THURSDAY, APRIL 11, 1901.

OSTWALD'S INORGANIC CHEMISTRY.

Grundlinien der anorganischen Chemie. Von W. Ostwald. Pp. xix+795. (Leipzig: W. Engelmann, 1900.)

NOTWITHSTANDING the great advances that have been made during the past generation in our theoretical knowledge regarding solutions and chemical equilibrium in general, elementary inorganic chemistry is taught to-day much in the same manner as it was in the early seventies. The ordinary student at the end of his junior course has a very hazy knowledge of chemical facts, and scarcely a trace of chemical common-sense; but to make up for these deficiencies he knows all about atoms and molecules. If he is asked how he would convert, say, cadmium sulphate into cadmium chloride, he will doubtfully reply, "Treat the cadmium sulphate with hydrochloric acid"—this because he knows no general principles concerning the facts of chemistry. If, on the other hand, he is asked why hydrogen and chlorine combine, he will probably answer with confidence somewhat in these terms: "They combine on account of the mutual attraction exercised by the chlorine and hydrogen atoms." He does not see that he is merely restating the fact in terms of an hypothesis, and that the question, in our present state of knowledge, has, properly speaking, no answer. The "heuristically" trained student has a better knowledge of certain facts, but he is equally ignorant of general principles, and equally unable to distinguish between what is fact and what is theory. To him, as to the other, chemical symbols, formulæ, and combining weights are part and parcel of the atomic theory, instead of a convenient method of expressing actual facts—a method, it is true, arrived at through the atomic theory, but a method which would persist though the atomic theory were abandoned to-morrow.

When such a student continues his course so far as to study modern theoretical and physical chemistry, he is loth to part with his old ideas, which enabled him to explain everything so beautifully (although in some mysterious, unfortunate way they never seemed to help him much when he was asked anything about facts), so that example and precept, experiment and lecture, do little to change his general attitude of mind towards the science.

All this is, of course, not the fault of the student, but the fault of the teacher, or rather of the text-books. The time that the student can devote to chemistry is, as a rule, so limited that some sort of text-book is indispensable, and this the teacher is obliged to follow more or less closely if he is to avoid confusing the student. Now of the elementary text-book of chemistry it may be said, "plus cela change, plus c'est la même chose;" the theory is almost invariably put before the student in its ancient form long before he needs to know anything about it, and long before he has a sufficient command of facts and principles to understand its derivation or appreciate its importance. The idea that a student must know the atomic theory and the means by which the present system of atomic weights has been arrived at, before he is taught the quantitative use of chemical symbols and equations, is pretty much on a par with the idea that a child must know the derivation of the alphabet from Egyptian hieroglyphics before he can be taught to read. From practical experience of teaching on both systems, the present writer can say that the student may be made to use symbols and formulæ very early in his course without attaching to them any theoretical significance whatever, and that he then uses them more carefully and correctly, because they represent to him definite quantities of definite materials, and not intangible atoms and molecules with which he can juggle at pleasure.

What is wanted, then, is an elementary text-book of chemistry developed from the outset in accordance with our modern theoretical knowledge. This want Prof. Ostwald's book is intended to supply, and the eminence of the author as investigator, writer and teacher is a sufficient guarantee of interesting and instructive reading.

So far as general arrangement is concerned, the book differs in no important respects from other text-books in the systematic description of the elements and their chief compounds. Physical and theoretical matters, however, are made subservient to the descriptive work, and are introduced as occasion requires. Thus the gas-laws come under the heading of oxygen; chemical forces, molecular weight, partial pressure, mass action, chemical equilibrium and catalysis, under hydrogen. The phase-rule is introduced in connection with water, to receive further exemplification under chlorine, sulphur, &c. In the same chapter are also discussed combining weights, the atomic and molecular theories and the law of reaction. Thermochemical equations are taken up in connection with hydrogen peroxide, photochemical action under chlorine, and electrolysis under hydrochloric acid. Valency appears halfway through the book in connection with phosphorus, and the last chapter of all deals with the choice of combining weights and the periodic system of the elements. Atoms and molecules are conspicuously absent.

These examples show the plan of treatment adopted; theory is throughout properly subordinated to fact and clearly distinguished from it.

As an instance of the modern aspect presented by the descriptive work in detail we may take the following section, which treats of the soluble salts of bismuth.

"*Bismuthion.*—Bismuth forms one sort of elementary ion, the trivalent bismuthion Bi'''. This is almost the only ion derived from bismuth, for the tendency of this metal to form complex ions is extremely small, only a few complex organic ions containing bismuth being known.

"Bismuthion is colourless and forms an extremely feeble base with hydroxyl. The phenomenon of hydrolysis is consequently so pronounced in bismuth salts that it can be used as a characteristic test for them. As the basic compounds formed in this way are very slightly soluble in water, the bismuth salts can be precipitated by merely diluting them with water: on addition of acid the precipitate is re-dissolved.

"The best known bismuth salt is the *nitrate*, which is obtained in the form of the hydrated crystals, $Bi(NO_3)_3 5H_2O$, when the solution of bismuth in nitric acid is crystallised. When water is poured over these crystals, a snow-white crystalline powder of basic nitrate,

$Bi(OH)_2NO_3$, separates out. . . . The nitric acid which is liberated passes into solution, so that a portion of the bismuth salt can remain dissolved. There is thus in the solution a chemical equilibrium with respect to the precipitate of basic salt, which is characterised by the concentration of the hydroxyl ion of the water being reduced, by the hydrogen ion of the free acid, to such a value as corresponds with the solubility-product of the basic salt. . . .

"When sodium thiosulphate is added to bismuth salts, a clear solution is obtained, which slowly decomposes with deposition of bismuth sulphide. The solution probably contains the sodium salt of a complex bismuth-thiosulphuric acid; for on addition of potassium salts, a very slightly soluble precipitate of $K_3Bi(S_2O_3)_3+H_2O$ separates out, which may be looked upon as the potassium salt of this acid. Although it is probable that we are here dealing with a complex bismuth ion, accurate investigations are still wanting. It has been proposed to use the precipitate, which is of a yellow colour, as a means of detecting and precipitating potassium."

It seems almost a pity that the author, having before him the problem of presenting the material in such a new light, should not have seen fit to depart entirely from the traditional arrangement and set out the whole matter as he himself thought best. As he tells us in the preface, his choice was deliberate, and was no doubt well-considered, but the limitation in adhering to the historical treatment makes itself felt here and there throughout the book. It is new wine in old bottles.

No teacher of chemistry who takes the slightest interest in his profession or in his science can afford to leave this book unread. For the first time he has laid before him a presentation of the facts of elementary chemistry from the standpoint of modern theory, written as only Ostwald could have written it, and compelling attention, whether the reader agrees with the author or not. We understand that an English translation of the work has been undertaken, so that the student also will soon have it at his disposal. J. W.

AN AMERICAN ZOOLOGICAL TEXT-BOOK.

Text-Book of Vertebrate Zoology. By. J. S. Kingsley. Pp. viii + 439. Illustrated. (London: George Bell and Sons, 1900.) Price 12*s.* net.

AMONG the multitude of text-books upon various branches of zoology, or on zoology as a whole, that it has been our fortune to peruse, there are few, if any, of which we can say that they contain so much information in a comparatively small space as is the case with the one before us. Nor is this all; whereas many works of a kindred nature are written in such an extremely abstruse style, and are so overloaded with technicalities as to be well nigh unreadable by any but the most thorough-going and uncompromising biological student, the style of the present volume is so easy, and the technical terms are so carefully explained, that a reader with little or no previous knowledge of anatomy or zoology would readily comprehend the nature of the structures described.

We refer in this connection to structures rather than to animals, because vertebrate morphology, based upon embryology, forms a leading feature of the book, the whole of the first part of which, comprising considerably more than half of the text, is devoted to this section of the subject. A systematic survey of all the leading groups of vertebrates constitutes the second moiety. And since there are few works known to us in which these two great divisions of the subject receive such an equal share of attention, on this ground alone Prof. Kingsley's treatise has a decided advantage over many of its fellows. Neither are his descriptions confined to the vertebrates of the present day, their extinct predecessors receiving a considerable share of attention. The work is, therefore, thoroughly comprehensive in its scope; and is, in fact, for the most part exactly what such a treatise should be. Although it by no means does away with the need for text-books dealing with the palæontological aspect of the subject, it serves to indicate that the day when the zoologist and palæontologist worked on separate lines is gone for ever.

In a very large number of instances those whose studies are chiefly devoted to the anatomical and embryological side of zoology fail to keep themselves abreast of modern views in regard to systematic classification. But this cannot be laid to the charge of the author of the present volume, who has adopted a thoroughly modern and up-to-date system of classification, as is especially noticeable in his treatment of the fishes and of that group of vertebrates typified by the lampreys and hag-fishes, for which a popular collective title is at present a desideratum. The division of mammals into Prototheria and Eutheria alone is also a feature in accord with modern ideas.

Indeed, not only is Prof. Kingsley thoroughly up-to-date as regards classification, but in one instance, at least, he is ahead of contemporary opinion. We refer to his treatment of that difficult subject, the classification of birds. In his preface the author states that

"he has been unable to recognise in the so-called orders of ornithologists groups of birds of more than family rank, while their families are equivalent to genera in the other classes of vertebrates."

Accordingly, we find the class Aves divided into four ordinal groups only, namely, the (1) Saururæ, as represented by Archæopteryx; (2) Odontormæ, typified by Ichthyornis; (3) Odontholcæ, containing Hesperornis; and (4) Eurhipiduræ, including all living birds. While our sympathies are to a very great extent on the side of the author in this matter, we are by no means prepared to go the whole way with him in this sweeping change, and venture to think that in this, as in most other matters, a *via media* is to be found. Moreover, we feel sure that if all existing birds are to be included in a single ordinal group, there is not the slightest justification for separating the cretaceous toothed birds (Hesperornis and Ichthyornis) as separate groups from the mere fact that they retain teeth, and in one instance biconcave vertebræ.

But all this is, to a great extent, a matter of detail, from which we return to the consideration of the work as a whole.

On one point, and on one point only, we take leave to consider that the author is unsound, and this is in connection with nomenclature. As he tells us in his preface, he refuses to change well-known generic names on the ground of priority, because "these are the names of morphological literature." If systematic zoologists have,

practically unanimously, come to the conclusion that Molge, and not Triton, is, for example, the proper title of the newts, and morphologists refuse to accept the change, we can only say so much the worse for the morphologists.

As we have already said, great credit is due to Prof. Kingsley for the attention he has devoted to the systematic part of his subject, as his own special studies are mainly directed to the anatomical and embryological aspects. But in these days it is well nigh impossible for a man to gain sufficient knowledge of a section of a subject with which he is not thoroughly familiar as to avoid mistakes when writing on it. And it would have been better for the reader had the author invoked the aid of a few specialists to revise the proofs of the systematic section of the work. Many awkward "misprints" and other errors would thereby have been avoided.

Restricting our criticism in this respect to the chapter on mammals, we may call attention to quite a number of "misprints" between pp. 395 and 399, most of which will be self-apparent to those conversant with the subject. One of the most serious is *Choeropus* for *Choeropsis* (p. 398); the one name indicating a marsupial and the other a hippopotamus!

But there are more serious errors still. On p. 399 we are told, for instance, that among the fossil genera of antelopes are Cosoryx, Tragelaphus and Antidorcas; the second being the title of the existing bushbucks, or harnessed antelopes, and the third that of the springbuck, which is alluded to on the same page as *Gazella euchore*, Cosoryx being also mentioned higher up on the same page as a deer! Neither is it correct to say that the American deer form only a sub-genus of Cervus. Again (p. 400), the domesticated Indian cattle are not the typical representatives of Bibos, and, indeed, do not belong to that group at all; while the statement (p. 401) that mastodons occur in Africa is, so far as we are aware, not founded upon fact. Were we disposed to dwell upon them, many other errors of a kindred nature might be pointed out, but we pass on to the illustrations.

Such of the latter as relate to anatomical structures and the development of the embryo are far the most satisfactory, and serve their purpose well, although frequently not of a very high class from an artistic point of view. But when we turn to the figures of birds and mammals we are surprised that any publisher could have been found willing to print such ghastly productions. Perhaps the very worst amongst a hopelessly bad lot are those of a bird of paradise on p. 350, and of the Sumatran rhinoceros on p. 355. Smudgy daubs is a mild way of describing them; and in the present age of cheap photographic illustration, the appearance of such ill-executed caricatures in any book is nothing short of a disgrace to all concerned in its production.

As regards the palæontological aspects of the subject, we think the author is to be congratulated on the manner in which it is treated. Of course there will be errors—and the omission of any mention of Ophthalmosaurus when noticing the Ichthyosauria (p. 313) is one—but they are few and far between; and in the main the relations of the extinct to the living types are well explained.

Apparently the book has been previously published in America, and its reproduction in this country may be taken as an indication that it has met with a favourable reception in the land of its birth. In spite of the blemishes to which we have referred (and they are, after all, not very great), we have no hesitation in saying that Prof. Kingsley's little volume is worthy of a hearty welcome on this side of the Atlantic on the part of both teachers and pupils. R. L.

POPULAR BIBLICAL STUDIES.

The Social Life of the Hebrews. By the Rev. Edward Day. The Semitic Series. Pp. 255. (London: John C. Nimmo, 1901.)

THE present volume is the second of a series published under the editorship of Prof. Craig, of the University of Michigan, with the object of presenting "in popularly scientific form" the results of recent researches in Semitic fields. Prof. Craig has laid down for the last two years an ambitious programme of the work to be done in his series, and has announced the titles of no less than thirteen books of the series, but up to the present time only two of them have appeared. The first, by Prof. Sayce, was devoted to the social life of the Babylonians and Assyrians, and was reviewed by us last year; the second, which has appeared this year, and with which we are concerned, deals with the manners and customs of the ancient Hebrews. Mr. Day has undertaken a subject of great interest and, at the same time, one of great difficulty, inasmuch as almost the only sources accessible are limited to the Books of the Old Testament.

The publication of the late Prof. Robertson Smith's "Kinship and Marriage" and "Religion of the Semites" marked a great advance in Semitic learning, and since that time all writers on the customs of the Hebrews have been in great measure indebted to these books. In the first part of his book Mr. Day summarises to a certain extent the main features of Prof. Robertson Smith's work, though with some serious omissions. The Clan, the Family and Sacrifice are dealt with in three short chapters, none too much space for such important subjects, though doubtless enough for a popular work, while the remainder of the first part treats of the Hebrews during the period of the Judges. But no explanation at all has been given of the significance of circumcision, either as a sacrificial rite or from its connection with the *hôthên* "wife's father"; and though this may be due to the fact that the book is a popular work, yet, on the same grounds, a good deal of the matter relating to the licentious temple worship and similar customs might have been omitted. More, too, might have been said with advantage on the subject of totemism, which is but briefly discussed. The difficult subject of the Hebrew idea of the immortality of the soul has, perhaps, been reserved for another volume of the series, but we should have been glad to see a little more space devoted to the popular beliefs concerning Sheol, which is only spoken of once. Some reference, also, might have been made to the stress laid by the Hebrews on the importance of posterity and of prolonging the family name, which thereby acquired a terrestrial immortality. The chapter on the conception of Yahweh towards the

end of the book is better thought out, and will suffice for the needs of a popular work.

A characteristic of the book to which we must take serious exception is the frequent omission of references to passages on which Mr. Day bases his deductions. It is not enough to say "suicide was not discountenanced" (p. 172); if the statement is to be fully accredited, all the arguments, with chapter and verse, should be given in full. Moreover, we cannot congratulate Mr. Day on his attempt to provide us with a translation superior to that of the Authorised Version of the words *'ăsereth d'bhârîm*, or of I. Sam. ii. 8; the former he renders by "the Ten Words," a most infelicitous choice of the meanings of *dâbhâr* open to him, while the latter is translated "He taketh the needy from the city-dump" (p. 144); surely the old English word "dunghill" is not too outspoken for a popular book? Again, we must protest against such barbarisms as "pled" for "pleaded" (p. 28); "demonic" for "demoniac" (p. 56); "a few nearby men" (p. 62); and "he was the power back of nature" (p. 88); or such a hybrid as "David ben Jesse" (p. 63). We could wish, too, that Mr. Day's thirst after "local colour" (p. 225) had not led him to describe Samson as "being peculiarly susceptible to female charms" (p. 53); or his labours as "deeds of a purely personal character, in which a man of great strength got a little needed exercise, and at the same time revenged himself upon his personal enemies" (p. 66); or to refer to the rich of Samaria as "wealthy nabobs" (p. 102). The use of modern colloquialisms is unpardonable in all descriptions of Biblical events, challenging, as they do, the classic English of the Authorised Version. What can be said in defence of the following: "It is probable that the star-gazing of the society belles of Jerusalem, a Babylonian importation, was, like similar attempts to acclimate (!) foreign cults, in the nature of a fad, as was charioteering in the capital in the days of Absalom and Adonijah" (p. 116), or, "It was a long way . . . from the city-dump to a seat among the nobles of the land; but Yahweh knew the way" (p. 151)? Moreover, we are not by any means convinced that the "modern picnic" (p. 45) is the survival of the ancient sacrificial feast, even with the limitation "though seldom of such an exclusive character." It is a great pity that Mr. Day has thought fit to include such colloquialisms as the above in a work on which he has evidently spent time and care. We think, however, that he has not made the most of his opportunities.

OUR BOOK SHELF.

The Table of British Strata. By Dr. H. Woodward and Mr. H. B. Woodward. (London: Dulau and Co., 1901.)

THIS table will be welcome to students and teachers, for the existing charts are now quite out of date. To compile such is a laborious and somewhat thankless task, for it is impossible to please every one; indeed, the authors admit that in two respects, retaining the Permian in the Palæozoic and placing the Wealden in the Jurassic, they "seek to assert general rather than individual opinion." As to the former, the question seems to be largely one of locality; but in the latter we should have preferred the conservative side, at any rate till better cause is shown for the change; especially since it has led to the virtual suppression of the Neocomian as a system. For the same reason we are glad to see the Tremadoc group left in the Cambrian system. The latter they allow to be an important geological system, though we should have liked to see the alternative title, "Primordial Silurian," entirely suppressed, for it is commemorative of nothing less than an unwarrantable usurpation. The authors include the Solva Beds of St. Davids with the Menevian, which no doubt is justified by the presence of Paradoxides; but in that case too small a thickness is assigned to the system, for this addition would make it at St. Davids over two thousand feet. Remembering its importance on the Continent, we should have ventured to exalt Rhætic, thin as it may be in Britain, to the dignity of a system, and we think that over much importance is conceded to the subdivisions of the Tertiary series. Are the Thanet Sands or the Oldhaven Beds—not to mention others—more important than the Lower Calcareous Grit or the Stonesfield Slate? Yet we find the former among Formations and the latter in Subdivisions. Does not the statement that the glacial deposits contain only derived fossils beg a disputed question? It would be well to add "slates" to the economic products of Charnwood, for the "honestone," which is mentioned, is very local. A notable feature is the recognition as formation of Torridonian, Uriconian, Dalradian and Lewisian in the Archæan rocks, though some objection may be taken to the third name, on the ground that as originally defined it was a much too heterogeneous assemblage, and we may doubt whether the Moine schists, having regard to their history, form a good type. These criticisms, however, affect only points of detail, and some may even regard them as excellences, while as to the general excellence of the table and its high value to students there cannot be the slightest question.

Differential and Integral Calculus for Beginners. By Edwin Edser, A.R.C.S. Pp. vi + 253. (London: Nelson and Sons, 1901.)

THIS is a book written to supply the wants of students in advanced physics who require some knowledge of the calculus to enable them to read treatises on physical science, but who have not time to devote to a thorough study of higher mathematics. It is the outcome of a series of articles printed some time ago in the pages of the *Practical Teacher*. Most of the text-books which have been written on the subject of the calculus treat it too fully, and deal with examples of too complex and difficult a character to be really suited to the needs of students, who chiefly want the calculus to enable them to understand the theory of comparatively simple experimental problems in mechanics and physics. The present little book is one of several that have been written in recent years with the object of supplying this want. The author has treated the subject in a very simple manner, and does not assume the reader to have more mathematical skill than is involved in a familiar knowledge of elementary algebra and geometry. The opening chapter deals with the elements of coordinate geometry, and explains the nature of the circular and exponential functions sufficiently to render it needless for the ordinary student to refer to other books. This is further ensured by the addition of an appendix dealing with trigonometrical ratios and formulæ. Two chapters are spent on the differentiation of simple and complex functions, two others on maxima and minima and expansions, and two more on simple integrations by direct and special methods. This is followed by a section devoted to applications to problems in geometry, mechanics and, more especially, in physics. The final chapters deal with double and triple integration and simple differential equations.

In general the book is well written, and suitable for beginners. A good feature is the introduction of several numerical problems. The subject in this way is more vividly brought to the student's mind than when the examples, as is ordinarily the case, begin and end in

mere symbols. The analytical working out of problems is given with unusual fulness. On the whole this is a distinct advantage to the beginner, though in some cases it has been a little overdone, as, for instance, on pages 190–193, where more than 2½ pages are devoted to the analytical work of a triple integration. Each chapter contains several examples fully worked out, and concludes with a number of exercises to which the answers are appended.

The arrangement of the book is good, but the section dealing with real and imaginary quantities early in the book, and that on the hyperbolic functions towards the end, might have been omitted without much real loss to the beginner, and certainly the former section is introduced too early.

A mistake occurs on page 101 in reference to an application to alternating electrical currents. The arithmetical average has been confused with the square root of mean square, with the result that the statement made is incorrect.

Engineering Chemistry. A manual of Quantitative Chemical Analysis for the use of Students, Chemists and Engineers. Second Edition. By Thomas B. Stillman. Pp. 503. (Easton, Pa.: The Chemical Publishing Co., 1900.)

THIS work is intended to be placed in the hands of the student who is commencing quantitative analysis, and hence the first eleven exercises deal with general elementary determinations, after which he will take up that portion of the book which deals with his special requirements. Schemes are then given for the analysis of coal and coke, iron ores, water, both for sanitary and technical purposes, of coal, oil, producer and flue gases, iron and steel, cement, building materials, paper, soap, lubricating oils, paint and asphalt. On account of the wide scope of the book, the author has secured special articles from experts on blast furnace practice, boiler tests, carbon compounds of iron, practical photometry, electrical units and energy equivalents. As must necessarily be the case from the size of the book and the variety of subjects dealt with, the work is written in a very compressed style throughout, so much so, in fact, that it is scarcely a suitable work to put in the hands of "students commencing quantitative analysis." The large amount of practical information in it, however, will render it a useful work of reference for chemists engaged in engineering work. In some respects there is room for improvement. The superabundance of decimal places in numerical results, which is, unfortunately, characteristic of American technical literature, is very much in evidence. Thus in an analysis of water for technical purposes, the constituents of which, on account of their minuteness, are weighed with an accuracy of about two, or at the most three, significant figures, in the final statement of results no less than five places are given. An even more striking case is in the section on calorimetry, in which the water equivalent of a calorimeter is laboriously worked out to six significant figures, 203·460, the experimental result being casually given as 227·22. Another example is in the determination of the heating value of a gas, the result being expressed as 10726·7 B.T.U. per pound. The section on photometry is somewhat out of date, no mention being made of any standard of light other than the sperm candle. The chapter on pyrometry and many of the numerical data also require bringing up to date, many of the tables and calculations being based upon the weight of a litre of hydrogen taken as 0·08958. A noteworthy feature, and one adding considerably to the value of the book, is the introduction of a short bibliography at the end of each special chapter. It is curious to note that in some cases recent papers of importance are given as references, but ignored in the text. This is especially noticeable in the chapter on pyrometry.

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.*]

Darwinism and Statecraft.

EVERY one who is interested in the bearing which the teaching of biology has to the affairs of the nation must have followed with interest not only this last work of Prof. Pearson, but also his many contributions to the subject of heredity. Very opportune, also, is Prof. Lankester's appeal in his review (March 21) to "the greatest in the land," for apart from the fact "that the crowd cannot guide itself in its blind impotence," it is being otherwise led by the hysterical nonsense of a halfpenny Press that is degrading journalism and the people by the substitution of bombastic ignorance and assertiveness for knowledge and real merit.

It seems to me that the statement in Prof. Pearson's book of what the British parent ought to say is just what he should not say, and that the implication in Prof. Perry's review that the development of the faculties ought to begin at the public schools is open to objection because such beginning can and ought to be made very much earlier. The statement which Prof. Pearson would have the parent say would be better if it were altered so that for "son" we should read "children," for surely we require thinking and observing daughters as well as sons; and, moreover, the statement seems to imply that the parent expects the public school or the University to teach his son to think and observe, whereas, if the parent did his duty, the most that he ought to expect of these institutions would be the further development of his children's thinking and observing powers, and not their initiation in these matters.

We need thinking men, it is true; but what is the nature and source of the early influences that makes or mars their careers before they will be brought into contact with the educational system that is to make them thinkers? Are we not on the wrong track when we talk of "making thinkers" or of "training men to think"? Remembering the nature of the child, rather it seems to me that we should be nearer a successful issue if we turned our energies in the direction of retaining and developing the thinking powers it naturally possesses. Any one who chooses to observe the development of a child's mind will, if he does not suppress its natural bent, convince himself that a child from three to five years of age possesses thinking powers of greater capacity than we are in the habit of crediting to it. One of the external evidences of a thoughtful mind is the asking of questions which bear definite and logical relations to each other; and this is precisely what an average child of that age, when talking to a person in sympathy with it, is persistently doing. It is not content with a flimsy and evasive answer, and how strong is its intellectual craving is manifested by its evident disappointment or display of temper when its ignorant parents impatiently curb its curiosity. It is very seldom that one finds a mother who has endeavoured to retain her child's thinking capacities. I was once present when the four-year-old little daughter of such a mother was making inquiries about the planet Venus, and after she had been informed that both Venus and the earth travelled round the sun and were illuminated by it she put the query, "Then if there were people on Venus our earth would look to them like Venus looks to us?" This question demonstrates that a child possesses thinking powers sufficiently vigorous to enable it to see the logical relationships of bodies to each other that would certainly do credit to many of its superiors in point of years. This is not an isolated instance, and my impression, derived from observation and from conversation with observant persons, is that the average child, if not suppressed, is capable of a quality of thinking that leads its elders, when they try to follow it, into an intellectual quagmire of inconsistency and absurdity from which they beat an inglorious retreat by angrily bidding it "not to ask silly questions." If they bid themselves not to give silly answers their request would be just. Let me give an instance of the intellectual stagnation upon which the children who will become the nation's men are being reared. I once heard a child ask its mother, "What makes the flowers grow?" Promptly came the answer, "Jesus!" No wonder when children's intellects are muddled with such unprovable assertions that they cease to think. I recall my

own younger days, and the questions I wanted answered: they were answered negatively as a rule, and those that were positively so never allowed me to reconcile them with the facts around me, and I have since learned that they were mostly perversions of the truth, designed to secure a theological end. Little wonder I ceased to think by the time I got to school, and it is a matter of surprise to me that the examination system which followed did not convert a state of abeyance into one of absolute destruction.

There is no need to "make" thinking men; they are born to us if we will but retain, develop and strengthen the qualities that every healthy average child possesses. But to do this we want, above all else, thoughtful, intelligent and well-informed women who, as mothers, will recognise their duties to the State and will endeavour to retain and train the natural qualities, physical and intellectual alike, of the children that are to become the nation's men and women. The old style of domestic wife and mother—an uninteresting, mechanical drudge or a gaudy doll—may have been good enough for our forefathers, but for us it means loss of national time and energy which, if utilised, can be converted into factors capable of retaining the supreme position that we are fast losing. Granting that the results of a mother's pernicious training can be remedied in later life, it is obviously waste of valuable energy, time and money to organise an elaborate system of education to undo that which ought never to have been done. And, therefore, I urge that our national progress depends very largely upon "the hand that rocks the cradle": if it rocks that with an intelligent purpose, it will be well with our future men; if not, then England, like Tyre, Venice and Rome, "whose greatnesses it has inherited," "must be led, through prouder eminence, to less pitied destruction."

G. P. MUDGE.

THE ROYAL LIBRARY AT NINEVEH.[1]

OUR readers who are in the position of being able to recall the "discovery" of Nineveh, which was announced between the years 1845 and 1854, will have no difficulty in remembering that the exhuming of colossal bulls and bas-reliefs from the site of the palace of the great kings of Nineveh was almost contemporaneous with the discovery of the means whereby the wedge-shaped characters, which were found cut upon them in long, symmetrical lines, could be read and understood. It was a coincidence of the most remarkable kind that the excavations at Nineveh yielded at that time such a large mass of new material for Rawlinson, Norris and Hincks to work upon, and it may be safely said that the correct information concerning Bible history which they succeeded in producing from it convinced the general public of the trustworthiness of Rawlinson's system of decipherment more effectually than his epoch-making translation of the inscription of Darius the Great, which was cut on the face of the now famous rock of Behistun, would ever have done. The bulls and colossal figures and bas-reliefs, which Sir Henry Layard drew out of their hiding places, appealed strongly to the popular imagination, which already at that time saw in them the prototypes of the mysterious figures that the prophets of the Hebrew god Yahwe saw in their visions, but for the scientific seeker after the knowledge of the long-lost cuneiform language they did little. It was soon recognised that the texts engraved upon them contained many duplicates, and also that they did little more than set forth, in stereotyped and vaunting phrases, the names and titles which the kings of the Second Assyrian Empire arrogated to themselves. But further examination of the smaller objects which were found in the ruins of the Assyrian palace at Nineveh resulted in the discovery of a large collection of "tiles," as they were first called, made of baked clay, which were inscribed with texts written in cuneiform with minute characters, and this "find" is, for cuneiform decipherment, probably the greatest which has ever been made. An investigation of these minutely written texts showed that they consisted of lists of cuneiform signs arranged on a definite plan, of lists of words and phrases, and of connected narratives, which might well come under the general description of "literature"; in fact, the thousands of tablets and fragments of tablets which had been sent home, without the least idea of their value having entered into the heads of those who found them, turned out to be neither more nor less than the fundamental matter upon which the whole of the great superstructure of Assyriology has been built. We now know of a certainty that, at the close of the eighth century before Christ, Sargon, king of Assyria, possessed a few tablets, the contents of which concerned the business of his kingdom, and that he kept these in a chamber in his palace. It seems also that his two successors, Sennacherib (B.C. 705–B.C. 681) and Esarhaddon (B.C. 681–B.C. 668), added other tablets to Sargon's, and that we may also regard the united collections of these great kings as the nucleus of the Royal Library at Nineveh.

The great literary king of Assyria was, however, Ashurbanipal, and it is to him that the world is indebted for whatever knowledge of the Assyrian and Sumerian language it possesses. This mighty hunter and warrior found time to take an interest in the welfare of the literature of his country, and he spared neither pains nor expense in the formation of his library and in making it to contain a truly representative collection of tablets. His interest was twofold, for he was anxious to preserve both the best works written in his own native Semitic language and those which had come down in a more or less fragmentary condition from the Sumerians, a mighty people who seem to have given to the Semitic inhabitants of Mesopotamia nearly all that they ever possessed in the way of literature. With this object in view he had copies of many of the great Sumerian literary compositions made, and to these he attached translations in Assyrian, arranged interlinearly, a fact which seems to indicate that the knowledge of Sumerian was disappearing from among his people when he began to reign. Literary compositions were, however, not the sole objects of his care, for he collected the materials necessary for learning and teaching both the Assyrian and Sumerian languages, and evidences of this are the important remains of the syllabaries, sign-lists, vocabularies, &c., compiled by his orders, which are now among the most precious possessions of our National Museum. Wherever rumour declared that a valuable document existed he sent scribes and messengers to take a copy, or copies, of it, and the accuracy of such copies is attested by the fact that defective or illegible words or passages in the archetype were generally indicated as such in the copy or copies made for Ashurbanipal.

The above preliminary remarks are sufficient to indicate the value of the thousands of baked clay tablets and fragments which were found at Nineveh; but it has for many years past been a problem of some magnitude to Assyriologists how best to make use of the mass of material which exists. It is manifestly impossible for every student of cuneiform to possess the time and means necessary for examining and copying texts from thousands of tablets, and besides, few students are sufficiently skilled in reading cuneiform from tablets to make it worth their while to devote months to the work.

The late Sir Henry Rawlinson made a noble attempt to lay before Assyriologists the best of the texts in his monumental publication entitled "The Cuneiform Inscriptions of Western Asia," but this work, after all, only contains a *selection* of the texts available, and at the time of publication no scholar possessed the knowledge necessary for arranging and classifying the various documents which existed among the remains of the works of the Royal Library at Nineveh. It must not be imagined

[1] "Catalogue of the Cuneiform Tablets in the Konyunjik Collection of the British Museum." By C. Bezold. 5 vols. Printed by order of the Trustees. (London, 1889–1900.)

that work of classification can ever become simple, for the greatest difficulty will be experienced for years to come in joining up the various fragments which go to form a complete tablet. At the sacking of Nineveh by the Medes, many of the tablets which were made and collected with such care by Ashurbanipal appear to have been wilfully broken, and fragments of them were scattered in all directions ; some were destroyed by fire and others crushed into dust.

A visit to the Nineveh Gallery in the British Museum will explain the difficulty to the reader in a few minutes, for in the cases there will be seen exhibited several tablets, or large portions of tablets, which are composed entirely of little pieces which have been joined together by the skill of generations of students of Assyriology. There are examples in which three or four of the fragments which help to form a tablet have been brought home from Nineveh by three or four different "discoverers," and many tablets must remain imperfect until the pieces necessary to complete them have been brought home from the ruins of the great palace at Nineveh, *where they still lie* awaiting the spade of the excavator.

The work of publishing the texts from the Nineveh Library which was begun by Sir Henry Rawlinson was carried on by Norris and Smith, and at a later period a number of foreign scholars began to publish works which professed to give amended and correct versions of some of their copies ; but all were unsatisfactory in a greater or lesser degree, because the groups of texts which were reproduced were incomplete. Every student felt that he had not got all the existing materials for his work before him, and that any result which he arrived at one day might be upset the next by the identification of a fragment hitherto unnoticed in the British Museum collections.

Matters went on in this fashion for some years, but at length the late Sir Henry Rawlinson took the matter up and brought before his fellow Trustees of the British Museum the bold suggestion that a complete catalogue of the Nineveh, or Konyunjik, Collection should be prepared under their direction and issued by them as a British Museum publication. There is no need to point out here the leading part which the Trustees of the British Museum have always taken in promoting the interests of Assyriology ; but it may be said in passing that, but for their powerful aid in advocating the importance of the subject, and the publications of texts which they have issued, practically regardless of cost, that science could never have attained to the position it now occupies, and its progress would have been retarded for a generation. In accordance with their enlightened policy, the Trustees decided to print the proposed catalogue of tablets, and the bulky work which we now have before us is the result.

The "Catalogue of the Cuneiform Tablets in the Konyunjik Collection of the British Museum" was prepared by Dr. C. Bezold, who is now professor of Assyriology in the University of Heidelberg, and is the author of some other works on his special subject. The Catalogue fills five volumes, which were published in 1889, 1891, 1893, 1896 and 1899 respectively, and contains 1949 pages, large royal 8vo, of descriptions of tablets ; 265 pages of "General Index" ; 154 pages of "Index of Reference Numbers" ; a Bibliography of 13 pages ; a brief Introduction of some 18 pages, besides the lists of texts published in Rawlinson's great work, "The Cuneiform Inscriptions of Western Asia," and several pages of preliminary matter issued with each of the first four volumes. The plan adopted by Dr. Bezold is, first, to give the size of each tablet or fragment, and to state, if a fragment, its position in the tablet of which it once formed part, *i.e.* he tells the reader if the fragment belongs to the top, middle, or bottom part of the tablet. These remarks are followed by details concerning the style of writing, its state of preservation, and notes which will serve to identify it. Next we are usually told what the contents of the tablet are, but if this is not possible the general character of the inscription is clearly indicated ; extracts from colophons, "catch-lines," &c., are often given in the original cuneiform, as well as many passages of importance from a linguistic or historical point of view. Last, but not by any means least in importance, Dr. Bezold tells us under the description of each document where the text has been published, or quoted, or referred to, or translated, so that up to the time of the publication of each volume the Catalogue was not only a guide to the tablets, but also to the published literature which related to it. At the end of each description we find given the number by which it is known in the registers of the British Museum.

An objection which will be made to the usefulness of the work is that the tablets described are not arranged in classes, but this may fairly be met by referring the objector to the very full General Index, which we have already mentioned, and its headings and subheadings. Thus, under the heading "Letters" we have twenty-seven closely printed columns of numbers, in which the reader is told the number of nearly every letter and report catalogued in the work and the page where the description of each will be found ; the subheadings state which letter refers to public and which to private affairs, and the groups are usually very well and clearly defined. With many subjects, however, the classification might have been carried much further, and the subheadings might have been multiplied with great benefit to every student of the Catalogue ; on the other hand, the page numbers have nearly doubled the size of the Index, and might with advantage to him have been omitted so far as K numbers are concerned.

We think the decision to print the descriptions under the register numbers was a wise one, for beyond all doubt it has tended to advance the progress of Assyriology, and has materially aided students of Assyrian in both hemispheres ; had it been decided to classify the tablets and fragments before printing, it is doubtful if Dr. Bezold's work would ever have seen the light.

The boundaries between astrology and astronomy, and magic and religion, and legend and history were so loosely defined by the Assyrian *savants* that the student of to-day is often sorely puzzled as to the class in which he should group certain documents, and experience shows that his doubts on the subject may be as far off from satisfaction five years hence as they are to-day.

In addition to the general contents of the volume described above, mention must be made of the twelve excellent plates, in which a number of cuneiform tablets and fragments, selected chiefly for their forms and philological importance, have been reproduced by a photographic process. With the help of these and the remarks which Dr. Bezold makes in his Introduction, the intelligent reader will have no difficulty in gaining a good general idea of the principal classes of tablets which are to be found in the Nineveh Collection, and of their appearance, and with care he may even make some progress in the difficult subject of palæography. It will surprise no one to learn that the student who has specialised in any one small branch of Assyriology will be able to pick holes in some parts of Dr. Bezold's work ; but in a progressive science like Assyriology this can never be avoided, especially as the publication of the Catalogue extended over a period of ten or eleven years. In fact, Dr. Bezold has himself supplied, in the later volumes of his Catalogue, the information which has enabled others to modify some of his statements and descriptions in the early parts of his monumental publication.

The space at our disposal will not admit of any even approximately detailed account of the contents of Ashurbanipal's great Library, but a general indication of the

chief classes of literature preserved in it must be added here.

Of almost the first importance for us are the large official authentic annals which were drawn up under the personal supervision of the high officials of the king, from which we gain very full accounts of the military expeditions undertaken by Sargon II., Sennacherib, Esarhaddon, and Ashurbanipal, and of their building operations. Intimately connected with these were the letters, despatches and reports written chiefly by the king's officials in various parts of the country, who by this means kept him informed of the progress of events in the countries under their jurisdiction. This class of document is of peculiar interest, and being in many cases dated they often afford precise information about important matters.

Next in importance come the tablets which deal with chronography and chronology, and by means of the so-called "Eponym Canon" it is possible to fix with exactness the dates of events which took place from about B.C. 900 to B.C. 640.

The business side of Assyrian life is represented by a considerable number of "contracts," which relate to all the principal matters concerning the transfer for payment of human beings, and of property of all kinds.

A very large class of tablets deals with astrology, and provides innumerable examples of omens of all kinds; these prove that the warlike Assyrian must have lived in a state of almost abject fear of the various spirits and demons with whom he peopled heaven and earth. Every event which happened was construed as a portent, and the Assyrian astrologer must have spent most of his time in tabulating forecasts. Diseases were cured by means of incantations and magical formulæ, for all diseases, both of mind and body, were believed to arise through the evil influences of the stars; such influences could be diverted, however, by the use of certain herbs, plants, stones, and portions of the bodies of animals. The ghost, the "evil foot" at the door, the evil dream, the bite of a snake, the sting of a scorpion, were all treated in much the same way, *i.e.* by magical means. Two great series of incantations have been identified, and the rubrics of some of the texts reveal a depth of superstition in the mind of the Assyrian which seems almost incredible. The burning of magical figures made of clay, bitumen, honey, flour, bronze, or wood during the recital of magical formulæ was, of course, common, and it is quite clear, from the documents of this class, that the Assyrians thoroughly earned their name of "magicians and sorcerers." Curiously enough, the Library included large numbers of prayers, many of which contain expressions of lofty spiritual ideas, but these show at the same time that the Assyrian religion never freed itself from the shackles of the basest superstition. Many religious texts describe and contain instructions for the performance of important rites and ceremonies, and most minute instructions concerning the offering up of sacrifices, the festivals of the gods, the dress of the priests, &c.

The legendary lore of the Assyrians is of peculiar interest, for it has preserved the history of the Creation and the account of the Deluge, which were incorporated by the Jewish compilers of the Hebrew Bible in Babylon.

We have already spoken at some length of the syllabaries, sign-lists and vocabularies which Ashurbanipal had drawn up, with Sumerian renderings arranged interlinearly, and from a modern point of view these will probably be regarded as the most valuable section of his Library. Dr. Bezold's Catalogue represents a vast deal of time and patience and hard work, and he is to be congratulated on the completion of a long and laborious task. There is no doubt that it will stimulate many in the prosecution of their Assyrian studies, and that it will greatly facilitate the rejoining of fragments of tablets; it will also help an investigator of any given class of tablets to produce an edition of its texts, which may be regarded as final until the tablets which still lie buried under the palace ruins at Nineveh are brought home to Bloomsbury. The thanks of every student of Assyrian are due to the Trustees of the British Museum for the production of such a costly but useful Catalogue.

NAVAL BOILERS.

THE interim report of the Admiralty Committee upon "Modern Types of Boilers for Naval Purposes," recently published, has caused much discussion; but, up to the present, it appears to have satisfied nobody and not to help the Admiralty much to settle the grave question of the best boilers for the future in the Navy. It gives the views, which are not so mature as could be desired, of the mercantile marine engineers of which the committee was chiefly composed, the experience of whom, up to the date of the appointment of the committee, had evidently been limited to the discarded cylindrical boiler.

The committee were asked (1) whether they consider water-tube boilers more suitable than cylindrical boilers for naval purposes; (2) if so, whether the Belleville is the best type of water-tube boiler for H.M. Navy; and (3) for suggestions on the extent to which any particular type or types of boilers should be fitted in new vessels. The replies given in the report are that "a satisfactory type of water-tube boiler" would be more suitable than the cylindrical boiler; that the Belleville boiler is not the type of water-tube boiler best adapted to the requirements of H.M. Navy; that Belleville boilers be not fitted in any ships not yet ordered, nor in any ships recently ordered for which the work upon the boilers is not too far advanced; but that they be retained in all completed ships and in all ships under construction for which the work is so far advanced as to involve delay in completion if the boilers were to be altered. The committee state that they have had under consideration four types of large straight tube boilers which have been tried in war vessels, viz., the Babcock and Wilcox, the Niclausse, the Dürr, and the Yarrow large tube boiler; and they suggest that "if a type of water-tube boiler has to be decided on at once for use in the Navy," some or all of these be taken. They recommend that boilers of these types be made and experimented with at the earliest possible date; and they call attention to the practical objections that have been found to the construction and working of the Belleville boiler.

The committee make the important admission that when the Belleville boiler was introduced into the Navy they consider "there was justification for then regarding it as the most suitable type of water-tube boiler for the Navy."

The only naval engineer upon the committee concurred with the report except that he considered, although the Belleville boiler has certain undesirable features, "it is a good steam generator, which will give satisfactory results when it is kept in good order and worked with the required care and skill"; and he sees "no necessity for delaying the progress of ships which have been designed for Belleville boilers in order to substitute another type of boiler."

This report does not satisfy the parliamentary opponents of the Belleville boiler, who appear to object to water-tube boilers of all kinds, and to advocate a return to the cylindrical boiler. In spite of the great advance recently made in the designs of boilers of water-tube type, they argue that because early attempts to use water-tube boilers at sea were unsuccessful, it is hopeless to expect any good results from those now available. These opinions are not endorsed by engineers of wider experience, especially by the designers of machinery for warships, who understand better the relative advantages and disadvantages

of different types of boilers from the point of view of warship requirements.

The Admiralty do not get much guidance from the report, and we understand that they only intend to supersede the Belleville boilers by those of Babcock and Wilcox and of the Yarrow types in a few vessels recently ordered, for which the boilers have not yet been put in hand. They had previously arranged for one of the recent cruisers to be fitted with boilers of the Niclausse type. The experiments recommended by the committee will doubtless be carried out as quickly as possible, after which there may be sufficient data available for determining the policy of the future.

The committee's report is distinctly disappointing, and suggests that their experience and judgment were not sufficiently matured to give much value to an interim statement. They seem to have been impressed by the advantages of good water-tube boilers for naval purposes, and to have realised that an ideal water-tube boiler—which, however, has not yet been approached in practice—would be much better for the Navy than the old cylindrical boiler. When they have to choose the best of the types that are available, they name four which they have had under consideration and recommend early experiments with them, and there they leave the matter. Meanwhile, the construction of battleships and their machinery must go on, and the Admiralty engineers are in the difficult position of having to decide upon the boilers for them. This task is not rendered easier for the Admiralty in carrying on the work of the Navy, nor is any one helped in forming an opinion upon the best policy for the future by the fact that the objections to the Belleville boiler which are pointed out by the committee apply, in a greater or less degree, to others that might be substituted for it. One thing that appears certain is that whatever the defects of water-tube boilers may be, or may be thought to be, their advantages to a warship are sufficiently proved to make a return to cylindrical boilers in the fighting navies of the world extremely improbable.

FORESTRY IN GREAT BRITAIN.

IT is probably known to most people that for the supply of our requirements in the matter of timber, as in that of foodstuffs, we depend largely upon imports from abroad. But it may be doubted if many beyond the comparatively few who have given special attention to the subject have realised the fact that the annual cost to the country of these imports amounts to somewhere about twenty-five millions of pounds. It has been often urged that it would be worth some trouble to prevent this large sum, or a portion of it, going out of the country, and it has been pointed out that a proper system of forest management would bring about this result. Of course, so long as the foreign supply is ample and the price of imported timber is less than that at which it is profitably produced at home, our markets will continue to absorb foreign produce as heretofore; but these conditions which have hitherto prevailed are, in the opinion of experts, not likely to continue. For some years past this and cognate questions have attracted considerable attention, as witness the writings of recent date noted below,[1] all of which are deserving of careful perusal. The burden of all of them may be summed up in the phrase cited by a writer in the *Times* of March 17, 1899. "'Cotton,' it is said on the other side of the Atlantic, 'was once called king; but King Cotton is a lesser potentate than King Timber must soon become.'" In other words, the world's demand for timber is outrunning the supply under present methods, and an appreciation of timber values is therefore setting in which is likely to be permanent and progressive. Cheap timber is probably a thing of the past in this country. To some such a declaration will only appeal as the old cry of "wolf," and they may argue that any scarcity of timber will be balanced by the substitution for it, in many cases, of other suitable products; and such substitution has, no doubt, in the past taken place, as, for example, in shipbuilding. But it must be remembered that facility of transport has by now led to inroads into the world's timber capital in practically every timber-producing region, and the ruthless destruction of virgin forest without attempt at regeneration has brought us now within measurable distance of the end of the natural supply; and, further, in recent years the applications of timber to other purposes than those of construction, as, for example, in the manufacture of wood-pulp, have made it an efficient substitute for other products, and thus the demands for it have been multiplied, and may be yet increased. In these circumstances, then, not from any sentimental ideas connected with the growing of timber at home, but from the standpoint of business principles, the question of the growing of timber in Great Britain to an extent which shall in some measure make us less dependent upon foreign supply is one which has now assumed practical importance.

That wood can be profitably grown in Great Britain, even under the unscientific methods now in operation, has been amply proved; that under a system of scientific management crops of timber could be raised to yield a certain and adequate return upon capital is demonstrable. What lies at the bottom of the absence of such crops in this country is want of appreciation, from land-owners down to the working forester, of the right principles upon which they can be grown. There is, speaking generally, no practice of scientific forestry in Great Britain. Other immediate causes there are which have contributed more or less to the neglect of scientific forestry in Britain, for instance, tenure of land, the claims of sport—this probably one of the most influential factors—the rating of woods, and so forth. These are obstacles, and no doubt will remain so, in the way of tree-planting; but assuredly were our landed proprietors, land-agents and foresters better instructed in the methods of growing timber and in the possibilities of remunerative crops, less would be heard of them as such. It is difficult to instil into those who have been brought up in other traditions the fact that trees which are to yield a crop of timber must be grown under rules as definite as those which govern the cultivation of ordinary agricultural crops, because the time which is required for the maturation of the crop and the securing of the final yield exceeds the lifetime of the individual. Yet it can only be when this fundamental fact has been realised that a supply of marketable home-grown timber will be available in Great Britain.

There are not, it is gratifying to note, wanting indications that already some proprietors, even the Government, are appreciating the necessity and the advantage of cultivating their woods upon rational lines. Working plans for the economical management of woods have been prepared and adopted upon estates of the Earl of Selborne in Hampshire—of which an account will be found in the *Transactions* of the Royal Scottish Arboricultural Society already cited—of the Duke of Bedford at Woburn, of Mr. Munro Ferguson at Raith and Novar, and in the Forest of Dean the Government has similarly arranged a working plan. These working plans, which are a novelty in the country, are worthy of study by those who own woodlands, for they indicate the method which ought to be followed upon every estate where it is desired to grow wood for profit. Hitherto proprietors who

1 "Forest Management, with Suggestions for the Economic Treatment of Woodlands in the British Isles" (*Trans.* Surveyors Inst., 1900); "Canadian Trade with Great Britain" (*Contemp. Review*, Jan. 1900); "British Forestry and its Prospects" (*Trans.* Roy. Scot. Arbor. Soc., vol. xvi. part ii, 1900); "Deficient Production of Timber in the World" (*Trans.* Eng. Arbor. Soc., vol. iv. part iii, 1900); "Outlook for the World's Timber Supply." Report of a lecture by Dr. W. Schlich (*Journal* of the Society of Arts, March 1).

may have desired to cultivate their woods on scientific principles may have met with the difficulty of obtaining expert advice; but such a difficulty no longer exists, for there are in this country now retired forest-officers of the Indian service to whom proprietors may readily go for sound and safe guidance. At the same time we cannot hope that the cultivation of crops of timber in this country will attain the dimensions which it must do if it is to affect to an appreciable extent the market supply of timber until means for the acquisition of knowledge of scientific principles underlying it are available to those to whom woods belong and to those who have the direct management of the woods. Within the last decade several trustworthy text-books upon forestry have appeared, but our only school for instruction in forestry at the present time is that at Coopers Hill. Coopers Hill is, however, open only to entrants to the Indian Forest Service, and there is no institution in the country to which any one desiring a thorough acquaintance with the principles of forestry can go. Our Universities are now alive to the claims of agriculture as a subject of study, and agricultural colleges are being formed in different districts. How long will it be before the Universities recognise that forestry also is worthy of attention, or the agricultural colleges take up the subject in their curricula? It is matter of common knowledge that a committee appointed by the Secretary of State for India recently reported in favour of the transference to Cambridge of the forest-school from Coopers Hill. As yet, however, no action has been taken upon the recommendation. The Secretary of State may rest assured that such a transference would be a reform meeting with the hearty approval of men of science, and the presence at Cambridge of such a school would give an opportunity to undergraduates connected with the landed interest to obtain some acquaintance with a subject of intimate concern to them. The influence of this upon the prosperity of the country would ultimately be most beneficial. As has been said above, ignorance is the real cause of our present condition as a wood-growing country, and until systematic instruction is provided in some of our Universities or colleges there will be no great reformation in forestry practice, although there may be amelioration through the action of intelligent and far-seeing individual proprietors.

THE CONCRETIONS OF THE CONNECTICUT VALLEY.[1]

THE curiously-shaped concretions met with in the Champlain clays of the Connecticut Valley have for many years attracted attention. Indeed, so long ago as 1670 some specimens were sent to the Royal Society of London. A detailed description of them and of their mode of occurrence, illustrated by fourteen beautiful quarto plates, has now been issued by Mr. J. M. Arms Sheldon. Four principal types of concretions are met with; some are discs which call to mind the Kimeridge coal-money; some are cylindrical or club-like, one example (probably a compound one) being a little more than twenty-two inches long; others are botryoidal, and not a few are "queer little images" resembling "fishes, birds, ant-eaters, elephants, dogs, babies' feet," &c. (Fig. 1).

These occur in stratified river-drift clays, some of which are of a kind suitable for modelling, and some are more or less gritty. The most remarkable point is that "each clay bed has a form of concretion peculiar to itself," that is to say, the principal types are never found together. The author has seen "forty-eight specimens from one bed so similar it was impossible to tell one from another."

[1] "Concretions from the Champlain Clays of the Connecticut Valley." 4to. (Boston, 1900.)

Compound forms occur, where, for instance, two or even three discs have coalesced or been joined together (Fig. 2); and intermediate stages of such examples, and of immature concretions of horse-shoe type, are met with.

These remarkable bodies occur along the planes of bedding in the clays, and the lines of stratification may sometimes be seen to run in unbroken continuity through concretion and clay. In composition they consist of argillaceous and somewhat sandy limestone with small amounts of iron-oxide, magnesia and manganese oxide. They contain from 42 to 56 per cent. of carbonate of lime, whereas the clay possesses but 2 or 3 per cent. The concretions spread out laterally in the clay, as if water holding carbonate of lime in solution made its way

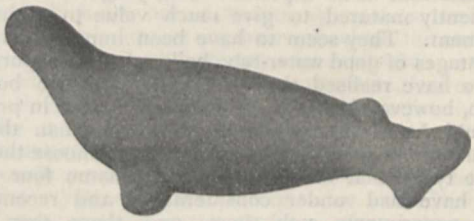

FIG. 1.—An animal form of concretion.

along the planes of stratification; and unless in the case of tiny spheroidal concretions they are almost invariably flattened. No doubt they are due to the obscure process of segregation, whereby the mineral matter, tending to collect together, has been unable to assume definite crystallographic shape, but has concentrated itself in nodular form. Some of the concretions show evidence of concentric structure, but no appreciable nucleus has, as a rule, been seen, though it might have consisted of a particle of carbonate of lime. Evidently the concretionary process went on in a quiet way, but not always uninterruptedly, as indicated by the distinct stages of growth seen in some specimens. The shape of the concretions is held to be partly determined by the structure

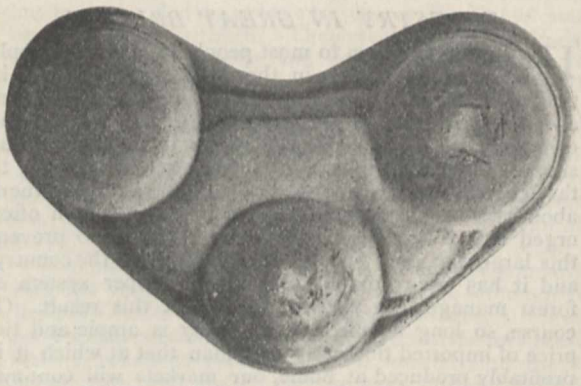

FIG. 2.—A treble form of symmetrical concretion.

and composition of the matrix which holds it, and by the amount of carbon dioxide and other organic acids present.

The author concludes his work with a useful bibliography, wherein the well-known researches of De la Beche, and the observations of A. H. Green and others are mentioned; but we miss the name of Sedgwick, who, in 1835, brought the matter before the Geological Society of London. The author, however, does not enter into the general question of concretionary structures; his work is essentially local, but it will be none the less interesting to those who give attention to the subject.

H. B. W.

THE WILDFOWL OF SCOTLAND.[1]

THE possession of artistic talents of the exceptionally high order of those with which the author of the beautiful volume before us is endowed confers, it must be confessed, an advantage over his brother naturalists to whom such accomplishments are denied the value and importance of which it is almost impossible to overestimate. Most naturalists who have to depend upon the labours of others to illustrate their works (and they are the great majority of their class) have but too often to deplore either the lifeless and "wooden" character of the sketches with which they are supplied, or, when higher things are attempted, the sacrifice of accuracy of detail to artistic effect. For, among at least a large percentage of professional zoological artists, the combination of lifelike posture with strict attention to details of form, colour and anatomy seems to be almost unattainable. An artist like Mr. Millais, on the other hand, who is well acquainted with the special characteristics of the animals he portrays, and is at the same time an accomplished landscape and animal painter, is enabled to combine zoological accuracy of detail with scenic effect in the happiest manner. And we have in consequence pictures of animal life which satisfy the professed naturalist in regard to fidelity, and likewise appeal with full strength to the connoisseur in art and the lover of the beautiful in nature.

In an earlier work, "A Breath from the Veldt," Mr. Millais gave us some startling, but apparently truthful, sketches of antelopes and vultures in their most active phases of movement; and in the present volume he has done the same for the British ducks and geese and certain other of our larger wild birds. Examples of the artist's power and originality in this style are displayed in the plate of a peregrine swooping down on a flight of frightened teal; in the one of wild geese arriving from the Arctic regions, where the figure in the foreground is a marvellous example of artistic skill in representing a bird in what seems an almost impossible attitude; and, again, in the plate of herons moving a party of wigeon; and also in the sketch of Loch Spynie at sunset, in which the whole scene is alive with bird-life. Equally bold and original are the sketches of flocks of wildfowl when raked by a shot in their midst; but we confess that such scenes of slaughter are much less to our taste than those of birds under more normal conditions, and we should have liked the coloured plate of a flying mallard far better had the bird been unwounded. Nor is the artist in any way less at home in his pictures of bird-life in repose or slow movement, of which the plates of mallards feeding, of wild geese throwing out sentinels, and of teal in "bunched and scattered formation" may be cited as charming and exquisite examples. As an example of illustration of this nature we reproduce, by permission of the publishers, the annexed text-figure of mallard feeding. The flight, too, of ducks and geese, as we shall have occasion to mention again, is a favourite subject with Mr. Millais; and as an example of the V-formation nothing can be better than the plate, entitled "brent and their satellites."

FIG. 1.—Mallard feeding in the shallows and on the mud. From "The Wildfowler in Scotland."

To those who have had no experience of wildfowl shooting in Scotland and the isles, nothing can be more wonderful than the profusion in which ducks and geese occur during winter in their favourite resorts; and few sights in the world can be more marvellous than the flocks of these birds when assembled in their thousands and tens of thousands. Most wonderful of all, perhaps, must be the arrival of wild geese from the Arctic regions. By rare good fortune, as he tells us, the author has on two occasions witnessed this marvellous sight. On the first occasion, in October, he writes:

"I heard the first 'honk' of the season coming from far away up in the vast expanse of the blue heaven. For a long time nothing could I see, until at last a tiny speck appeared in the sky as far as the eye could reach, and, watching it intently, I saw it grow into the form of a goose that was slowly descending in great spirals. This bird was followed at regular intervals by others of the tribe subdivided into little parties of from six to ten individuals. . . . The prime leader came down immediately above the Inch, and while she was preparing to alight there were still small companies evolving themselves from the blue expanse, until at last there must have been some fifteen hundred birds actually on the wing, all in process of descent, and all following one another at regular intervals. By and by, when the leading geese had settled, the parties at the rear seemed to straggle more, and longer intervals occurred between them; yet they kept coming in all day as I roamed round and about the lake, till by the evening, when I disturbed the company, there must have been between two and three thousand geese sitting on the island."

A keen and enthusiastic sportsman himself, Mr. Millais writes mainly for his brother sportsmen, and much of his work, apart from the illustrations, will be interesting to them and to them alone. And this being so, he has done well in alluding to the birds whose haunts and habits he describes so graphically by their English names alone. But the author may also lay claim to be regarded as a field-naturalist of no mean ability, and many of his observations with regard to the flight of ducks are not to be found in any of the ornithological works with which we are acquainted. Several of the more interesting of these observations are given in the appendix, which is specially devoted to the appearance on the water of the different British ducks and the localities they especially affect in Scotland, and is accordingly

[1] "The Wildfowler in Scotland." By J. G. Millais. Pp. xv + 167. Illustrated. (London: Longmans and Co., 1901.) Price 30s. net.

the section of most importance to the naturalist. The following passage, from p. 37, may be quoted as a good example of the closeness of the author's observations :—

"Most sportsmen," he writes, "will have noticed that duck when travelling prefer flying over water ; even when passing from one sheet of water to another they will avoid the land if they can. This may be said to be a hard and fast rule with all the true diving ducks, but not with the surface feeders, such as mallard, wigeon and teal ; for when they in their flight observe the waters for which they are heading, they are as likely as not to cut over large extents of land to reach their desired haven, especially if they have been much shot at at any given point on their usual water route."

The text-figures in the appendix are especially intended to illustrate the modes in which different species of duck rise from the water, and the formation they assume when in the air. One exhibits the manner in which mallard and teal "scoot" along the surface of the water in close phalanx before rising ; a second (herewith reproduced) displays the "bunched" formation assumed by eiders

FIG. 2.—Eiders rising and showing bunched formation. From "The Wildfowler in Scotland."

when rising ; while a third shows the swallow-like flight and linear formation so characteristic of the long-tailed duck.

For many of the species referred to the author well says that the illustrations best display the manner in which they severally leave the water when alarmed. When illustrations are lacking, excellent descriptions are given, as witness the following :—

"Shovellers are easily recognised when they rise from a marsh by the rattling noise they make, and I have heard them designated as 'rattle-wings' in more than one locality. They ascend abruptly at first, and fly rather like wigeon, but more easily and gracefully. They are adepts at turning, and seem to enjoy in spring beating up and down for hours together over the marsh which they intend to make their summer home. They do not fly very high as a general rule."

With this quotation we take leave, regretfully, of what is in every respect a very charming book, acceptable alike to the lover of art, the sportsman and the naturalist, and forming a handsome addition to the works allowed a permanent place on the drawing-room or library table.

COOPERS HILL COLLEGE.

THE report on this institution by the body called, on the *lucus a non lucendo* principle, the "Board of Visitors," was published last week so shortly before the House of Commons adjourned for the Easter recess that there was not time to take any parliamentary action.

The day after we went to press a letter appeared in the *Times* from Colonel Pennycuick, the president of the College who preceded Colonel Ottley, from which we make the following extracts :—

Sir,—The final decision of the Secretary of State for India, after the inquiry promised in his letter to Sir William Anson, has now been announced, and has justified the opinion expressed by every one acquainted with the facts, that the inquiry in question would be a farce, the Board of Visitors, by whom the inquiry was conducted, being already committed to an opinion, and its own competence being one of the very questions on which an inquiry was most urgently required.

Lord George Hamilton's letter to Sir William Anson repeats the libels contained in his reply to the deputation which waited on him earlier in the year, that the college "is in such a condition that it must be either reformed or abolished," and that it is "a burden upon the Indian revenues." Both these statements, unless they have been justified by something that has happened since the end of 1899, are absolutely untrue. At that date the number of candidates for entrance far exceeded the number for whom accommodation was available ; the standard of the entrance examination had been steadily raised during the three previous years, and was still further raised in 1900 ; the college accounts during the same years showed a handsome surplus of income over expenditure ; and the reputation of its students for practical efficiency stood at the highest possible level ; its associate's diploma was accepted by the Institution of Civil Engineers as equivalent to their own associate's examination, and this latter examination was passed, while still at the college, by many students who did not succeed in obtaining that diploma ; every student who obtained the ordinary diploma of the college, and some who did not, obtained useful employment within a few months after leaving the college. When and whence arose the necessity for "reform or abolition" in an institution which eighteen months ago was producing such results as these?

In his reply to the deputation Lord George Hamilton stated that shortly after he came into office—*i.e.* in the end of 1895 or early in 1896—he "determined to reorganise" the college as an alternative to abolition. If he did, I can only say that he

kept this determination a most profound secret from the college authorities.

I had three personal interviews with him during 1896 and 1897, and neither then nor at any other time while I was president of the college did he give the smallest hint that any dissatisfaction was felt with its condition (except on financial grounds) or that anything in the shape of reorganisation was contemplated or desired; I challenge production of any official document pointing to the necessity for any reorganisation, or for any change beyond those slight alterations which are from time to time necessary in every living organism. A Minister would deserve impeachment who really held the views which Lord George Hamilton professes to have held in 1896, and took no steps to give effect to those views, but continued to speak, publicly and privately, in the highest praise of an institution with which he was in reality so profoundly dissatisfied.

The committee of 1895, to which Lord George Hamilton refers, and whose proceedings occupy so large a space in the Blue-book, did not deal at all with the question of efficiency nor with the teaching staff, but with the financial question alone, a question which at that time appeared somewhat pressing, but which has lost its interest in view of the increasing prosperity of the college during the years succeeding 1895; this latter fact is concealed in the Blue-book by the ingeniously simple process of giving the accounts only down to 1895 and suppressing those of the later years.

. . . . . .

The India Office have striven to represent the question at issue to be whether the personal interests of the professors concerned are to outweigh the interests of the public service. The real question is not this, but whether these latter interests require or justify the drastic changes which have been made.

With an experience of the Indian Public Works Department and of Coopers Hill considerably greater than that of the present president, I assert most positively that they do not, and am prepared to prove this assertion to the satisfaction of any unprejudiced authority. I believe that I could prove it to the satisfaction of the Secretary of State himself, if I could get at him without the intervention of a prejudiced board or of hostile officials.

It is hoped that some means will yet be found to prevent irreparable injury from being inflicted on an institution which has such a splendid history and has done such signal service to our Indian Empire as Coopers Hill.

Yours faithfully,

JOHN PENNYCUICK, Col. R.E. (late President R.I.E.C., Coopers Hill).

Camberley, April 2.

With regard to the Report itself, which contains the evidence taken by the Board of Visitors, we have received the following from a Correspondent.

After a good deal of pressure both from within and from without the Houses of Parliament, the Secretary of State for India agreed to hold an inquiry into the condition into which the Royal Indian Engineering College at Coopers Hill has fallen under the present *régime*. This inquiry was to be held by a more or less newly constituted body. Lord George Hamilton, however, declined to submit the question of the dismissal of seven of the professors and teachers to an independent body, but he offered to allow the Board of Visitors to hold an inquiry into the justice of the sentences they had themselves pronounced. Adopting the principle familiar to readers of "Through the Looking-Glass," the Secretary of State permits first the judgment and then the trial. On the same principle, the Board of Visitors, into whose competency it is perhaps the most important matter of all to inquire, having acted as judges, not to say executioners, now appear in the *rôle* of prosecuting counsel.

The duties of the Board of Visitors of Coopers Hill seem nowhere to be very clearly defined. But by all analogy the staff of the College should have the right to appeal to the Board, and such an appeal should be listened to with impartiality. The Blue-book issued on April 1, which contains the account of the inquiry, shows, however, the very reverse of a judicial spirit. One of the disadvantages of the method of sentence first and trial afterwards is that instead of making "the punishment fit the crime" it becomes imperative to make the crime fit the punishment, and this the Board of Visitors have most sedulously attempted. They evidently felt they must "save their face" at no matter what cost to the institution whose interests they are supposed to protect.

Throughout the inquiry the dismissed professors and teachers were subjected to a hostile examination which contrasts most strangely with the friendly tone adopted to the president of the College and to other members of the staff, except when the evidence of the latter tended in favour of their dismissed colleagues and against the proposals of the president. The inquiry was rendered nugatory by the rules laid down for its conduct by the India Office. It was ordered that the evidence of each member of the staff should be rigidly restricted to the effect of the proposed changes on the teaching of his own subject and on himself personally, thus preventing material evidence being given on many points of vital importance to the welfare of the College. The Board of Visitors further limited the oral evidence by restricting the staff to the answering of certain questions prepared by the Board. The aim of Sir Charles H. T. Crosthwaite, the chairman of the Board, was apparently to make each of the gentlemen dismissed admit that his retirement was for the benefit of the College. Evidence was continually ruled out because, in the opinion of the chairman, it was of a personal nature; yet Colonel Ottley was allowed to indulge in personalities to an almost unlimited extent.

Throughout the inquiry the Board made little or no attempt to decry the ability or the efficiency of the gentlemen concerned. That was an impossible line, but their attitude throughout was one of

"Willing to wound, and yet afraid to strike,
Just hint a fault, and hesitate dislike."

Evidence exists both in the report of the inquiry and elsewhere that some at least of the Board were unacquainted with the contents of the report contained in the first Blue-book, a report purporting to have been drawn up by themselves. This is possibly to be accounted for by the indecent haste with which that document was considered and signed. More than one member of the Board was unaware that he had recommended such wholesale dismissals. The chairman and Sir W. S. S. Bissett express ignorance of the recommendation of the Board that the professor of electrical engineering should teach chemistry and physics in addition to his own subject, and of the fact that this extraordinary arrangement has had the approval of Lord George Hamilton. The Board knew so little of the staff of the College that they inquired after an instructor who has been dead for some years.

A careful examination of the Blue-book and of the minutes of the evidence reveals a wholesale repudiation by the Board of its previous recommendations. They repudiate the time-table incorporated in the first Blue-book and recommended for adoption by themselves. Perhaps the rejection of this document is the wisest thing the Board has done. They repudiate their own arrangement for the teaching of physics and electrical engineering. They repudiate their own arrangement for the teaching of mathematics, and they repudiate their own arrangement for the teaching of engineering.

One of the saddest features of the whole inquiry is the persistent effort made by both the Board and the president to belittle the status of the College. Coopers Hill in the past has stood high amongst the few institutions for scientific education in this country. It has done a great public service to India, and the prestige attached to its name is highly valued by the Government *in* India. Yet throughout the inquiry the Board compare it to a school, or to a technical college. Sir William Preece finds its nearest analogy in a

Metropolitan polytechnic. Finally, the president is desirous of following the lines adopted at Woolwich and Sandhurst, oblivious of the fact that these are military institutions and that Coopers Hill is a civil scientific College. The proper arrangement for the conduct of such a college as Coopers Hill is, in the opinion of Colonel Ottley, that there should be no intercommunication among the staff, but that each member of the staff should communicate alone with the president. The danger of this system of private conferences as leading to misrepresentation is exemplified by the case of Prof. Hearson, whose private consultations with the president are presented in such an extraordinary light by Colonel Ottley (Blue-book, p. 54). It is probably due to this that Prof. Hearson has been dismissed, though the reason adduced by the president was that Dr. Brightmore was debarred from teaching hydraulics, "his strongest subject," because that subject had been allotted to Prof. Hearson. There is, however, conclusive evidence that both professors were desirous of effecting an interchange of work by which hydraulics would have been handed over to Dr. Brightmore. This evidence the Board of Visitors ignore. Another result of this plan of separate conferences has been shown during the past year. The College has been divided into a series of separate camps. Tempted by the secret offers of the president, some of the junior members of the staff have consented to supplant their seniors for the modern equivalent of a mess of pottage, which appears, in this instance, to be something under 100*l.* a year.

The only charge against the College which appears in the report—and if any other existed we may feel sure the Board of Visitors would have set it forth—is that certain of the telegraph men have been found to be unsatisfactory, and that in some respects the telegraph branch might be improved. No fault of any kind is found with the training of the engineering students, who form by far the larger part of what is essentially an engineering college.

The criticisms on the telegraph men, of whom there are about three a year, is contained in Appendix 12 of the Report, pp. 131–146; and Mr. Pitman, who writes therein, expressly states that his "object is not to unduly criticise the course of instruction at the Coopers Hill College, *which has supplied the Department with so many excellent officers*,[1] but to bring to the notice of the responsible authorities that it would be possible to greatly improve the course of instruction and turn out officers with a greater knowledge of the theory and practice of Indian telegraphy than they can now obtain." This report, which is obviously intended, not as an adverse criticism, but as a friendly suggestion to the staff for improvement in details, expressly states that all the physical laboratory work (for which Mr. Shields is responsible) is excellent.

We have searched the Blue-book in vain for evidence that the Board of Visitors have tried to discover whether any of the suggestions made have been adopted, though Mr. Shields does manage to tell them that those referring to his part of the work have been adopted as far as time permits. And yet Mr. Shields is sent away. We happen to know that it was absolutely necessary for the Board to get rid of Mr. Shields because his successor had already been appointed! and because, moreover, Colonel Ottley had informed that successor, in the interval between the dates of the correspondence between Sir Wm. Anson and Lord George Hamilton (which was published in the daily papers) and the beginning of the inquiry, that whatever happened his appointment was secure! The bias of the Board is further shown by their conducting no inquiry into the admittedly excellent electro-technical course taken by Mr. Shields with some of the third year students.

[1] The italics are ours.

The defects of the telegraph students are not due to this or that part of the course being capable of slight improvement, for it is cordially admitted that many of them are excellent officers. The real reasons are given on pp. 121, 122. The calibre of some of the men during recent years has been exceptionally low, and owing to a variety of circumstances the abler men have not chosen to take telegraph appointments. This year, however, the standard is higher, and unless the break in their work, caused by the extraordinary plan adopted by the India Office of dismissing half the staff in the middle of the session, has too disastrous an effect on the students, they should take a high place in the service.

So far, therefore, from the indictment being justified that the College must be reformed or abolished, we can confidently assert that very few colleges, if subjected to such a hostile criticism as has been applied to Coopers Hill both by the president and by the Board, could show so clean a record.

A grave injustice has been done, not only to the seven gentlemen dismissed, but to all those whose services are "for the present" retained and to all who take part in the higher education of the country. The Board of Visitors have dropped their plea of economy because the changes have been shown not to be economical. They have dropped their plea of increased efficiency because it is impossible to maintain that to dismiss a man with Prof. Hearson's reputation and to replace him by a man of the reputation of Dr. Brightmore (who has not hesitated to inform the Board that he is unable to maintain discipline in his class) makes for efficiency. The Board of Visitors have, in fact, no plea to put forward for the action they have taken. They have relinquished their powers of judgment to a military autocrat who, backed up by other retired officials at the India Office, has absolute power over the destinies of the entire staff at Coopers Hill. Recent events in this country have not increased the faith of the people in the ability of either our public offices or of our army officers. Military methods have been shown to be imperfect and the scientific and educated opinion of the country will be slow to recognise the advisability of extending them to such institutions as the Engineering College at Coopers Hill.

NOTES.

As already announced, a meeting of the International Association of Academies will be opened at Paris on Tuesday next, April 16, in the rooms of the Institute of France. The following is a list of delegates appointed to represent the various academies which will constitute the Association:—Amsterdam: Prof. H. G. van de Sande Bakhuysen, president of the physico-mathematical section of the Academy; Prof. H. Kern, president of the section of letters; Prof. J. de Goeje. Berlin: Prof. H. Diels and Prof. W. Waldeyer, permanent secretaries of the Prussian Royal Academy of Sciences; Prof. R. Helmert; Prof. J. H. van 't Hoff; Prof. T. Mommsen; Prof. E. Sachau. Brussels: Lieut.-General de Tilly; Prof. P. Fredericq. Budapest: Prof. C. Than; Prof. I. Goldziher. Christiania, not yet announced. Göttingen: Dr. E. Ehlers and Dr. F. Leo, secretaries of the Society; Prof. E. Riecke. Copenhagen: Prof. J. L. Heiberg; General G. Zachariæ. Leipzig: Prof. W. His; Prof. A. Fischer; Prof. H. Gelzer. London: Sir Michael Foster and Prof. A. W. Rücker, secretaries of the Royal Society; Dr. T. E. Thorpe, foreign secretary of the society; Sir Norman Lockyer; Sir Archibald Geikie; Prof. A. R. Forsyth; Prof. E. Ray Lankester; Prof. A. Schuster. Munich Prof. W. Dyck; Prof. F. Lindemann; Prof. K. Krumbacher. Paris, Academy of Inscriptions and Belles Lettres: Count De Lasteyrie, president; MM. P. Berger, vice-president;

H. Wallon, permanent secretary; L. Delisle; G. Boissier; Bréal; Barbier De Meynard; Senart; E. Müntz. Academy of Sciences: MM. Fouqué, president; Bouquet de la Grye, vice-president; Berthelot and Darboux, permanent secretaries; Marey; H. Poincaré; Moissan; Lannelongue. Academy of Moral and Political Sciences: Count de Franqueville, president; G. Picot, permanent secretary; Gréard; Glasson; Lachelier; Sorel; Boutroux. St. Petersburg: MM. Famintzin; Backlund; Oldenbourg; Kouliabko. Rome: Prof. S. Canizzaro; Prof. A. Mosso; Prof. I. Guidi. Stockholm: Prof. G. Retzius, president of the Academy of Sciences. Washington: Prof. G. L. Goodale. Vienna: Prof. Victor von Lang, general secretary of the Academy of Sciences; Prof. T. Gomperz; Prof. Leopold von Schroeder; Prof. J. Karabacek; Prof. J. C. Zirecek; Prof. A. Rollett; Prof. G. Tschermak.

MR. L. DE NICÉVILLE, who has for many years been well known by his published work on Indian and Malay Lepidoptera, has been appointed entomologist in the Indian Museum, Calcutta.

PROF. EUGEN WARMING AND DR. VICTOR MADSEN have been appointed to the Danish Geological Survey, and Dr. H. Topsöe has retired from the Survey.

THE death from cholera of Mr. G. F. Reader, of the Geological Survey of India, took place at Madras on March 12. Mr. Reader was appointed as a specialist in coal mining in 1899, and for the last five months of his life also officiated as Government mining inspector.

REUTER'S correspondent at Constantinople states that the sharp earthquake experienced there on March 30 occurred at five minutes past nine in the morning. The movements observed were in the direction from south-west to north-east and lasted nearly five seconds.

MR. W B. TRIPP, writing from Isleworth, says that on April 4, about 10 p.m., a fine display was observed of lunar halo with horizontal ray on a level with moon and two paraselenæ (or mock moons) at its intersection with the halo, which remained all the evening while the paraselenæ soon disappeared.

THE subjects of the Walker prizes in natural history to be awarded by the Boston Society of Natural History, Massachusetts, U.S.A., are as follows:—For 1901: Monograph on any problem connected with, or any group belonging to, the North American fauna or flora; for 1902: (1) nuclear fusions in plants; (2) the fate of specific areas of the germ of chordates, as determined by local destruction; (3) the reactions of organisms to solutions, considered from the standpoint of the chemical theory of dissociation.

AN International Maritime Congress will be held at Monaco on April 12–15, under the presidency of M. J. Charles-Roux. The congress will discuss, among other questions, those of assistance to the shipwrecked, the international unification of coast-lights and buoyage, maritime meteorological observations, wireless telegraphy, marine pigeon-post, international maritime tribunals, and a scheme for the creation of a permanent international maritime bureau. The last-named project aims at the international discussion of maritime questions by a permanent and official body.

THE Director of the Missouri Botanic Garden has recently called attention to the facilities offered by that institution for botanical research. The garden owes its foundation to the munificence of Henry Shaw, and the good work which he inaugurated has resulted in the formation of a splendid collection of plants in the garden and in the herbarium, together with an adequate library without which they would lose much of their value. The collection of books is especially rich in systematic works, and thus affords opportunities for study of the American flora and of its relations with that of other countries. The Director, Dr. Trelease, extends also a courteous invitation to those who may desire to make use of the collections for physiological or other objects, suggesting that provision may be made to suit the requirements of those who desire to engage in such investigations. The growing prominence which is being given to research, and the spirit which impels it, affords one of the surest guarantees for greatness of the intellectual and material future which lies before a strong and virile community.

THE Brussels Academy of Sciences announces the following prize subjects for 1901:—New researches upon the compounds formed by the halogens between themselves (800 francs); the determination of the form of the principal terms introduced into the formulæ of nutation in obliquity and longitude by the elasticity of the earth's crust (800 francs); historical and critical discussion of Weber's experiments on unipolar induction, and new experiments bearing upon the laws and interpretation of this physical fact (800 francs); a contribution to the study of mixed forms with a number of series of variables, and the application of the results to the geometry of space (600 francs); history of researches on the variation of latitude, and a discussion of the interpretations of this phenomenon (600 francs); investigations of the physiological *rôle* of albuminoid substances in the nutrition of animals or plants (800 francs); new researches on the organisation and development of Phoronis, and the relations existing between the animals Rhabdopleura and Cephalodiscus, and the class to which the name Enteropneusta has been applied (1000 francs); description of simple substances, sulphates and binary compounds of Belgian soil (800 francs); researches on the influence of external factors on karyokinesis and cellular divisions in plants (800 francs).

THE expeditions which will start for the Arctic regions during 1901 are described in the U.S. *Monthly Weather Review* as follows:—(1) The Zeigler-Baldwin, to be led by Mr. Evelyn B. Baldwin, who lately resigned from the Weather Bureau for this purpose, the funds to be contributed by Mr. William Ziegler, of New York. (2) A Russian expedition, commanded by Vice-Admiral Makaroff, in a vessel constructed to push its way through ice fourteen feet thick. (3) A Canadian expedition, in charge of Captain Bernier, in the *Scottish King*. (4) A German expedition, plans not yet published. (5) A joint expedition by Dr. Nansen and the Duke of the Abruzzi. (6) Peary and his companions will finish the exploration of Grinnell Land and return home. (7) Dr. Robert Stein and his companions will complete the exploration of Ellesmere Land. (8) A relief expedition to Franz Josef Land, under the command of Captain Stoekken, and apparently at the joint expense of Nansen and Abruzzi. (9) Baron Toll will send a party from the Kara Sea eastward along the Siberian coast. Captain J. E. Bernier, of Quebec, proposes to travel by the route taken by the wreck of the *Jeannette*, with dogs, reindeers, and sledges, over the ice from the Lena or Bennett Island region. The trip may last two and a half years.

ON Tuesday next, April 16, Dr. Allan Macfadyen will deliver the first of a course of six lectures at the Royal Institution on cellular physiology, with special reference to the enzymes and ferments. On Thursday, April 18, Mr. Roger Fry will begin a course of two lectures on naturalism in Italian painting, and on Saturday, April 20, Mr. John Young Buchanan will deliver the first of a course of three lectures on climate: its causes and its effects. The Friday evening discourse on April 19 will be delivered by Prof. J. J. Thomson, his subject being "The Existence of Bodies smaller than Atoms."

THE dispute between the London United Tramways Company and the authorities of Kew Observatory has at last been settled. The tests made at the Board of Trade trial, referred to in our issue of March 21 (p. 499), having shown that the electrical working of the tramway from Hammersmith to Kew will interfere with the magnetic work done at the Observatory, the Tramways Company have agreed to pay a considerable sum towards the cost of removing the instruments to some more suitable site. The electric cars have in the meantime started running. The cars, which are much superior to the old horse trams in comfort, run smoothly and rapidly, taking about five and twenty minutes over the journey from Hammersmith to Kew. The overhead wires, though they certainly do not improve the appearance of the street, cannot be said to be excessively ugly; even at Young's Corner, Chiswick, where the branch line runs off to Shepherd's Bush, and where, consequently, the number of wires is considerable, the effect is not so bad as to be an eyesore. The route, leading direct to Kew Gardens, is a popular one with Londoners anxious to get into the country, and they seem already to appreciate the benefit of the electric trams; it is to be hoped that the system will undergo rapid expansion and extension and give Londoners a cheap, quick and easy method of getting really out of the town.

WE have received a copy of *Traction and Transmission*, a monthly supplement to *Engineering*, which makes its first appearance this month. Although the multiplication of technical journals is not a thing to be indiscriminately encouraged, the possibility of keeping pace with all the modern papers becoming daily more difficult to the engineer, there can be no doubt there is ample room at the present time for a magazine devoted to these subjects. England has been at last obliged to set itself seriously to the consideration of the means of relieving the overcrowding and congestion of traffic in the large towns, and the appearance of this paper, at a moment when the attention of every one is being directed to big schemes for traction and the transmission of power, is therefore very opportune. The first number, which is almost wholly devoted to electric traction, contains, amongst many others of great interest, articles on the standardisation of electrical apparatus, by Mr. H. F. Parshall, on the conveyance of goods on electric trolley lines, by Mr. A. H. Gilbings, and on the much vexed question of the education of the electrical engineer, by Mr. R. A. Raworth. The paper is got up in sumptuous style, being printed in very large type on extra thick paper and illustrated by a number of capitally-executed plates and diagrams.

THE U.S. *Monthly Weather Review* for December last contains the report of an interesting investigation by Dr. O. L. Fassig on the relation between summer and winter temperatures, with the view of finding, for instance, whether an extremely hot summer precedes a cold winter. The basis of the investigation was an accurate daily record of weather from 1817 to the present time. The investigation shows that neither warm nor cold summers have any more relation to the succeeding winter temperatures than the normal summers have, and that, generally speaking, there is no regular alternation or period in atmospheric temperatures.

The Summary of the Weekly Weather Report for the year 1900, published by the Meteorological Council, contains the mean values of rainfall and temperature for the principal wheat-producing and grazing districts of the British Islands for each five years of the thirty-five yearly period, from 1866 to 1900. The rainfall for the British Islands generally in the year 1900 was 3·7 inches above the average for the whole period. The greatest excess was 16·3 inches in the west of Scotland; in the north of Scotland the excess was 10·2 inches, and in the south of Ireland 7·9 inches. The only districts in which there was a deficit were the east and south of England, being 1·3 inch in both cases. The driest year, for the whole kingdom, was 1887 (25·8 inches), and the wettest 1872 (49·1 inches). The mean temperature during 1900 was, on the whole, 0°·4 in excess of the average, the greatest departures being +1° in the east and south of England. The coldest year was 1879 (46°·2) and the warmest 1868 (50°·4) for the British islands generally.

AT South Pasadena, California, the large reflector shown in the accompanying illustration, from the *Scientific American*, has been erected, and the solar rays concentrated by it are utilised to produce steam in a boiler at 150 lbs. pressure and drive a motor of fifteen horse-power. The reflector is 36 feet 6 inches in diameter at the top and 15 feet at the lower part. The inner surface is made up of nearly eighteen hundred small mirrors, all arranged to bring the sun's rays to one focus, at which spot a boiler 13 feet 6 inches in length and holding one hundred gallons of water is suspended. The reflector is mounted upon the same principle as that adopted for large telescopes, and is kept facing

the sun by a driving clock. The steam from the boiler is carried to the engine by means of a flexible phosphor-bronze tube, and returns from the condenser to the boiler, so that the water supply in the boiler is kept up automatically. The temperature at the focus of the reflector is sufficient to melt copper, and a pole of wood thrust into it burns like a match. The motor is used to pump water from a well and appears to work satisfactorily. As the skies of Southern California are remarkably free from clouds, and millions of square miles of arid lands are only awaiting the flow of water to be converted into fertile tracks, the solar motor may provide a practicable means for pumping the water and thus leading to the development of the country.

FOR sixty-seven years the Royal Observatory of Belgium has published an *Annuaire* dealing both with astronomy and meteorology, but from the present year each of these services has its own *Annuaire*. Twenty years ago M. Houzeau made a separation of these sciences, so far as the *Annales* are concerned; the division is now complete in everything except the administration. The *Annuaire Meteorologique* for 1901 contains a large

amount of useful information, including the average mean temperature and the mean maximum and minimum temperature at Brussels (or Uccle) for each day of the year, and the monthly means and extremes of all the principal meteorological elements since 1833. There are several articles of special interest, including one by M. J. Vincent on the history of meteorology in Belgium from the earliest times until the establishment of the Academy of Sciences at Brussels in 1773. The next *Annuaire* will continue the sketch from the creation of the Academy until the foundation of the Royal Observatory in 1833.

THE Committee of the Bristol Museum record in their annual report the extensive operations carried on at Brislington, near Bristol, where the remains of a Roman villa have been found. The extensive foundation walls of the villa were laid bare, showing the plan of its construction and many of its domestic features. In addition to two fine mosaic pavements, a great variety of relics of the Roman period were discovered.

THE "Physical Geography of the Texas Region," by Mr. Robert T. Hill, forms Folio 3 of the Topographic Atlas of the United States, issued by the U.S. Geological Survey (1900). It is a finely-printed work, illustrated with numerous maps and beautiful photographic representations of topographic forms, mountains, plains and scarps, rivers and canyons. In the descriptive text the author deals, for the most part, concisely with his subject, showing, first of all, the relations between the geological formations and the scenery, and then describing the principal features.

THE Maryland Geological Survey, which is under the direction of Dr. Wm. Bullock Clark, has just commenced the issue of a series of reports on the physical features of the counties of Maryland. The first report on Allegany County may be taken as a sample of what can be done by an energetic and well-equipped staff. It occupies 323 pages, is printed in remarkably clear type, and is illustrated with numerous diagrams, pictorial views and maps. Accompanying it is a folio atlas, with a colour-printed geological map on a scale of 1 inch to a mile, and other topographic maps. Many experts aid in the descriptions of various subjects, such as physiography, stratigraphy, mineral resources, soils, climate, hydrography, forestry, and fauna and flora. The county, indeed, is one highly favoured, few regions being more salubrious or more picturesque. Along its full length from east to west the Potomac River meanders through a district of rich farming lands and wild mountain scenery. Silurian, Devonian, Carboniferous, Permian and Pleistocene formations are met with, and the history of research among these strata is fully recorded. The leading characters and many details concerning the formations are given, though with too scant particulars of the fossils to please those who seek comparisons with equivalent strata elsewhere. The rocks grouped as Permian follow the Carboniferous conformably. They comprise shales and limestones with unimportant sandstones and coal-beds, and their fossils have yet to be described. To those residing in Allegany County this admirable memoir cannot fail to be of the greatest interest and service.

THOSE who have visited the Bankfield Museum at Halifax are aware of the improvements effected in the ethnographical section by the untiring industry of Mr. H. Ling Roth, the honorary curator, who has, in addition, just issued a pamphlet on the Fijian Collection. This excellent little guide of twenty-seven pages contains forty-four illustrations, mostly of specimens in the collection. It forms an interesting sketch of Fijian ethnography, written with that carefulness of detail which students have learnt to expect from Mr. Ling Roth. As coloured designs on bark cloth are found in some parts of New Guinea where direct Polynesian influence is entirely out of question, there seems no reason to believe, as Mr. Ling Roth suspects, that Fijian *masi* or *tapa* is a "Polynesian institution introduced among this Melanesian people." The same argument applies, though perhaps not so conclusively, to tatuing.

WHERE the Thompson and Fraser rivers meet at Lytton in Southern British Columbia has always been an important site of the Indians, as the ancient burial grounds and village sites testify. The late Dr. G. M. Dawson first described the remains in 1891, but recently the Jesup North Pacific Expedition made a series of explorations in this vicinity, of which an abstract has been described by Harlan J. Smith in the *Memoirs* of the American Museum of Natural History, vol. ii. part iii. (*Monumental Records*). The prehistoric culture resembles that of the present inhabitants of the interior of British Columbia. The mode of life of the prehistoric tribes, their utensils and even their customs must have been practically the same as those of recent Indians. There are, however, a few slight differences; the ancient type of pipe resembles the prehistoric pipe of Oregon and California, while the recent pipe is practically of the same type as that found on the plains. The potter's art was then, as now, unknown. On the whole the prehistoric culture of the interior of British Columbia shows greater affinity to that of the western plateaus than to that of the North Pacific coast.

MR. C. D. CHILD, writing in the *Physical Review* for February, describes some experiments made with the new method for determining the velocity of ions, recently suggested by Prof. J. J. Thomson. The method in question "is to produce the ions in one region and measure the electrical intensity at two points where there is no production of ions, but to which ions of one sign only can penetrate under the action of the electric field." The author shows by an application of Prof. Thomson's method that the velocity of the positive ions drawn from a Bunsen burner is approximately 2·2 cm. per sec. for potential gradient of 1 volt per cm., and that for negative ions 2·6 cm. Further, in the case of an unlimited supply of ions, if the discharge takes place between two regular surfaces, the velocity may be determined by simply measuring the current per unit area and the difference of potential between these surfaces, and if the surfaces are not at all regular the relative velocities of the positive and negative ions may be determined by comparing the positive and negative currents.

IN a paper on stationary motions, published in the *Atti dei Lincei*, x. 5, Signor T. Levi-Civita has endeavoured to furnish a more precise definition than commonly exists of the conception of stationary motion. Routh's definition, taken in its purely formal aspect, leads to the conclusion that by a proper choice of variables any motion may be regarded as stationary. On the other hand, experience teaches us that certain motions possess peculiar characters of simplicity and regularity which distinguish them clearly from other motions, and, moreover, Routh's examples show that in certain cases his definition actually does distinguish stationary motions (in the physical sense) from non-stationary motions. The author considers that the distinguishing characteristic in such cases is that the integrals or invariable relations which determine stationary solutions are always *uniform* in the sense considered by Poincaré. According to Routh, a stationary motion Σ is characterised by the property that if the conditions are equally modified at any two instants, t', t'', the disturbed motions Σ', Σ'' present relations such that under a certain condition they may be regarded as equivalent. Now Signor Levi-Civita considers that an analytical condition which is not uniform has no physical interest, and he is of opinion that Routh's definition of stationarity should be completed by adding the proviso that the relations between two disturbed motions, Σ', Σ'', should be uniform. As an example,

it follows that the problem of n bodies does not admit of any forms of motion absolutely stationary beyond the particular solutions of Laplace, in which the bodies rotate uniformly, maintaining an invariable (plane or rectilinear) configuration. On the other hand, the chief problems of ordinary dynamics conform to the property in question.

WE learn from the April number of the *Entomologists' Monthly Magazine* that the late Mr. Lennon's collection of British Coleoptera has found a permanent home in the Edinburgh Museum of Science and Art. Its richness may be gathered from the circumstance that the number of species from the Solway district alone is estimated at more than twelve hundred.

IN addition to several papers dealing with abnormalities in human anatomy and others on ethnology, the *Proceedings* of the Anatomical and Anthropological Society of the University of Aberdeen for 1899-1900 contains an abbreviated report of a lecture delivered before the University by Dr. A. Keith, on the relations of man to the higher Primates. The lecturer expressed his opinion that the gorilla and chimpanzee are co-descendants of an early Miocene anthropoid, for which the name Protroglodytes was suggested. It was estimated that more than five million years have elapsed since the separation of the human stock as a distinct form.

THE osteology of the woodpeckers forms the subject of a paper by Dr. R. W. Shufeldt in the October-December issue of the *Proceedings* of the American Philosophical Society. As the result of his investigations, the author concludes that these birds are more nearly related to the Passeres than to any other group, and that both are probably divergent branches of a single ancestral stock. In a second communication to the same journal, Dr. Shufeldt treats of the skeleton of the owls, and arrives at the conclusion that there is no marked affinity between that group and the diurnal birds of prey. Rather, he thinks, there is a relationship, although a remote one, between the owls and the nightjars, the South American oil-bird (Steatornis) and the Australasian Podargus being the members of the latter group in which the evidence of strigine affinities is most conspicuous.

THE journal last quoted also contains an interesting communication by Mr. R. H. Mathews, dealing with the origin and customs of the Australian aborigines. It is argued that the Australians reached their present home by way of the Malay Islands, but that the immigration has taken place at more than one epoch, the later immigrants being of a higher grade than their predecessors. The earlier immigrants are considered to have been of the Melanesian type, and their unmodified descendants were the now extinct Tasmanians. The later invaders, on the other hand, never reached Tasmania, which had, at the time of their arrival, become insulated. "There is nothing unreasonable," adds the author, "in the assumption that these invaders and the native tribes of the southern portion of India are the descendants of a common stock—the Australians, owing to their long isolation, having retained the primitive character of their Neanderthaloid ancestors, while the later Indian tribes have attained a higher grade of evolution." Possibly this may be the real solution of an extremely puzzling ethnological problem.

THE *Century Magazine* for April contains an excellent and fully illustrated popular account, by Dr. L. O. Howard, the chief entomologist of the U.S. Department of Agriculture, of the recent investigations connecting the propagation of malaria with mosquitoes of the genus Anopheles. The author first of all dwells upon the great prevalence of malaria in certain parts of the world. Although in temperate regions the mortality from this disease is not high, in one year in the United States the deaths due to malarial fever were 3976 per 100,000, and in a later year 2673 per 100,000. In Italy the average death-rate from this cause is 15,000 annually, while in India five million deaths were ascribed to "fever" in 1892, and in Italy two million persons suffer annually in one way or another from malaria. The malaria-producing species are then described, after which comes a description, with illustrations, of the development of the malaria-parasite in the red blood corpuscles and in the body of the Anopheles mosquitoes. The article concludes with a brief reference to the evidence now being collected to connect yellow fever with a mosquito. Instead of belonging to Anopheles, the suspected insect pertains to the genus Culex (or perhaps represents a genus by itself); and it is considered probable, if the suspected connection between this insect and yellow fever be verified, that the fever germ will prove to be a protozoon, that is to say, an animal, and not a bacterion or vegetable organism. The experiments in question were made during last summer and winter by the U.S. Army surgeons in the hospitals at Cuba; and they tend to show with a reasonable degree of certainty that mosquitoes which have bitten patients suffering from yellow fever may, and do, convey the disease by biting healthy persons.

WE have received the annual report of the Indian Museum, Calcutta, for the year ending March 31, 1900, and are pleased to learn that considerable progress has recently been made in the development of that institution. Owing to the removal of the offices of the Geological Survey to another building, four additional galleries are available for exhibition, and the superintendent, Major Alcock, reports that three of these have been already opened to the public. They have respectively been filled with reptiles, fishes and insects, arranged with special regard to the requirements of the student of the Indian fauna. The transfer of these specimens has allowed a much-needed expansion of some of the other groups. A very large proportion of the work of the staff has, indeed, been devoted to the improvement and rearrangement of the exhibition series, which, as the superintendent remarks, is that portion of the museum whereby progress is gauged by the public, and where the influence of the museum is most exerted. It may interest museum officials in this country to learn that most of the fishes in the Indian Museum are now coloured in imitation of their natural tints and that a large proportion of the reptiles and amphibians are represented by coloured clay models. Almost the only thing that Major Alcock has to lament is the circumstance that the post of naturalist to the surveying ship was vacant during the greater part of the year, in consequence of which the museum's list of acquisitions fell much below the normal.

THE second part of a bibliography, guide and index to bacteriological literature, belonging to vol. i. (Bacteria) of "The Scientific Roll" has been received. The magazine, which is conducted by Mr. Alexander Ramsay, contains lists of papers published from 1876 to 1892 (both inclusive), arranged in each year alphabetically according to authors' names.

A NEW edition (the third) of Mr. W. W. Rouse Ball's inspiring "Short account of the History of Mathematics" has been published by Messrs. Macmillan and Co., Ltd. The work originally appeared in 1888 and was described in detail in these columns (vol. xxxix. p. 265). The present edition has been revised but not materially altered.

FOUR parts of the first volume of *Proceedings* of the University of Durham Philosophical Society, containing papers brought before the Society in the years 1896-1900, have been received. As a record of the Society's contributions to knowledge during the first four years of its existence, the *Proceedings* are very creditable. Many of the papers contain the results of

research, and others deal with various aspects of science descriptively. Such a society is a centre of beneficial influence, for it encourages investigation, affords facilities for the communication of facts and ideas, and promotes the friendly intercourse which broadens the views and sympathies of workers in different fields.

INCREASING interest in physical chemistry is shown by the fact that Prof. Walker's "Introduction to Physical Chemistry" (Macmillan), which was published towards the end of 1899, is already in its second edition. The book, which contains a full discussion of the chief principles of modern physical chemistry and shows their application to ordinary laboratory chemistry, has already been noticed in these columns (vol. lxii. p. 76, May 1900). Among other new matter in the new edition are accounts of "Berthelot's method for determining exact molecular weights from the limiting densities of gases, Traube's volume researches, and the position of the recently-discovered atmospheric gases in the periodic system."

IN the current number of the *Berichte*, Messrs. Pictet and Rotschy give an account of the isolation of three new alkaloids from tobacco. Up to the present only a single organic base, nicotine, has been found in tobacco. In most plants producing alkaloids several bases usually occur together, and as it appeared unlikely that the tobacco plant should prove exceptional in this respect, a large quantity of tobacco extract was worked up, with the result that three new bases were discovered, to which the names nicotein, nicotellin and nicotimin are given. Of these, the last is associated with the crude nicotine, with which it is isomeric, differing, however, in being a secondary base and forming a nitrosamine by means of which it can be separated from the nicotine, in spite of the fact that it is present in very small amount in the crude base. The nicotein contains two atoms and the nicotellin four atoms of hydrogen less than nicotine.

THE additions to the Zoological Society's Gardens during the past week include a Patas Monkey (*Cercopithecus patas*) from West Africa, presented by Mr. H. Plange; a Diana Monkey (*Cercopithecus diana*) from West Africa, presented by Mrs. Yorke; a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. W. K. Edwards; a Common Otter (*Lutra vulgaris*), British, presented by Mr. W. Radcliffe Saunders; a Maximilian's Aracari (*Pteroglossus wiedi*) from Brazil, presented by Mrs. J. Rose; a Common Viper (*Vipera berus*), British, presented by Mr. G. Leighton; two Spanish Cattle (*Bos taurus*) from Spain, a Black-faced Kangaroo (*Macropus melanops*) from Tasmania, a Yellow-footed Rock Kangaroo (*Petrogale xanthopus*) from South Australia, a Grevy's Zebra (*Equus grevyi*) from Southern Abyssinia, three Zebus (*Bos indicus*) from India, two Nubian Goats (*Capra hircus*) from Nubia, five four-horned Sheep (*Ovis aries*) from St. Kilda, two Somali Ostriches (*Struthio molybdophanes*) from Somaliland, deposited; a Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. F. Layer.

OUR ASTRONOMICAL COLUMN.

THE SPECTRUM OF NOVA PERSEI.—Prof. Vogel, in a recent communication (*Sitzber.* d. k. Akad. der Wiss. zu Berlin, March 21, xvi.), gives the results of a discussion of the Potsdam observations of Nova Persei. Prof. Vogel considers that the spectrum can only be explained on the hypothesis of Wilsing. The immense perturbations in the star give rise to great differences of pressure in the layers of the materials composing the Nova, and these differences account not only for the presence of the bright and dark lines, but their great breadth. Prof. Vogel does not think that there is any reason to assume that the apparent great displacement of the dark lines is the consequence of a large motion deduced on the principle of Doppler. This displacement he accounts for on the supposition of the overlapping of the broad dark band over the bright band, the great pressure of the substance giving the bright band being more strongly developed on the red side, thus allowing the dark band to appear more prominent on the violet side.

STONEHENGE AND OTHER STONE CIRCLES.

TWO interesting papers on stone circles, by Mr. A. L. Lewis, have recently been published by the Anthropological Institute. One dealing more particularly with the stone circles of Scotland occurs in the *Journal* of the Institute (vol. xxx. New Series, vol. iii. 1900), and the other, on the damage recently sustained by Stonehenge, appears in *Man*—the monthly record of anthropological science published under the direction of the Institute. We reprint the latter paper, with the two illustrations accompanying it, and are glad to acknowledge the courtesy of the Institute in permitting us to do so. And here it will not be out of place to remark that both the *Journal* and *Man* are full of papers and notes of interest to every one devoted to the study of the human race in its many aspects. When one considers how little encouragement is given to the science of anthropology in this country, it is really astonishing to see the large amount of excellent material published under the auspices of the Anthropological Institute. The U.S. Bureau of Ethnology have funds to publish magnificent volumes showing the results of ethnological investigations carried on by its officers, but here there is no similar department for the preparation and distribution of such contributions to science, and anything that is done represents the result of private efforts for the advancement of natural knowledge. Even if no assistance is given to systematic anthropological inquiries in our colonies and dependencies, every facility ought to be provided for the publication of facts obtained by observers interested in the characteristics and customs of the races of men.

Mr. Lewis describes, in the *Journal* already mentioned, the observations made by him of stone circles in various parts of Scotland. The condition of some of these monuments of antiquity is deplorable, many of the stones having been shifted and used for all kinds of purposes. At Clava, for instance, we notice that one stone has been shifted to be parallel with a road running across the circle, and another has been placed to form the end of a stone wall. From an examination of a large number of stone circles in Scotland, Mr. Lewis concludes that they may be divided into different types each of which has its centre in a different locality. The types are (1) the Western Scottish type, consisting of a rather irregular single ring or sometimes of two concentric rings. (2) The Inverness type, consisting of a more regular ring of better-shaped stones, surrounding a tumulus with a retaining wall, containing a built-up chamber and passage leading to it, or a kist without a passage. (3) The Aberdeen type, consisting of a similar ring with the addition of a so-called "altar-stone" and usually having traces of a tumulus and kist in the middle. There is reason to believe that most of the circles of these three types were used for burial, if, indeed, that were not their chief purpose, but as there is evidence that all have not been so used, it cannot have been their only purpose. In addition to these three types of circles, there are what Mr. Lewis calls sun and star circles, with their alignments of stones, and apparently proportioned measurements. The stone circles of England appear to refer to the sun and stars more frequently than those of Scotland, where, however, more similar circles may yet be found. The Stonehenge group of stones seems almost to form a class by itself, and Mr. Lewis's description of it, reprinted below from *Man*, describes the present condition of this unique monument.

"The end of the nineteenth century has been signalised by—amongst other things—the fall of a part of Stonehenge, a misfortune which may not be without its compensating advantage if it should be the cause of the necessary measures being taken to preserve what is left of this unique monument in an intelligible condition.

"Stonehenge, it will be remembered, consists of a number of comparatively small stones standing in the form of a horse-shoe with the open end to the north-east, outside which were five "trilithons," or sets of two upright stones, each supporting a huge cross-piece; these were the largest stones of all, and only two sets of them remain complete, the last great change at

Stonehenge having been the fall of one of them in January 1797. Outside these was a circle of small stones, and outside these again a circle of larger upright stones, joined at the top by cross stones; both these circles are so defective, especially towards the south-west, that it has been doubted whether they ever were complete. It is one of the uprights of this outer circle (marked

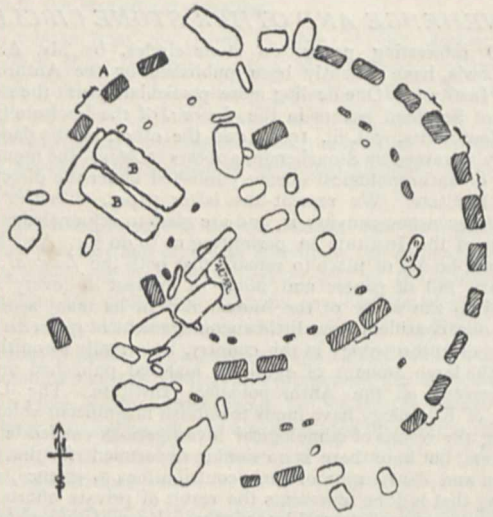

FIG. 1.—Plan of Stonehenge. A, Stone now fallen. BB, Stones which fell in 1797.
(*Reproduced from "Man."*)

A on the plan—No. 22 on Petrie's plan) that has now fallen inward, carrying with it the capstone which connected it with the adjoining stone, and which has been broken in two by striking in its fall the remains of the trilithon which fell in 1797.

"It is, perhaps, fortunate that these stones have fallen instead of the remaining stone of the central trilithon, the downfall of which has long been expected on account of its leaning position, an occurrence which, if not prevented, will cause much more damage than has been caused for centuries, and the practical question for archæologists is what is to be done to prevent it? Of course, no one advocates "restoration" in the sense of adding new stones to supply the places of those which have disappeared; but, inasmuch as the exact original position of almost every existing stone is perfectly obvious, and inasmuch as exact surveys have been made and published both by Sir Henry James on behalf of the Ordnance Survey,[1] and by Prof. Flinders Petrie,[2] there should be no objection to setting the leaning stones upright, so as to prevent them falling and breaking themselves and others, and to setting up those that are quite fallen, except those that are too much broken to be capable of being joined together. Such fragments should be left where they are, as also should any the precise original position of which cannot be ascertained. Next comes the question of keeping the stones in their position when they have been restored to it; and the best way to do this would be to dig out the whole interior down to the solid chalk, underpinning the stones while the work was going on, and to fill it up with concrete. In the digging out it might be expected that some relics would be found which might throw light on the date if not on the purpose of the monument; but the objection will no doubt be made that future generations might think that the concrete was part of the original work. This would be less likely to happen if the concrete were covered for its better preservation with half an inch of the best asphalte, such as is used in paving the London streets, under which boxes with documents might be buried for the benefit of any future excavators.

"If it were possible to keep things as they are, it might be preferable from an artistic point of view to do so, but it is not possible. If something be not done to prevent them further falls will happen, and where will be the poetry in a shapeless heap of broken stones?

"It must, however, be remembered that Stonehenge, though an object of national concern, is private property."

A plan of Stonehenge is given in the *Times* of Tuesday, April 9, with a description of the condition of the monument and the natural and other causes which threaten to do mischief to it. To protect the monument, Sir Edmund Antrobus is prepared to erect around it, at his own cost, a wire fence 1500 yards in total length.

This course is recommended by the Society of Antiquaries, the Wiltshire Archæological Society, and the Society for the Protection of Ancient Monuments, and the suggestion has the approval of the county council, the district council, and the parish council of Amesbury. The societies further recommend

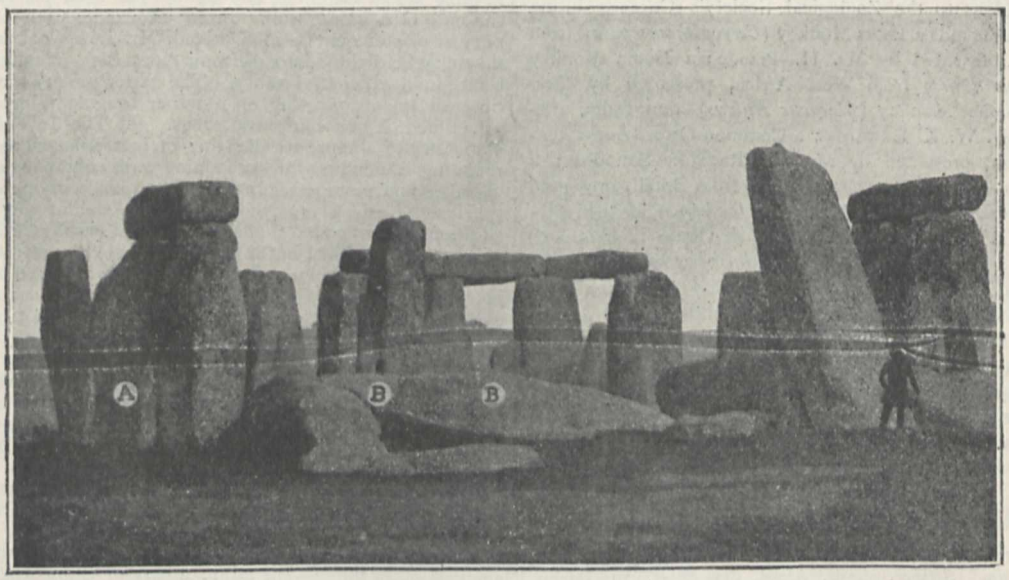

FIG. 2.—View of Stonehenge from the west. A, Stone now fallen. BB Stones which fell in 1797.
(*Reproduced from "Man."*)

1 "Plans and Photographs of Stonehenge and of Turnsuchan in the Island of Lewis." 4to. Ordnance Survey: Southampton, 1867.

2 "Stonehenge: Plans, Descriptions and Theories." 4to. London: Stanford, 1880.

the diversion of a grass driving road which now cuts across the earthwork, without prejudice to any legal question.

To prevent other stones from falling it is suggested by the societies mentioned that the trilithon which has slewed round and also a leaning-stone be first examined with a view to maintaining them in safety. It is understood that no excavation beyond what is absolutely necessary will be allowed. This examination will show what can be done and ought to be done with all the standing Sarsens. It is advised that the monolith and lintel, which fell three months ago, be replaced, the companion Sarsen being made safe against the effects of the fall. Further, the societies recommend the erection of the great trilithon which fell in 1797, the exact place of which is known. All the rest they would leave as it is, though in some cases the place of fallen stones is known with fair certainty. The questions of how best to fix more firmly in the ground the stones now standing, and how best to re-erect the two trilithons which have fallen in the last 104 years, is left to engineering experts.

A STUDENT'S DRUM RECORDER.[1]

THIS admirable instrument consists of five parts easily detachable, viz. (i.) an adjustable tripod, which carries on one foot (ii.) a steel bracket for the attachment of the appurtenances incident to an observation; and (iii.) a central adjustable rod so fashioned as to receive (iv.) the drum, the heads of which are widely perforated for purposes of manipulation; and (v.) a clockwork driver, which is keyed at two points for insertion into the head of the rod. The special novelty of the instrument lies in the driver, which is so constructed that when at work it and the drum are together rotated. The driver is, moreover, set in a metal framework supported upon three feet, upon which it rests when not in use, adequately protected. Its working parts are all exposed, and there are no accessories. The arbor of the spring-wheel above, and of the main driving-wheel below, are each so keyed as to fit into the head of the rod or axle, the former being intended for slow motion, the latter for quick. For one winding the drum will run at its most rapid rate for 12–13 minutes, at its slowest for 16–17, allowance being made for adjustment of the wings of the "fly," which as a whole can be itself easily removed to ensure the maximum obtainable speed. The instrument is a triumph of ingenuity and good workmanship, and we have nought but praise to accord it. To produce at little more than one-fourth the price of the conventional drum-recorder a substitute in efficiency its equal, is to deserve well of the scientific public. This drum supplies a want long felt by teachers, and is bound to become popular. We heartily wish it the success it deserves.

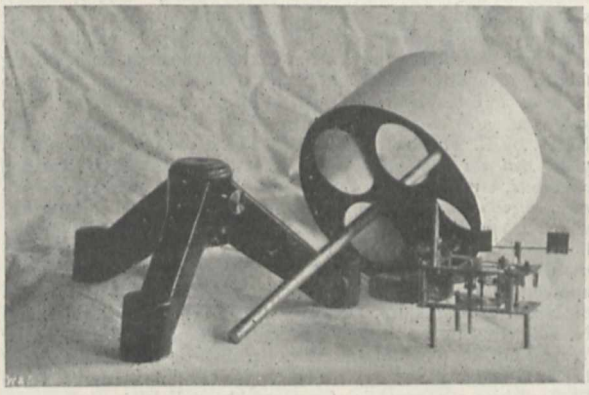

FIG. 1.—A Drum Recorder dismounted to show its parts.

[1] By W. E. Pye and Co., "Granta Works," Mill Lane, Cambridge. Price 70s.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. HERBERT F. ROBERTS, instructor in botany in Washington University, at St. Louis, Missouri, U.S.A., has been elected to the chair of botany in the Kansas State Agricultural College.

FOR the last two or three decades the engineering profession of Austria and Hungary spared no efforts to raise the technical institutions throughout those countries to the standard of the universities and to obtain for the former some of the more important academic privileges and powers which the latter have enjoyed since their establishment. The first aim of the leading members of the said profession was that the technical institutions should be authorised by the Government to grant degrees which, from an academic point of view, should be regarded as equal to those granted by the universities. We now notice, therefore, with satisfaction that their endeavours have been finally crowned with the desired success, and that the Minister of Public Instruction in Austria held, on April the 4th, a meeting which was attended by representatives of almost every technical institution in that country, and on this occasion announced the Government's intention of introducing a special statute by means of which the technical high schools should be empowered to confer the degree of Doctor of "Rerum Technicarum" upon students whose scientific attainments entitle them to that distinction. A special examining body will be appointed for that purpose, and some of the examiners, it is urged, should be at the same time members of the teaching staff in connection with some of the universities; the examinations, again, will be conducted on the same lines as those prescribed by the philosophical faculty of a university for the bestowal of the degree of Ph.D. The acquirement of that degree, however, will not—at least for the present—be made compulsory for all students of the technical academies; those, on the other hand, who attain it will, of course, be given special precedence in the case of Government appointments, which are usually accessible to all graduates of the recognised technical institutions by open competition.

SCIENTIFIC SERIAL.

Bulletin of the American Mathematical Society, March.—Prof. T. F. Holgate reports the December meeting of the Chicago section of the Society (December 27 and 28, 1900), and gives abstracts of several of the twenty-two papers which were read. In addition there is printed a paper by Prof. Hathaway on pure mathematics for engineering students, which was followed by an interesting discussion. The subject was treated under the heads (1) its utility; (2) methods of instruction; (3) the course; and (4) the instructor.—A paper read by Prof. Newson, at the February meeting, on indirect circular transformations and mixed groups, is supplementary to a paper entitled "Continuous Groups of Circular Transformations" (which appeared in the *Bulletin* for December, 1897), and deals with indirect circular transformations and the mixed groups obtained by combining these with the direct transformations. Prof. E. W. Brown reviews, at some length, the scientific papers of J. Couch Adams and the lectures on the Lunar theory, (vol. ii. Parts 1 and 2), edited by Profs. R. A. Sampson and W. G. Adams. Then follows, in English, the notice on M. Hermite, by M. C. Jordan, an address delivered at the meeting of the Paris Academy of Sciences, January 21, 1901.—The notes, as usual, cover a wide ground, and there is the usual portion appropriated to new publications.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 14.—"On the Ionisation of Atmospheric Air." By C. T. R. Wilson, F.R.S., Fellow of Sidney Sussex College, Cambridge.

In a preliminary note (*Camb. Phil. Soc. Proc.*, November 26, 1900) it was stated that a body, charged with electricity and suspended within a vessel containing dust-free air, loses its charge by leakage through the air. The same conclusion was arrived at by Geitel in a paper published a few days previously (*Physikalische Zeitschrift*, 2 Jahrgang, No. 8, pp. 116–119). The leakage

was in each case attributed to the continuous production of ions throughout the volume of the air. In the present paper a description is given of the apparatus used in Mr. Wilson's experiments, and of further results obtained with it. The air, in most of the experiments, was contained in a glass bulb, coated internally with a layer of silver sufficiently thin to enable the position of a gold leaf within the vessel to be read by means of a microscope. The gold leaf was attached to a narrow brass strip, fixed by means of a sulphur bead to a brass rod passing through the neck of the bulb. The brass strip and gold leaf formed the whole of the system of which the fall of potential was observed; the capacity was thus very small. To avoid all danger of being misled by leakage through the insulating support, the rod, to which the leaking system was attached by the sulphur bead, was kept at constant potential by means of a condenser of zinc plates embedded in sulphur. By a momentary contact, brought about with the aid of a magnet, the initial potential of the leaking system was made equal to that of the supporting rod. The rate of leakage in air at atmospheric pressure corresponds to the production of about twenty ions of either sign in each c.c. per second; the ionisation is approximately proportional to the pressure. Experiments made with a portable apparatus showed that the ionisation in a closed vessel is the same when the experiment is performed in an underground tunnel as above ground. It appears, therefore, not to be due to the action of ionising radiation which has traversed our atmosphere.

"The Chemistry of Nerve-degeneration." By Dr. F. W. Mott, F.R.S., and Dr. W. D. Halliburton, F.R.S.

Linnean Society, March 21.—Mr. F. D. Godman, F.R.S., vice-president, in the chair.—Mr. J. E. Harting exhibited and made remarks on some photographs of female roedeer (*Capreolus caprea*) bearing antlers, one of which had been shot at Neudau, in East Styria, in December last.—Mr. H. J. Elwes, F.R.S., considered the case so remarkable and unusual as to suggest the probability of some mistake having been made in determining the sex. Mr. Harting, in reply, stated that this was by no means unique. In Germany, where roedeer are much more plentiful than in this country, several does with antlers had been recorded. Dr. Altum, in his *Forstzoologie* (Bd. i. p. 211), states that many such cases were known to him. One instance noted in the Black Forest at Kippenheim is mentioned in *The Zoologist*, 1866, p. 435. In that case the horns were "in the velvet," but perfectly hard; one was about 6 in. long with a single short tine, the other about 3 in. without any tine. A female roe with budding horns was shot in October 1875 by Mr. Duncan Davidson, of Inchmarlo, Banchory, Aberdeenshire. The skull of another in the museum of the Royal College of Surgeons, forwarded from Petworth Park, Sussex, by Lord Egremont, is figured in the *Proceedings of the Zoological Society*, 1879, p. 297. Mr. Harting also pointed out that such cases were not confined to the genus Capreolus, but had been noted rarely in *Cervus elaphus*, and once in the case of the American white-tailed deer *Cariacus virginianus* (shot in East Kootenay, British Columbia), a photograph of which he exhibited.—Mr. P. Chalmers Mitchell read a paper entitled "The Anatomy and Morphology of the Intestinal Tract in Birds; with Remarks on the Nomenclature and Valuation of Zoological Characters." He described the various conformations of the intestinal tract in birds, his material consisting of many hundreds of specimens belonging to all the living Ratitæ as well as all the orders and suborders and nearly all the families of Carinatæ. He discussed the morphology of the tract, distinguishing, in their adult anatomy and in their relation to the embryonic metamerism, the duodenum, Meckel's tract, and the rectum. He described the nature and distribution of the changes in these organs and in Meckel's diverticulum, and the colic cæca, and gave an account of a remarkable and hitherto undescribed series of nervous structures belonging to the autonomic nervous system apparently peculiar to birds. In discussing the relation of the series of facts described to the systems of avian classification, he insisted on the primary necessity of valuing characters as archicentric or apocentric, primitive or specialised. A common possession of a character in either the archicentric or apocentric condition was no indication of systematic affinity. Amongst apocentric characters he distinguished between *multi-radial apocentricities* (many of which were plastic effects and afforded no guide to affinity) and *uniradial apocentricities* which had arisen by a limitation and definition of variability in a particular branch of the family tree.

Geological Society, March 20.—J. J. H. Teall, V.P.R.S., president, in the chair. Prof. Friedrich Johann Becke, of Vienna, was proposed as a foreign correspondent of the Society.—Mr. H. B. Woodward called attention to a polished slab of landscape marble, or cotham stone, from the Rhætic Beds near Bristol, which had been lent for exhibition by Mr. Frederick James, curator of Maidstone Museum. The specimen showed that after the arborescent markings had been produced in the soft mud, some irregular and partial solidification took place in the upper layers of the deposit; and then during contraction a kind of subsidence occurred of the upper and harder portions into the lower and softer materials. This subsidence was accompanied by a breaking-up of the harder portions, suggesting a comparison (in miniature) with "broken beds" and even crush-conglomerates. The specimen was of considerable interest, as illustrating the mechanical changes produced during solidification. The following communications were read:—On a remarkable volcanic vent of Tertiary age in the Island of Arran, enclosing Mesozoic fossiliferous rocks (communicated by permission of the Director-General of H.M. Geological Survey). Part i. On the geological structure, by Benjamin Neeve Peach and William Gunn. The rocks which form the subject of this paper cover an area of about seven or eight square miles, and culminate in Ard Bheinn A'Chruach and Beinn Bhreac. They are in contact with formations ranging from the Lower Old Red Sandstone to the Trias, and are later in date even than the important faults of the area. They are made up partly of fragmental volcanic materials, and partly of various intrusive masses, confined within an almost unbroken ring of intrusive rocks. In addition to igneous fragments the clastic volcanic rocks contain fragments derived from the surrounding formations; and also masses of shale, marl, limestone and sandstone belonging to formations not now found *in situ* in the island. One of these is several acres in extent, contains fossils, and is in part of Rhætic age; a second is a fragment of Lias; and a third is of limestone and chert resembling the Antrim Cretaceous rocks, and yielding fossils. The absence of Oolitic and older Cretaceous seems to indicate a resemblance between a former succession in Arran and that now seen in Antrim.—Part ii. "Palæontological Notes, by E. T. Newton, F.R.S. The masses of Rhætic strata yield *Avicula contorto*, *Pecten valoniensis*, *Schizodus* (*Axinus*) *cloacinus*, etc.; those of Lower Lias *Gryphæa arcuata*, *Ammonites angulatus*, and new species of *Nuculana* and *Tancredia*, which are figured and described. Thin slices of the Cretaceous limestones prove to be very like those of the Antrim chalk, and the rocks yield determinable foraminifera, *Inocerami*, sponges, and echinoderms.—On the character of the Upper Coal Measures of North Staffordshire, Denbighshire, South Staffordshire and Nottinghamshire; and their relation to the productive series, by Walcot Gibson (communicated by permission of the Director of H.M. Geological Survey). The Upper Coal Measures of North Staffordshire are capable of a fourfold subdivision, the groups representing a definite sequence of red and grey strata.

MANCHESTER.

Literary and Philosophical Society, March 19.—Charles Bailey, vice-president, in the chair.—Mr. E. F. Morris exhibited two drawings of recent excavations in the Roman Forum. The one represented a rostrum, stated to be that from which Antony delivered his famous speech. It is built of tufa and concrete, and consists of five little vaulted rooms, as seen in the well-known medal of Palikanus. The other was a sketch of a little ædicula in brick work, the front decorated with two marble columns supporting an architrave on which is carved the name of the deity (Juturna) to which it was consecrated. In front of it is a circular well with an elegant marble head, ornamented with a carved cornice bearing an inscription stating that the well was consecrated to Juturna by Marcus Barbatius Pollio. Before the well is a marble altar with a sculptured front, on which are the figures of Mars and of a female deity—Juno or Venus. Signor Boni has also brought to light the celebrated fountain of Juturna, which is enclosed by a spacious rectangular construction in tufa-work of the Republican epoch. The water now gushes out fresh and clear, in abundance. The sculptures in the room enclosing the spring were also described.—Mr. Thomas Thorp showed photographs of the spectrum of the new star in Perseus, showing the bright lines very clearly. Mr. Thorp also described a variation in the ordinary arrangement of a star spectroscope, in which the eye-piece of the telescope used is replaced by a

doublet, one of the elements of which is a long focus lens which can be tilted and by that means made to yield a band of light in place of the line, an effect ordinarily secured by means of a cylindrical lens, as in Maclean's method.—The macro-lepidoptera of Sherwood Forest, by J. R. Hardy. The paper contained a list of 269 species collected in the course of the past twenty-two years, mostly in the district between Worksop, Edwinstowe and Chekerhouse. All the species, some of which are peculiar to the district, have been deposited in the Manchester Museum.

PARIS.

Academy of Sciences, April 1.—M. Fouqué in the chair.—A general proposition in the calculus of probabilities, by M. A. Liapounoff.—On the deformation of the general paraboloid, by M. Servant.—On the sum of the angles of a polygon with multiple connection, by M. M. d'Ocagne.—Studies in psycho-acoustics, by M. F. Larroque.—On the electro-capillary properties of some organic compounds in aqueous solution, by M. Gouy. If H is the maximum height of the column of the capillary electrometer with a given solution of a standard electrolyte, and H′ the maximum height after the addition of an organic substance, then 1000 (H − H′)/H is a constant which varies with a constitution of the body and which varies with dilution in a characteristic manner. Preliminary measurements are given for a number of organic substances.—On some osmyl-oxalates, by M. L. Wintrebert. The osmyloxalates form a well characterised series of salts, details being given of the mode of preparation and properties of the salts of sodium, ammonium, silver, barium, strontium and calcium.—On the reducing properties of magnesium and aluminium, by M. A. Dubois.—On cinchonine, by MM. E. Jungfleisch and E. Léger. Ordinary commercial cinchonine always contains a variable quantity of hydrocinchonine, the separation of the latter being a somewhat tedious process. The physical constants of the purified cinchonine salts were determined and found to differ considerably from the accepted figures.—On some iodo-derivatives of phenol, by M. P. Brenans.—The action of the esters of dibasic acids upon the organometallic compounds, by M. Amand Valeur. The reaction of magnesium methyl iodide with the esters of oxalic, malonic and succinic acids was found to correspond with the action of the same reagent upon the esters of monobasic acids, except that with ethyl malonate an additional molecule of water is split off with the formation of an unsaturated alcohol.—On the organometallic compounds of magnesium, by MM. Tissier and Grignard. The principal product of the action of magnesium upon an alkyl iodide or bromide in ethereal solution is a compound of the type $C_nH_{2n+1} - Mg - I$, and this, on treatment with water, gives the hydrocarbon C_nH_{2n+2}. In the higher members of the series a secondary reaction takes place in which the hydrocarbon $C_nH_{2n+1} - C_nH_{2n+1}$ is formed. Thus secondary hexyl iodide gives hexane and dihexane.—Some new reactions of the organomagnesium compounds, by M. Ch. Moureu. Magnesium ethyl iodide reacts easily with amyl nitrite, giving diethyl-hydroxylamine. Nitroethane gives the same product, the reaction appearing to be a general one.—On the organomagnesium derivatives, by M. E. E. Blaise.—On a new synthesis of aniline, by M. George F. Jaubert. Benzene and hydroxylamine hydrochloride, heated with aluminium chloride, give traces of aniline.—On the mechanism of lipolytic reactions, by M. M. Hanriot.—On the internal organisation of *Pleurotomaria Beyrichii*, by MM. E. L. Bouvier and H. Fischer. Studies of the digestive tube and nervous system of this animal.—The sexual variation in the males of certain Coleoptera belonging to the family of the Bostrychides, by M. P. Lesne.—On the mode of production of eggs in *Trochus*, by M. A. Robert. The eggs of *Trochus conuloides* are produced in a long cylindrical string exactly resembling those of *Tr. granulatus*.—On the comparative value of saline and sugar solutions in experimental teratogenesis, by M. E. Bataillon.—On the origin of the paranuclei in the cells of the digestive gland of the crayfish, by M. P. Vigier.—Influence of the climatological conditions upon the growth of the shoots of the vine, by M. F. Kövessi.—The comparative study of the zoospore and the spermatozoid, by M. A. Dangeard.—New cytological researches on the Hymenomycetes, by M. René Maire.—On a conidian form of the fungus of black rot, by M. G. Delacroix.—The position and approximate velocity of a meteor, by M. Jean Mascart. A meteor which was seen in the neighbourhood of Angoulême on September 24, 1900, had a velocity of over 4 kilometres per second, and was entirely consumed at a height of about 40 kilometres.

NEW SOUTH WALES.

Royal Society, December 5, 1900.—Prof. Liversidge, F.R.S., president, in the chair.—Sir William Crookes, F.R.S., and Sir W. T. Thiselton-Dyer, K.C.M.G., F.R.S., were elected honorary members of the Society.—The following papers were read:—Intercolonial water rights as affected by federation, by H. G. McKinney.—The organisation, language, and initiation ceremonies of the aborigines of the south-east coast of New South Wales, by R. H. Mathews, and Miss M. M. Everitt.—This article described the laws of marriage, descent and relationship in force among the native tribes occupying the south-east coast of New South Wales from the Hawkesbury River to Cape Howe, on the Victorian frontier, and extending inland till met on the west by the Wiradjuri organisation. A grammar of the language of the Gundungurra, one of the principal tribes in the region dealt with, was also supplied, in which the structure of the native tongue was fully investigated and explained. The paper concluded with a short account of the Kudsha, or Narramang, a ceremony of initiation practised within the same geographical limits, by means of which the young men are admitted to the status and responsibilities of tribesmen.—Tables to facilitate the location of the cubic parabola, by C. J. Merfield. In some brief remarks the author gives an outline of the general application of the cubic parabola, when used as a transition to connect the straights and circular curves of railway lines. The paper forms a contribution to the engineering profession, and will be found useful to those engaged in the location of railway lines. A valuable table is appended, from which the constants of the curve for any case may be found. A complete numerical example illustrates the method of using the table.—Boogaldi meteorite, by Prof. Liversidge, F.R.S. This meteorite was exhibited by Mr. R. T. Baker at the June meeting of the Society, when he stated that it was found early in January 1900 at a place two miles from Boogaldi, a post town fifteen miles north-west of Coonanbarabran. Mr. Baker afterwards forwarded it to Prof. Liversidge for investigation and analysis. The meteorite is a metallic one or a siderite, and is somewhat pear-shaped; it is a little over five inches long by about three inches broad at the widest part, and it weighed before cutting 2057·5 grammes. Its sp. gr. at 14° C. was found to be 7·85. It was covered, as usual, with a closely adherent skin of fused oxides, except in one place where it had been detached, the exposed metal had a bright lustrous appearance like nickel iron. At the thick end of the meteorite the fused oxides forming the skin have been thrown into well-defined concentric waves or rings with transverse furrows in the direction of the thinner end of the meteorite—the waves and furrows gradually fade away in this direction. These waves and furrows are believed to show that the meteorite travelled through the earth's atmosphere with the thick end in front, the waves of fused oxide being thrown up by the resistance of the air, just as waves are formed in sand by the wind. That the meteorite did travel with the thick end first is confirmed by the fact that at the thin end there are longitudinal ridges and furrows in the fused skin which clearly show where the excess of fused oxide was dragged off; the luminous streak usually seen behind a meteorite is, if not wholly, certainly in part, due to the fused incandescence left in its trail. Hence the waves and other markings in the skin not only show the direction in which the meteorite travelled but also its position, *i.e.* with the curved point of the thin end downwards as represented in the photograph; for the fused oxides forming the skin are thickest on the lower side.—On a new aromatic aldehyde occurring in eucalyptus oils, by Henry G. Smith. In this paper the author records the results of his investigation (so far as he has gone) on the aldehyde occurring in so many eucalyptus oils, which had for a long time been supposed to be cuminaldehyde. The aldehyde occurs in greatest amount in the oils obtained from members of the group of Eucalypts known in Australia as the "Boxes." The true boxes, *E. hemiphloia*, *E. albens* and *E. Woollsiana*, contain it in the largest quantity. The oil was obtained from *E. hemiphloia*, this tree growing plentifully at Belmore, in the neighbourhood of Sydney. 1000 c.c. of the crude oil were distilled, and the constituents distilling below 190° C. removed, the remainder of the oil was agitated with acid sodium sulphite

with which it readily formed a solid compound, the pure aldehyde was easily obtained from this by the usual methods. The specific gravity of the aldehyde at 15° C. was ·9477. The specific rotation was $[\alpha]_D - 49{\cdot}17°$, this somewhat high lævorotation causes those oils containing it to be lævorotatory, although mostly devoid of phellandrene. It is this aldehyde that causes the oil of *E. cnerifolia* of South Australia to be lævorotatory. The pure aldehyde has an aromatic odour and is slightly yellowish in tint. It was soluble in the usual solvents. The author proposes the name aromadendral for this aldehyde, and aromadendric acid for the corresponding acid.

ST. LOUIS.

Academy of Science, March 18.—Prof. E. H. Keiser delivered an address showing the progress made in the science of chemistry during the nineteenth century.—Prof. F. E. Nipher exhibited pieces of pine board a foot square, showing the tracks of ball lightning discharges upon them like those formerly described by him in No. 6, vol. x. of the *Transactions* of the Academy. The discharges formerly described had been formed on a photographic film. The balls were very small, and wandered over the plate, leaving a track of metallic silver in their wake. In the present instance the balls were much larger, and they burned a deep channel in the wood. They are formed at the secondary spark gap of a coil. The terminals are pointed and are under control, so that the gap may be changed in length. To start the balls, the pointed terminals are put upon the wood surface, so near that the spark carbonises somewhat, after which the gap is made longer. These balls travel in either direction, when a direct current is used with a Wehnelt interrupter. This differs from the results reached on the photographic film with the Holtz machine. There the balls came from the kathode. Even when they originated at isolated points on the film, they travelled away from the kathode. In the present results, the balls have been caused to originate at isolated points, and two balls have started in opposite directions. Wood which gives little flame shows the phenomenon to best advantage, but the balls preserve their identity and travel slowly along even when completely surrounded by flames of the burning wood.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part 4 for 1900, contains the following memoirs communicated to the Society:—

December 22, 1900.—W. Voigt: On the parameters of crystallo-physics, and on directed magnitudes of higher orders (tensors, rotors, torsors, &c.). J. Wellstein: Prime forms on Riemann surfaces.

February 9.—E. Ehlers: On Atlantic palolo-worms.

DIARY OF SOCIETIES.

THURSDAY, APRIL 11.

MATHEMATICAL SOCIETY, at 5.30.—Summation of the Series $\Sigma_0^{\infty} \frac{\Gamma^3(a+n)}{\Gamma^3(1+n)}$: Dr. F. Morley.—On the Projective properties of Cubic and Quartics: A. B. Basset, F.R.S.

FRIDAY, APRIL 12.

MALACOLOGICAL SOCIETY, at 8.—On the Dates of Publication of Kiener's "Species générales des Coquilles vivants," 1834-80½: C. Davies Sherborn and B. B. Woodward.—New Species of Land-Shells from Central and South America: S. I. DaCosta.—Note on the Genus *Temesa*, with Descriptions of Two New Land-Shells from South America: E. R. Sykes.

GEOLOGISTS' ASSOCIATION, at 8.—The Zonal Value of Red Strata in the Carboniferous Rocks of the Midlands: Walcot Gibson.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Note on some Engraved Charts of Pogson's Proposed Atlas of Variable Stars: Rev. J. G. Hagen.—Meteoric Showers from the Region α-β Persei and η Aurigæ: W. F. Denning.—Anomalous Occultations of Stars by the Moon: R. T. A. Innes.—A Method of Mechanically Compensating the Rotation of the Field of a Siderostat: H. C. Plummer.—Variations of R Horologii during 1900: A. W. Roberts.—Note on Meridian Observations of Nova Persei: A. Graham.—Further Observations of the New Star in Perseus: A. Stanley Williams.—(1) The Spectrum of Nova Persei; (2) The Spectrum of Nova Persei, Nova Persei as a Variable Star with a Variable Spectrum: Rev. W. Sidgreaves.—*Probable Paper*: The Magnitude of Nova Persei as deduced from Photographs taken with the Astrographic Equatorial, Royal Observatory, Greenwich.

MONDAY, APRIL 15.

VICTORIA INSTITUTE, at 4.30.—The Ice Age: Warren Upham.

TUESDAY, APRIL 16.

ROYAL INSTITUTION, at 3.—Cellular Physiology: Dr. A. Macfadyen.

ZOOLOGICAL SOCIETY, at 8.30.—Revision of the Insects of the Order Rhynchota belonging to the Family *Coreidae* in the Hope Collection at Oxford: W. L. Distant.—On some Earthworms from Tropical Africa, and on the Spermatophores of *Polytoreutes* and *Stuehlmannia*: F. E. Beddard, F.R.S.—On the Identity and Distribution of the Mother-of-Pearl Oysters: a Revision of the Subgenus *Margaritifera*: Dr. H. Lyster Jameson.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Modern Practice in the Manufacture and Distribution of Gas: Harry E. Jones.

WEDNESDAY, APRIL 17.

SOCIETY OF ARTS, at 8.—The Synthesis of Indigo: Prof. Raphael Meldola, F.R.S.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Special Characteristics of the Weather of March, 1901: W. Marriott.—Vapour Tension in Relation to Wind: R. Strachan.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Demonstration on the Metamorphoses of *Æschna cyanea*, illustrated by Photographs from Life: Fred Enock.

SANITARY INSTITUTE, at 8.—Sewage Purification and Standards of Purity: Dr. H. R. Kenwood and Dr. W. Butler.

THURSDAY, APRIL 18.

ROYAL INSTITUTION, at 3.—Naturalism in Italian Painting: Roger Fry.

SOCIETY OF ARTS (Indian Section), at 4.30.—Madras, the Southern Satrapy: J. D. Rees.

RÖNTGEN SOCIETY, at 8.—Meeting for Discussion. Subject: X-Ray Therapeutics: To be opened by Miss M. M. Sharpe.

CHEMICAL SOCIETY, at 8.—Researches on Moorland Waters. Part II. On the Origin of the Combined Chlorine: W. Ackroyd.—Robinin, Viola-quercitrin, and Osyritrin: A. G. Perkin.—Preparation of Orthodimethoxybenzoin, and a New Method of preparing Salicylaldehydemethylether: J. C. Irvine.—(1) Action of Alkyl Haloids on Aldoximes and Ketoximes, Part II. (2) The Supposed Existence of Two Isomeric Triethyloxamines: Wyndham R. Dunstan and E. Goulding.—(1) Nitrocamphene, Aminocamphene, and Hydroxycamphene; (2) Action of Hydroxylamine on the Anhydrides of Bromonitrocamphane: M. O. Forster.—The Influence of Cane Sugar on the Conductivities of Potassium Chloride and Potassium Hydroxide, with Evidence of Salt Formation in the Latter Case: C. J. Martin and O. Masson.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Replies of Mr. H. Ravenshaw and Mr. S. F. Walker to the Discussion on their Papers read at the last Meeting.—Test-Room Methods of Alternate Current Measurements: A. Campbell.—Note on the Use of the Differential Galvanometer: C. W. S. Crawley.

FRIDAY, APRIL 19.

ROYAL INSTITUTION, at 9.—The Existence of Bodies Smaller than Atoms: Prof. J. J. Thomson, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Theory of Cast-Iron Beams: E. V. Clark.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Address by the President, W. H. Maw.

SATURDAY, APRIL 20.

ROYAL INSTITUTION, at 3.—Climate: its Causes and Effects: J. Y. Buchanan, F.R.S.

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