Shenstone. What is a fair man to say when he hears his friends talk of the greatness of Sophocles and Euripides and Aristophanes in the original, if he knows that these friends never read Shakespeare or Jane Austen or Goldsmith or Dickens? I feel ungrateful as I speak, for I have enjoyed the reading of Bohn's "Odyssey" and many another translation from the ancients as much as anything modern. Yet I cannot help acknowledging a suspicion that this worship of Greek is like one's fondness for the rhymes, often rubbishy rhymes, that associate themselves with our infancy and boyhood, or like Johnson's belief that his wife was amiable and beautiful. Have I, therefore, prejudices against Greek which prevent my seeing things from an Oxford point of view? I think not. At all events I can respect it, for I know that the other point of view has been held by some of the greatest Englishmen, and this alone is sufficient to give me diffidence. But whatever diffidence a man may feel in the expression of his opinion, he is sometimes compelled to put it aside. Not once, but many times in preparing this address upon Iceland and its snakes have I felt how stupid I was to undertake it, but it was too late to withdraw.

You will say that I, a man of little culture, am very poorly qualified to speak of reform to cultured Oxford men. Do you think that Jonah was particularly cultured when he was called upon to urge reform upon the rich, the intellectual, the high descended people of Nineveh? I do not speak to conscious Oxford. It is something altogether subconscious in a human being or in an institution to which we really speak when we expect reform. It is to subconscious Oxford that I speak, that dumb unconscious soul which has, on the whole, guided her rightly through the centuries in spite of all the visible long-continued eruptions of the flesh. Many colleges have for generations in the past been given up to eating and drinking and sensuality in general. Jealous quarrelling has ruled in her common rooms. Poor thin scholarship has often had unworthy victory. But the heart of England is beating in Oxford, and on the whole it is a very sound heart.

Now it seems to me—a rank outsider—that Oxford is cursed among universities in one very important particular. There has in the past been only one kind of real study here. Whatever was studied in Athens or Alexandria to the end of the second century A.D., that has been open to you, that has been a medium of mental training. But those subjects in which Germany has made her mark, theology, law, history, Bible criticism and others, these are denied you.

Who was it who first pointed out how England differs from France in one important particular? The French Revolution has made such a complete severance of the modern from the old French system that a French philosopher can discuss French history as if it were of another planet. When he speaks of the old provincial Parliaments or the edicts of St. Louis, his prejudices and interests interfere in no way with his reasoning. When he discusses the present Concordat or the *Coup d'État* of Napoleon, he makes no reference to the times of Philip Augustus or Louis XIV. But in England it is quite different. When the lunacy regency in the time of George III. was being discussed in Parliament, all the precedents long before the time of Henry VI., even back to the time of Edward II., had the force of legal documents. The Parliament and ministers of Charles I. both appealed to English history, and both found support for their very divergent views, and so English history has to be read and written with the bias of modern political party spirit. In the same way the student cannot touch the questions of theology or law without considering them as party questions. A subject which can only be approached by a student with prejudices evoked by the party politics of his own day is distinctly not a subject through which university culture is possible; I mean that it cannot be studied scientifically. Theology presently becomes mere dogma, and degenerates into credulity as the glory of the church is more important than truth. Thus it is that the scientific students at Oxford have confined themselves to the study of eight or nine old books. Never, perhaps, has there been so wonderful a phenomenon as this, the cleverest men of a nation devoting themselves for centuries to one narrow stream of erudition, making Greek literature and Greek philosophy phosphoresce in the most brilliant manner. But it is too narrow, this stream, and the laws of the game are too technical, too artificial. Consequently, every now and again something like the fidgets, the desire for something real to think about, seizes upon the Oxford community; it throws itself into politics or tractarian movements, it is strongly conservative or strongly liberal, it is high or broad or low, and, after a splendid display of energy, the fever works itself out, and there is a gradual return to the older learning after a time of unintellectual laziness. In these times of fever, as in the time of the Tracts, real study falls to its lowest ebb, because truth of any kind has ceased to be an object of worship. If I am right, then it is the leanness of the studies which are really scientific which causes these great alternations, these periods of degradation, these times of easy conscience when that freedom which is the glory of Oxford degenerates into licence. You know quite well that there must be such degeneration unless men have healthy, delightful work to do, and there is a healthy public opinion to be feared or welcomed.

Such attacks as those on the fair-minded Gibbon and examples such as that of the very much prejudiced Froude show how difficult it is for any Englishman to make a scientific study of English history, or English law, or English, or, indeed, any kind of Christian theology. Indeed, in the study of mental and moral philosophy of the *a priori* kind, according to any school from that of Socrates to that of Kant, it is difficult for an Englishman to keep clear of dogmatic theology and partisanship.

But the great world of natural science remains, the region in which no attention whatsoever need be paid to sacred books, to dogma, to authority, the region in which the mind feels no fetters, where no kind of individuality is a crime, a world of promise in which the first pioneers have already in a short time found great stores of wealth on the mere surface of the ground, a world which seems infinite in its possibilities. It is only in this free atmosphere that the mental constitution will become healthy enough to be able to combat prejudice and the dogmatic microbe. Talk no more of man as if he were apart from nature. The mind, the consciousness, the soul of man and all his emotions are natural and to be studied by the deductive and experimental and inductive methods used by us in all parts of natural philosophy. Give up this mere absorption of other men's ideas, whether in old classics or in quarterly and monthly reviews, this collecting of ready-made opinions on all subjects whatsoever. Are you for ever to hang to the apron strings of the ancients? Is your manhood worth so little that you cannot exist without worshipping men who were creatures like yourselves? You speak of the reason of man as if it were an omnipotent thing. We speak of the spirit of God in man brooding over phenomena which seem chaotic until new light is evolved and you actually think that we are beggars living upon scraps of wisdom dropped from your tables. When you insist upon your classical tests you spoil our whole scheme of study, and you are merely acting as brigands, you are only taking that sort of *advantage* which all mean people take when they have official positions.

It is not learning that is important. A university is to create men, men of original thought, men of character, men of resource, men fond of reading. And you men of the university as distinct from the colleges—if you really can invent some examination which will select the men of thought, do so, and use it, but for my part I do not think this business of selection one for

any kind of machinery that ever yet was invented. There is too much of the ludicrousness of Teufelsdröch's iron king about all schemes of examination that ever I have known, and there is too much of the draper's assistant style of work about your boards and committees. If you have any really important piece of work to do, give it to some one *man* to do, and ask people to discuss it at a public meeting; but this committee kind of pretence of work is getting to be ridiculous. You are certainly wasting the time of the few good men and giving easy consciences to all the other men who attend these boards.

I hold a brief for the average man usually said to be stupid, and yet I have been speaking of scholars, the rulers of the university, the men to whom younger men look up with worship. This is because there can be no real teaching unless some of these higher men are really great students themselves. Never did men have as good a chance of education for themselves as the fellows of the rich Oxford colleges; never had men such a chance of merely marking time and pretending to educate themselves.

About seventy years ago teaching began to become the very valuable monopoly of the college tutors. This could hurt, but could not destroy, the effect of college life in producing liberal culture. The college don ceased to be a student, he tried to teach many different subjects much in the style of the fourth form master in schools; he prepared men for Responsions, which is really a sort of belated matriculation examination; clever men may still pay him fees, but for them there is only harm in attending his classes. Hence it is that for thirty years you have been returning to the ancient practice, and the number of university professors, of lecture halls and laboratories is slowly growing. Surely this is the direction of true reform. Is it not possible to get each rich college to establish two or three great schools in which only two or three subjects may be studied by men through their own research, commanded by men of the highest talent and initiative, who are free to teach as they please and to examine as they please? But what chance is there of this or any reform? We have reached a time when the good men are discouraged and the bad men are triumphant. The powers of Arimanes set themselves against the powers of Oromasdes, disputing reform, and there have been many signs during the last fifteen years that the powers of darkness, those opposed to science, have organised themselves more scientifically than the powers of light. They have determined that in the future no change shall be made in the character of Oxford studies.[1] They do their best to make past reforms operative only for evil. As for the reformers, their conception of a university is of one in which there are so many literary and scientific subjects taught that every student can obtain, through the study of few or many of them, the most perfect training of which his mind is capable. Some of us have the belief that the average mind is capable, by training, of becoming immeasurably richer than even a few exceptionally great minds have ever been.

By the study of a subject I mean not merely listening to lectures, not merely using books, not merely a student's own research, or discussion with other men whose courses of study may be the same or not the same, but all this and much more, the most important after research being the worshipful study of great men whom the student is privileged to meet and possibly to work with. I mean also that a youth ought to have had a previous training fitting him for university study. There are few boys who might not be well trained at the age of fifteen; in my opinion ninety per cent. of Oxford undergraduates are at present quite unfit for any kind of university study.

I now come to a question in which I stand alone, and I beg your patience. My best friends seem unable to criticise me, for they find it impossible to get to my point of view. What ought to be the nature of the matriculation examination? I wish I had half an hour in which to try to convince you that its sole object is to test whether a student is likely to benefit by *any* of the university courses of study. Surely this was the mediæval idea; the one compulsory subject was Latin, because all the literature known to students and teachers was in Latin; all lectures were delivered in Latin; all teaching was in Latin. Consequently, in some Oxford colleges a man was fined if he spoke in any other tongue. Surely it was a good time when all learned men in the world spoke the same language. Then came the time when there was still no English literature, and not only was the best literature in Greek, but Greek was the only approach to natural knowledge, so Greek also was compulsory, and so it has remained to this day—to this day, when English literature is of greater worth than any ancient or, indeed, any other modern literature, when all teaching, all lectures are given in English, and when our English knowledge of natural science is not only infinitely greater than anything possessed by the ancients, but it enables us to say that the ancients were hopelessly wrong, when nobody except the official university orator or some traveller ignorant of the language of a foreign country speaks Latin, and speaks rather the Latin of Stratford-atte-Bow than the Latin of Rome! Three hundred years ago the rule was reasonable and necessary, but to insist on its observance now, when it is stupid and unnecessary, seems to me quite unscientific.[1]

I would therefore make a knowledge of Latin or of Greek compulsory only on students of certain subjects, and the professor ought to impose the condition, not the university. Again, students of certain other subjects ought to be supposed to know one or more modern foreign languages, and, indeed, it seems to me that the professor in each subject has a right to insist, if he pleases, on his students having certain special knowledge before they enter on the study with him. I would give him this right because I want him to have perfect freedom. But to enter the university, merely to matriculate, surely the compulsory subjects ought to be as few as possible. It seems to me that the most important thing is that every student should have had an early education through his own language, English; should be able to write an account in English of anything he had seen; should have some acquaintance with what are called English subjects, such as geography and history and the principles of natural science, and the power to make simple computations. All the teaching is to be in English, all his companions speak English; there are good English books on all subjects, there are English translations of all the good books that have been written in foreign languages.

I am afraid that no Oxford man can understand the following statement, which I make as a man of some experience, speaking with a full sense of responsibility. So abominable do I think *compulsory* Latin or Greek, or French or German, that I believe a board school to be a much better school than any other for a boy if he is fitting himself for any profession in which applied science is important.

I can understand why Tom Sawyer and his friends, when they started their gang of robbers, initiated them through passwords and a ritual. That was for "side." The gang did not consist of pirates or robbers; they were innocent young boys, and their passwords and ritual were the essence of the romance of the thing. This compulsory Latin and Greek for the average youth at Oxford seems to me merely grown up Tom Sawyerism, and it is allied in obvious ways to the worship of mumbo-jumbo. It used to be that the use of fur on clothes was reserved for the higher classes. At another time gentlemen only were allowed to wear swords. In China and Japan certain buttons and coloured dresses indicated certain rank. In our own time there are fashions of slang which distinguish the smart set of society. The survival of Latin and Greek as compulsory subjects is very much the same sort of thing. It

[1] Throughout this address my hands have been tied so that I may not make particular references. But suppose I were to provide money for the endowment of a valuable professorship of some scientific subject, do we not know what the Oxford authorities would do with it? They would appoint as professor a man who had never done any scientific work, who can never be expected to do any scientific work, who never wants to do any scientific work, and whose highest ambition will be to act zealously as the bursar of his college!

[1] It is very interesting to me to note that on the very day when I wrote this sentence, after dinner, amusing myself and not in any way for the purposes of this address, I happened to be reading the "Life of Plutarch" written by the Langhornes, and these words caught my eye:—"Another principal advantage, which the ancient mode of the Greek education gave its pupils, was their early access to every branch of philosophical learning. They did not, like us, employ their youth in the acquisition of words; they were engaged in pursuits of a higher nature; in acquiring the knowledge of *things*. They did not, like us, spend seven or ten years of scholastic labour in making a general acquaintance with two dead languages. Those years were employed in the study of *nature*, and in gaining the elements of philosophical knowledge from her original economy and laws."

has no more to do with education than the two hind buttons on our coats or the wigs of our judges have to do with convenience. These three kinds of school training—in one's own language and literature, in the principles of natural science, in common-sense computation—are absent from all public schools at the present time; it seems mere impudence in me to make them the only compulsory forms of training for men who are to enter a university. Until this is done, I think that most of the endowment of science scholarships is quite wasted.

I agreed to give this address because I knew that Sir Norman Lockyer intended in his British Association address to propose a very large Government endowment of the universities. At first sight his suggestion that 24 millions of pounds should be devoted to this purpose seemed ridiculous, but careful study has brought many thoughtful business men round to the idea; it is not utopian, it has actually a good chance of being carried out.

I saw, as many of my friends see, that the one thing which may wreck the project is the reputation of Oxford. Our rulers who have to grant the money know of universities only through their knowledge of Oxford. It is hardly possible for them to understand what we mean by a true university, which would give to every student real breadth of culture, real mental training. They may be brought to see it if Oxford men are in earnest in trying to develop Oxford on scientific as opposed to unscientific and ill-regulated lines; if the powers of light organise themselves as scientifically as the powers of darkness are organised. But there are certain intellectual movements going on in our nation which may force our rulers to grant the money; Oxford seems to know little about them and to care less; they seem to her to be merely a new untying of the bags of Æolus; it is my belief that if Oxford knew more about them she would build an altar to the goddess of *Fear* and offer sacrifices upon it, yea, burnt offerings of some of her best-loved possessions.

Oxford has a well earned prestige and still attracts all young men of intellect, but these new intellectual forces may quite quickly destroy the reputation which has been built up during centuries. For example, we have a new kind of secondary school, of which some five hundred have been established all over the country in the last few years. I myself think the science schools, scheduled as A schools, to be much the best of them, but the most numerous of them are the B schools, in which there is some natural science taught through boys' own research, but the time devoted to it is not much more than what is sufficient to enable us to say that in these schools boys are greatly emancipated from the old Oxford limitations. These schools before their emancipation sent many a fine scholar and mathematician to Oxford and Cambridge. They still rank below the great public schools. What is aimed at is an education which may suit any kind of boy, a real liberal education such as the older schools know nothing of. It is even hoped that shortly somebody in one of these schools will discover how English may be taught to English boys. All these, like the science schools, are due to the work of Sir William Abney. Now the boys of these schools, when they leave, wish to complete their education on the lines on which they have been working so far; are these exceptionally able students to be told that Oxford cannot complete that education? Few people seem to be aware that the growth of these schools indicates a great revolution; anybody who notes their rapid growth must feel sure that in a few years no secondary schools, except a few of the public schools, will continue to work under Oxford traditions. It ought to be noticed that unless boys in future are prepared on these new lines, it is not worth their while to enter Woolwich or Sandhurst, or the Admiralty colleges, because they will not be able to follow the higher instruction there given, and must drop out of the race for commissions. It is evident that the days of special army and other classes in schools are numbered. If Oxford by holding aloof from this movement ceases to influence the majority of the secondary schools, it will lose its influence over a great body of people of the middle class.

I have already mentioned another great movement from which Oxford is holding aloof, the movement for technical education the basis of which is the sort of study trifled with, feared, and hated at Oxford, natural science. It has spread from the very lower classes to the lower middle classes, and better and better buildings and apparatus, and better paid teachers indicate the higher and higher social position of the pupils of the technical schools. A few Oxford men have greatly helped in starting both of these great movements, and Oxford as a whole, if she cared, might be in a position to take a leading part in them. She has an influence now due to the easily interpreted fact that Oxford men occupy many of the higher posts connected with both of them.

It is not only that Oxford keeps aloof from technical education, but she keeps aloof from the very much greater thing of which this movement is only a symptom, namely, the phenomenon that trade and manufacture are no longer left to themselves as they used to be; they are being organised on scientific lines in all countries. She has always ostentatiously held herself aloof from manufactures and commerce. It is almost incomprehensible that a university aiming at breadth of culture should scorn those things which keep England in her high position, give value to the real estate on which Oxford's own revenues depend, and differentiate Oxford from Beyrout. I feel sure that this attitude ought to be quite carefully veiled if Oxford is to have such a share in the 24 millions as her prestige would otherwise warrant her demanding.

The truest stories about man are the fairy stories; they are true of all times, of all races of men, and the truest fairy story is that which tells how men who look back and not forward are turned into lumps of rock or pillars of salt.

I want the forces of light at Oxford to organise themselves to teach Oxford how she may become worthy to maintain the reputation which she earned so well in the past. Her great glory is *not* in her defence of lost causes as many men think. Was the movement started by Roger Bacon a bad cause? Is it a lost cause? Has the movement started by Grocyn and Colet become a lost cause? Has the movement started by those Oxford men who founded the Royal Society become a lost cause? Are the names of Wycliffe and Wesley forgotten? Have the reforms started by Stanley, Jowett and Pattison in our own times become lost causes? Not yet! The influence of Oxford over intellectual England used to be supreme, it is still enormous; it rests with the young Oxford men of the present day who know something of history to decide whether this influence may or may not become a cause lost beyond all chance of finding again.

A NEW GERMAN BOTANICAL SOCIETY.[1]

THE publication of the first report of the meeting in Berlin of the Society of Germans interested in the Study of Systematic Botany and Plant Geography calls for more than passing notice. The society owes its creation to a well-founded cause, and is indicative of a response to that spirit of colonisation which has shown itself in Germany more and more during the past thirty years. In the first half of the nineteenth century the British Government, merchants and others were calling out for information as to the character of the flora of our colonies, and, as a result, British botanists were mainly engaged in the study of systematic botany, while the German botanists were occupied in the investigation of the structure, physiology and pathology of the individual plant, with results in each case well known to all serious students of botany.

The German systematists do not take a prominent place at the meetings of the German Association for the Advancement of Science, and though in their new society they propose cooperation, if possible, with it and with the Deutsche Botanische Gesellschaft, they seem to feel the necessity of a separate society to meet the requirements of their own branch of botanical study, which, during the last twenty years, has made enormous strides. Explorers have been sent out into all parts of the globe, and not simply to the German colonies. Listening to the papers from day to day it seemed that, so far as the conference was concerned, the

[1] Bericht ü. d. Erste Zusammenkunft der freien Vereinigung der systematischen Botaniker u. Pflanzengeographen zu Berlin. Pp. 83. (Leipzig: W. Engelmann, 1903.)

German flora might have been almost non-existent, so wide is the field covered nowadays by German investigators. Nor is this outlook due simply to the desire to know more of the economic value of their colonial floras. The more complete our knowledge the surer will the foundation be laid for that natural system of classification which so far has been most nearly reached in Engler's "Pflanzenfamilien." These two objects, increase of knowledge of the economic value of particular floras, and the reduction of the imperfection of record of the world's flora, in time and space, were kept prominently before the conference. It was refreshing to an Englishman to hear the various readers of papers acknowledge the work of the Hookers, Bentham, and others. A third object in starting the society was well carried out—to bring together the systematists in Germany, &c., for semi-scientific and semi-social intercourse.

Each evening members, accompanied in some cases by ladies, met in a restaurant for dinner, the most enjoyable of these functions being the one in Potsdam, ending a long day's excursion in the forest on the banks of the Wann See. After an explanation of the plans for the new herbarium, &c., to replace the overcrowded botanical museum and the old gardens in the city, a visit was paid to the new gardens in the suburb of Dahlen. Here, as in the old museum, it was interesting to notice not only the grasp the director, Dr. Engler, had of everything, but also the way in which he brought forward the officers of the various departments, and left them to tell their story. Appreciation of the importance of the protection and preservation of special plant habitats or of special individual plants, and also of beautiful scenery, was illustrated by a paper by Dr. Conwentz, who for three years past has devoted his time, at the Government's request, to the study of the question, and is now engaged in the preparation of an illustrated elaborate report. The next meeting of the Society will be held in Stuttgart on August 4–7, 1904, and should be borne in mind by British botanists; the subscription for membership is only three shillings.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. R. H. YAPP, of Cambridge, has been appointed professor of botany in the University College of Aberystwyth in succession to Prof. J. H. Salter.

MR. HUGH DAVIES has been appointed head of the building trades department of the Northern Polytechnic Institute in succession to Mr. H. W. Richards, who was recently made principal of the London County Council School of Building at Brixton.

THE debt of 5000*l.* in connection with the University College, Bristol, has now been entirely liquidated. Sir William H. Wills, Bart., and Sir Frederick Wills, Bart., M.P., each contributed 1000*l.* towards the amount required, and a further sum of 500*l.* has been given by the managers of the Exhibition of Welsh Industries recently held in Bristol.

THE governing body of the South-western Polytechnic, Chelsea, has accepted with very great regret the resignation of the principal, Mr. Herbert Tomlinson, F.R.S. At a meeting held on December 16, the following resolution was passed:—"That the governing body hereby desire to record their cordial appreciation of the admirable work that Mr. Tomlinson as the first principal has accomplished in organising and developing the institute in all its branches."

AT the Royal United Service Institution Mr. C. E. Stromeyer read a paper on short service training for reserve officers. It contained a sketch of the German "Einjährig Freiwilliger" system, which, according to the author's views, supplements the ordinary school and university studies by a good insight into the human nature of the German workman by bringing him and the one year volunteer into close contact while serving together in the ranks. German technical students are therefore fit at an early age for the posts of submanagers in industrial undertakings, whereas English lads fresh from technical colleges are not trusted to deal with workmen. The author suggests that the War Office should encourage young men from public schools and from universities to join the army for a short period.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, December 21.—M. Albert Gaudry in the chair.—After the delivery of the annual presidential address, the prizes offered for the year 1903 were awarded. In geometry, the Francœur prize to M. Émile **Lemoine** for the whole of his work in geometry; the Poncelet prize to Prof. M. **Hilbert,** University of Göttingen, for his works on the principles of geometry. In mechanics, the extraordinary prize of 6000 francs was divided as follows:—one-half to M. **Maugas,** chief engineer in the navy, for his researches on the stability of battleships and his works on submarine navigation; the other half was divided in equal parts between Lieutenants **Jehenne, Gaillard,** and **Germain,** the first for his work in the application of wireless telegraphy to the navy, the other two for the improvements they have carried out in apparatus intended for the transmission of orders or signals during a battle. The Montyon prize was awarded to Prof. **Bodin** for designing and executing a new system of cantilever at the Viaur viaduct; the Plumey prize to Prof. **Marchis** for the free courses of instruction in applied mechanics organised by him, and more especially for his lessons on steam and heat engines. The Fourneyron prize was not awarded. In astronomy, the Pierre Guzman prize was not awarded; the Lalande prize was awarded to Prof. **Campbell,** of the Lick Observatory, for his investigations in stellar spectroscopy and astronomical physics; the Valz prize to M. **Borrelly** for his discoveries of comets; and the G. de Pontécoulant prize, intended to encourage researches in celestial mechanics, to M. H. **Andoyer** for his memoirs on the theory of the moon and that of the small planets. In physics, the Hébert prize was awarded to Dr. E. **Goldstein,** of the Berlin Observatory, for his investigations, during thirty years, of electric discharges through rarefied gases and the discovery of a particular kind of radiation; the Hughes prize fell to M. Pierre **Picard** for the improvements effected in telegraphy, improvements which have increased the rapidity of transmission in submarine cables; the Gaston Planté prize to M. **Hospitalier** for his ondograph. In statistics, the Montyon prize was not awarded, though MM. **Loncq,** de Montessus **de Ballore,** and **Razous** each received an honourable mention. In chemistry, the Jecker prize was given to M. L. **Bouveault** for his numerous researches in organic chemistry during the last seventeen years. The La Caze prize fell to M. A. **Guntz** for his thermochemical investigations on the compounds of fluorine with metalloids and with metals. In mineralogy and geology the Delesse prize is awarded to M. Emmanuel **de Margerie,** joint author with General de la Noë of "Les Formes du Terrain," and translator into French of "La Face de la Terre," by Prof. Suess, of Vienna. In physical geography, M. R. P. **Colin** received the Gay prize for the determination of numerous geographical positions in Madagascar. In botany, the grand prize of the physical sciences was not awarded, nor were the Bordin and Desmazières prizes. M. **Mairе** was accorded the Montagne prize for his delicate researches in connection with the Basidiomycetes. The Thore prize was awarded to M. **de Istvanffi** for his work upon the diseases of the vine known as "white" or "red" rot. In rural economy the Bigot de Morogues prize fell to M. Eugène **Rister** for his well-known "Géologie agricole." In anatomy and zoology, M. R. **Fourtau** is accorded the Savigny prize for his memoirs on Egyptian stratigraphy and other palæontological subjects, and M. **Krempf** receives an honourable mention. The Countess **Maria von Linden** gained the Da Gama Machado prize for two memoirs on the development of the colours in the wings of butterflies. In medicine and surgery, Montyon prizes are awarded to M. **Dominici** for his memoirs on the normal condition of certain organs, and also when infected; to

M. Jean **Camus** for a work entitled "Les Hémoglobinuries"; to M. Robert **Lœwy** for his method of peritoneal grafting. Honourable mention was also made of the contributions of MM. **Nicolle** and **Remlinger, Nobecourt, Merklen** and **Sevin**, Ch. **Monod** and J. **Vanverts.** The Barbier prize is divided between MM. **Anthony** and **Glover**, the work of the former being in connection with the sternum, and that of the latter a new therapeutic method based on the application of a warm spray of non-volatile liquid. The arrears of the Bréant prize were divided between M. E. **Chambon** for his memoir "L'Institut de vaccine animale, son histoire depuis sa fondation en 1864," and Dr. **Borrel** for his papers on the parasitic theory of cancer. The Godard prize was awarded to Drs. N. **Hallé** and B. **Mötz** for their contributions to the pathological anatomy of the bladder. Dr. J. B. **Hillairet** received an honourable mention. The Lallemand prize was divided between Mlle. **Joteyko** and MM. **Garnier** and **Coloiiau**, and Dr. Giuseppe **Pagano** was honourably mentioned. Dr. Paul **Godin** received the Larrey prize for his contribution on military hygiene, and M. G.-H. **Lemoine** and Dr. Jules **Régnault** were honourably mentioned. Dr. F. **Battesti** was accorded the Bellion prize, while Dr. R. **Glatard** was mentioned very honourably. The arrears of the Mège prize fell to Dr. A. **Monprofit** for his work "Chirurgie des ovaires et des trompes." Dr. Alfred **Fournier** was awarded the Chaussier prize for his important contributions to medical and social science. In physiology, the Montyon prize was divided between M. **Arthus** for his researches on the coagulation of the blood, and M. V. **Henri** for his work on the action of diastases. The work of M. **Bounhiol** on the respiration of annelids receives particular mention. The Philipeaux prize was accorded to M. Lucien **Daniel** for his investigations as to the nature of grafts and grafting. Prof. Chas. **Richet** received the La Caze prize for his numerous contributions to physiology. Dr. J. **Denoyès** was awarded the Pourat prize for his treatment of the subject proposed, viz. the action of high frequency currents on the phenomena of life. The essays of MM. **Regnier** and **Bruhat** were honourably mentioned. Prof. H.-G. **Zeuthen**, of Copenhagen, received the Binoux prize for his studies on the history of the sciences. Of the general prizes, the Lavoisier medal was awarded to Prof. Carl **Graebe**, of Geneva, for his work in organic chemistry. Berthelot medals were awarded to Prof. **Graebe** and to MM. **Bouveault, Guntz, Chavanne,** Victor **Henri, Arthus,** and **Capelle.** The Montyon prize (unhealthy trades) was not awarded, but an honourable mention was accorded to M. Édouard **Capelle** for his work on lighting and heating by acetylene, the Wilde prize to M. **Collet** for his determinations of the intensity of gravity, the Tchihatchef prize to Dr. Sven **Hedin** for his explorations in Asia, the Cuvier prize to M. Eugène **Simon** for his "Histoire naturelle des Araignées," the Parkin prize to MM. **Lacroix** and **Giraud** for their investigations on the recent eruptions of Martinique, the Petit D'Ormoy prize (mathematical sciences) to M. Jacques **Hadamard**, the Petit D'Ormoy prize (natural sciences) to M. Bernard **Renault,** the Boileau prize to M. Marius-Georges **Grandjean,** the Estrade-Delcros prize to M. Léon Teisserenc **de Bort** for his fourteen years' work in meteorology, the Cahours prize between MM. **Marquis** and **Chavanne,** the Saintour prize to M. Marcel **Brillouin** for his works on mathematical physics, the Trémont prize to M. Charles **Frémont** for his method of determining the limit of elasticity of metals employed in the arts, the Gegner prize to M. Jean-Henri **Fabre** for his investigations in biological science, the Lannelongue prize to Mme. Vve **Nepveu,** the prize founded by Mme. la Marquise de Laplace to M. **Rémy** (Louis-Gabriel), and that founded by M. Félix Rivot is divided between MM. **Rémy, Breynaert, Gillier,** and **Bouteloup.**

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part v., 1903, contains the following memoirs communicated to the Society:—

July 25.—K. **Schwarzschild**: Electrodynamics, iii. On the motion of the electron. A. **Schœnflies** and F. **Pockels**: Report on Plücker's scientific remains.

August 5.—P. **Furtwangler**: On the construction of the *Klassenkörper* for given algebraical domains, which contain the *l*th root of unity.

October 31.—F. **Bernstein**: On the *Klassenkörper* of an algebraical domain (second paper). L. **Heffter**: Proof of the Cauchy-Goursat integral theorem. R. **Schimmack**: On the axiomatic basis of vector-addition. C. **Runge**: On the electromagnetic mass of the electrons. R. **Fricke**: On the polygonal *continua* occurring in the theory of automorphous functions.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 31.

ROYAL INSTITUTION, at 3.—Extinct Animals: Prof. Ray Lankester, F.R.S.

FRIDAY, JANUARY 1.

GEOLOGISTS' ASSOCIATION, at 8.—The Jurassic Rocks of East Greenland: Dr. Victor Madsen, translated with additional observations by Miss Ethel G. Skeat.

SATURDAY, JANUARY 2.

ROYAL INSTITUTION, at 3.—Extinct Animals: Prof. Ray Lankester, F.R.S.

MONDAY, JANUARY 4.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—On the Defects of Uncarburetted Water Gas as Fuel for Laboratory Use: Dr. Chikashigé.—The Rapid Estimation of Mercury by means of Hypophosphorous Acid: B. F. Howard.—The Determination of Moisture in Nitro-glycerine Explosives: Arthur Marshall.

ARISTOTELIAN SOCIETY, at 8.—Prof. Sidgwick's Ethical Philosophy: Miss E. E. Constance Jones.

TUESDAY, JANUARY 5.

ROYAL INSTITUTION, at 3.—Extinct Animals: Prof. Ray Lankester, F.R.S.

WEDNESDAY, JANUARY 6.

SOCIETY OF ARTS, at 5.—Navigation of the Air (Juvenile Lecture): Eric S. Bruce.

GEOLOGICAL SOCIETY, at 8.—On a Palæolithic Floor at Prah Sands in Cornwall: Clement Reid, F.R.S., and Mrs. Clement Reid.—Implementiferous Sections at Wolvercote (Oxfordshire): Alexander M. Bell.

THURSDAY, JANUARY 7.

RÖNTGEN SOCIETY, at 8.30.—The Revelations of Radium: Dr. G. B. Batten.

ROYAL INSTITUTION, at 3.—Extinct Animals: Prof. Ray Lankester, F.R.S.

FRIDAY, JANUARY 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.

SATURDAY, JANUARY 9.

ROYAL INSTITUTION, at 3.—Extinct Animals: Prof. Ray Lankester, F.R.S.

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