THURSDAY, MARCH 19, 1903.

A DUTCH PRIME MINISTER ON ECONOMICS.

Principles of Economics. By Dr. N. G. Pierson. Translated from the Dutch by A. A. Wotzel. Vol. i. Pp. xxx + 604. (London: Macmillan and Co., Ltd., 1902.) Price 10*s.* net.

DR. PIERSON'S book in the original Dutch has become widely known in this country, in spite of the obstacle of language. So much was due to the author on account of his peculiar position as a banker and man of business, as well as a statesman, entitling him to a special hearing as an economist. But the intrinsic qualities of the book have also been such as to attract an appreciative audience. It is an account very largely at first hand of the writer's own experiences in applying economic principles to the daily practice of banking business, and later on to the problems of economics which came before him as Prime Minister of his State. We are glad, therefore, to see the present translation into English, which is extremely well done, and will contribute greatly to extend Dr. Pierson's reputation in this country, well known as he already is.

Dr. Pierson informs us in his introduction that "economics may be described as the science which teaches us what rules mankind should observe in order to advance in material prosperity"; and this appears to be an excellent definition if the qualification be added to the word "rules," that they are to be general rules applicable to every description of industry and business, and not the special rules of each industry by itself. There are many rules, for instance, to be studied and applied by the farmer or banker, each in his own profession, in order to advance in material prosperity, which are no part of the more general economic rules that equally require study. The qualification should also be added, perhaps, that the rules referred to are largely rules to be followed by public men in directing the action of the State where it comes in contact with business—in regulating taxation, monopolies, currency, and any other matters that seem properly reserved for the action of the community as a whole in the conduct of common business. Nothing much, however, turns upon definitions of this kind. In economic books the important thing always is to be in contact with reality, and in this respect Dr. Pierson's book is not lacking. Leading business men and politicians are practically taught how to advance in material prosperity by observing the nature and conditions of exchanges. It is, in fact, thoroughly scientific.

Dr. Pierson's conclusion that the science is mainly deductive may also be accepted. There is often confusion in discussions as to the limits and functions of political economy between the phrases deductive and theoretical. Because it is so much deductive, political economy is often said, with reproach, to be a theoretical study only, and its professors are nicknamed theorists. But the deductions, nevertheless, may be from facts of a general kind, and are thus as legitimate as the propositions of the multiplication table. Dr. Pierson, accordingly, is fully justified in his remark. It should be understood, moreover, that as to large provinces of the study, especially the province of the money market, Dr. Pierson is mainly a describer, and not a theorist, or if, as sometimes happens, he appears to theorise and is not so much a describer, he theorises as Ricardo did—that is, by giving as a theory a description of what business men invariably do under the conditions stated.

We would especially refer students to the closing chapter of the book on foreign exchanges as of singular excellence, containing, perhaps, the fullest exposition ever given of the various puzzles as to balance of trade, balance of payments, and balance of indebtedness, as well as those respecting high and low rates of discount, on which so many people make shipwreck. There has been no more complete exposition of the subject, and what Dr. Pierson has to say may well be compared with Mr. (now Lord) Goschen's "Theory of the Foreign Exchanges" and Mr. Bagehot's "Lombard Street." We are not quite sure we can agree with him throughout as to the regulation of currencies, a subject which we should have liked to see discussed from the point of view of no regulation at all, instead of from the Continental point of view, which accepts regulation as a matter of course; but this criticism in no way diminishes our sense of the value of the discussion itself.

The chapters on the principal monetary systems and on banking in the principal countries are equally complete and interesting, especially when the student remembers that Dr. Pierson himself has had to deal with the business in his capacity as President of the Netherlands Bank and Prime Minister of the Netherlands.

The student will find it both interesting and amusing, we believe, that Dr. Pierson, after an elaborate description of the fall in silver and the ineffectual attempts of bimetallic agitators in the United States and elsewhere to restore the ratio, goes on to describe with effect various practical reasons for believing that bimetallism is no longer a possibility, and then adds a regret that this should be the case, when the opinion had become very general among experts—he himself holding the same opinion—that bimetallism is really possible if only all nations would consent to try it at the same time! We cannot but think this expression of opinion the one symptom of imperfection in the book. The practical reasons against bimetallism—universal or otherwise—are, in fact, found to be based on the mathematical reasoning of Locke, who demonstrated that, as there could be no fixed price between gold and silver, there could be no coexistence of the two as standard money and no joint circulation of the two at any time at a fixed price. But this is a small blemish in a book all but perfect in other respects, which ought to be in the hands of every economic student. R. G.

PURIFICATION AND DISPOSAL OF SEWAGE.

Sewage Works Analyses. By Gilbert J. Fowler, M.Sc. (Vict.), F.I.C. Pp. vi+130. (Westminster: King and Son; New York: John Wiley and Sons, 1902.)

THE thanks of all who are directly interested in the disposal and purification of sewage—a rapidly increasing number—are due to Mr. Fowler for his excellent little manual. In his preface he says:—

"The following book has been written in response to several requests for an account of the methods of analysis in use in the laboratory of the Manchester Corporation Sewage Works.

"Through the courtesy of Mr. F. Scudder, the author has been able to include descriptions of some of the more important processes employed in the laboratory of the Mersey and Irwell Joint Committee.

"In general it may be said that the Joint Committee's methods are designed for cases where samples from different works have to be critically examined, the Manchester methods for the analysis of a large number of samples of sewage and effluents of the same general character.

"The successful application of modern bacterial processes will necessitate careful chemical control. It is hoped, therefore, that the following book will prove of use to the increasing number of chemists who are interested in the scientific treatment of sewage.

"The methods here described are such as a considerable experience has shown to be capable of being rapidly executed, and of giving results of an accuracy amply sufficient for practical requirements."

The book opens with a very brief description of the general principles of sewage purification, divided under the two headings:—(*a*) mechanical or disposal processes; (*b*) biological or purification processes, with regard to the second of which the author writes:—

"The changes which take place in all these biological processes are much more complex than those which are effected by any of the mechanical or disposal methods in class (*a*), and chemical control is absolutely necessary if they are to be maintained in their greatest efficiency."

The few pages which are devoted to this section might, we think, be extended with advantage in a future edition. Even allowing for the fact that the work is one intended to deal with analytical methods, a somewhat fuller summary—so far as present knowledge goes—of the changes which take place in septic tanks and bacterial filters, from the pen of one who has made a special study of those points, could not fail to be of direct benefit to the laboratory worker. Such a summary would almost certainly stimulate his interest in the methods with which the book subsequently deals.

After a short discussion on the gauging of sewage flow and upon methods of sampling, the latter a point on which it is difficult to lay too much stress, the author goes on (p. 11) to indicate what in his opinion are the chief chemical data required to determine the amount of impurity in sewage and effluent, the working out of these data being given later in the book. A further portion of the chapter is devoted to the "method of recording results," and here we might add that it is very desirable that some uniform system of records should be adopted throughout the country. The chapter closes with a section on the degree of purity necessary in an effluent, some of the provisional standards adopted by different Rivers' Boards being quoted. This question of standards is too large and thorny a one to be entered into within the limits of a short review, but the author rightly emphasises the point that an effluent should be purified to such a degree that it will not take up oxygen from the water of any stream into which it may flow.

In chapter ii. the well-known "oxygen absorbed" test is discussed at length, and full directions are given for carrying it out; one advantage of this test is that a simple modification of the "three minutes'" test can be applied by any intelligent workman. The chapter concludes with a description of Mr. Scudder's "incubator test," which is now so widely employed.

In the section dealing with the determination of free and "albuminoid" ammonia, the methods followed both in the Manchester Corporation and in the Mersey and Irwell laboratories are detailed at length (p. 44 *et seq.*). The accurate estimation of albuminoid ammonia in sewage effluents is not so simple as it is usually assumed to be, and, as it is a point of much importance, it would be well if some more or less uniform system of procedure could be generally followed.

The determination of nitrates (p. 61) is one of the most important of all estimations in a sewage effluent. The Gladstone-Tribe method (reduction with the copper-zinc couple), which Mr. Fowler himself uses, is probably the most accurate of any, but it has the disadvantage of requiring twelve to twenty-four hours for completion. It is to be noted here that the author recommends the preliminary expulsion of any excess of ammonia present by distillation with steam—a plan which is perhaps better than by simple boiling in an open flask. At the same time a loss of nitrogen is apt to occur here if nitrites are present in any quantity—at least, this is the case with the boiling procedure; it can, however, be prevented, as has been shown by P. Frankland, by the previous addition of a small quantity of some alkali.

In detailing several processes for the determination of dissolved oxygen in effluents, a reference to Winkler's chloride of manganese method, as modified by Rideal, might with advantage have been included.

On pp. 82-85, the determination of the *rate of absorption* of dissolved oxygen by an effluent—perhaps the most important of all the chemical tests—is explained, and various examples are cited.

In the remaining sections of the book there are to be found such important items as the determination of solids in suspension, of supreme consequence in the case of a tank liquor and of an effluent which passes directly into a stream; the collection and examination of the gases evolved from septic tanks and in the interior of filter beds, &c. But enough has already been said to show the comprehensive and exact character of this little volume.

Before closing, two omissions may perhaps be referred to, viz. (1) in any book dealing with the analysis of sewages and effluents, one might naturally expect a reference to be made to the work of the late Sir E. Frankland, Dupré and Adeney; and (2) it is

frequently desirable to make a determination of the *total* nitrogen in an effluent, if only as a check on the estimation of the nitrogen in its various forms of ammonia, nitrate, &c. We would, therefore, suggest these points for a future edition, which will no doubt shortly be called for.

Mr. Fowler is to be congratulated on having compressed a great deal of valuable information within short compass, and at the same time in a clear and pleasant style. G. M.

ANOTHER TEXT-BOOK OF ZOOLOGY.

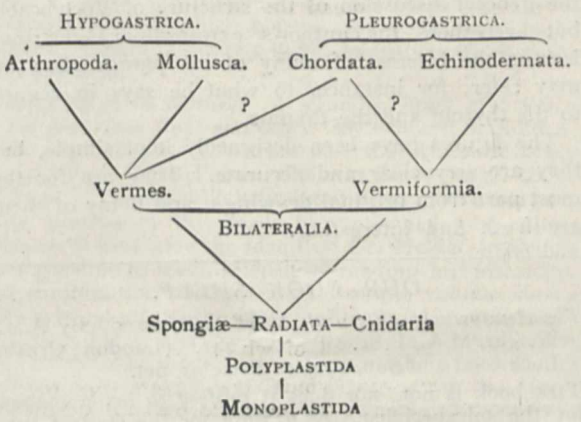
Lehrbuch der Zoologie. By Dr. Alexander Goette, Professor of Zoology in the University of Strassburg. Pp. xii + 504; 512 figs. (Leipzig: Engelmann, 1902.) Price 12*s.* net.

WHAT the illustrious and experienced author proposes in his preface is a text-book for University students—presumed to be serious—a scientific work, a synthetic presentation of the results of analysis, an evolutionist outlook, an exposition in which structure, function, and relationships are to be considered essentially "als Erfolge einer geschichtlichen Wandlung." This is a noble ideal of a text-book, and to say that the outcome falls short of it is only to say that Dr. Goette is human—a busy investigator and teacher, with much more urgent tasks than writing text-books.

The volume begins with a commendably terse introduction of twenty-five pages, in which the author discusses with clearness the basis of a genetic classification; the concepts of analogy, homology, and homoplasy ("Homoidie"); the essential facts regarding cells and protoplasm; the progress of modern zoology; and the evolution theory. He lays emphasis on the intra-organismal causes of the constitutional variations on which natural selection plays the part of the pruning-knife. It is a lucid introduction, but probably too terse and abstract to rivet the attention of the University student, who desires a wealth of concrete illustration and a non-dogmatic mode of argument. In a subsequent chapter, introductory to the Metazoa or Polyplastids, Goette discusses the beginnings of "body-forming" and the associated tax of "natural death," the differentiation of tissues and organs, and the nature of sexual reproduction.

The author's method is to follow the systematic order, and we wish to refer to his classification, which seems ultra-conservative. Thus in the phylum of Monoplastids or Protozoa, he recognises two classes—the Rhizopods and the Infusorians. The Sporozoa appear as an appendage of the Rhizopods and the Suctoria as an order of Ciliata. We do not find that Goette gives any reasons for this maltreatment. In the next section, which deals with radially symmetrical animals ("Radiata"), the Sponges are discussed in an elementary fashion in four pages, and classified as horny, flinty, and calcareous—again without a hint of phylogenetic relationships; and while the Cnidaria or Cœlenterates are more fully discussed, divided into Hydrozoa and Scyphozoa (including Ctenophora), we get no picture of the possible evolution of the phylum. We have the same comment to make throughout, that although the treatment of the various classes and subclasses is clear and terse, there is little of that evolutionary discussion of the phyletic affinities which the preface led us to expect.

Goette divides bilaterally symmetrical animals into Hypogastrica and Pleurogastrica, the former including Vermes, Arthropoda and Mollusca, the latter including Vermiformia, Echinoderma and Chordata. His scheme is as follows:—



In Hypogastrica, the gastrula is elongated in the direction of its transverse axis, and its slit-like blastopore (prostoma) lies ventrally, and coincides anteriorly with the formation of the mouth; in Pleurogastrica the gastrula is elongated in the direction of its longitudinal axis, and the compressed prostoma usually becomes the anus, the mouth being a new formation anteriorly.

In the phylum Vermes, the Nemerteans are ranked, without argument, as a third order of Turbellaria; and the Nematodes are placed as a class beside Annelids in the subphylum Cœlhelminthes, though the cavity of the nematode body is spoken of distinctly enough as a pseudocœl, not a cœlom. Echiurids and Sipunculids are slumped together as Gephyrea, and the appendix to the Vermes includes (1) Bryozoa, (2) Rotifers, and (3) Brachiopods.

There is less eccentricity in the treatment of Arthropods and Molluscs, which receive a full and yet admirably terse discussion. The Trilobites are ranked as an appendix to Entomostraca, the Eurypterids and King-Crabs as a third subclass of Crustacea. The author's Vermiformia, with which the pleurogastric group of phyla begins, include Chætognatha and Enteropneusta, with Cephalodiscus and Rhabdopleura appended to the latter. After a clear account of the Echinoderma, Prof. Goette passes to chordate animals: he dignifies Ascidiæ, Appendiculariæ and Salpæ as separate classes of the subphylum Tunicata; the Lancelets represent the second subphylum, and Vertebrata the third. Cyclostomes are ranked as a class of Pisces, but distinguished sharply from

the "Euichthyes," which include Plagiostomes, Teleostomes, and Dipnoi. The order of Ganoidei is still allowed to survive, and Polypterus reposes beside Lepidosteus and Amia. In the treatment of Reptiles a recognition of the phylogenetic relations is practically missed by insufficient notice of the extinct classes, and Archæopteryx (der zwar kein wirklicher Vogel war) is discussed under Reptiles rather than under Birds. Placental mammals are dealt with in four groups:—Unguiculata (the Rodents come somewhat quaintly between Chiroptera and Edentates), Ungulata, Natantia (Sirenia beside Cetacea), and Primates. The strongest part of the volume seems to us to be the general discussion of the structure of Vertebrata, but even here the author's extraordinary restraint lessens the interest of many of his paragraphs; we may refer, for instance, to what he says in regard to the thyroid and the thymus.

The figures have been designedly kept simple, but they are very clear and accurate. They are for the most part from original drawings, and many of them are fresh and interesting.

OUR BOOK SHELF.

The Analysis of Oils and Allied Substances. By A. C. Wright, M.A., B.Sc. Pp. xi + 241. (London: Crosby Lockwood and Son, 1903.) Price 9*s.* net.

THE book is not, nor does it profess to be, a manual for the oil specialist. As a work for the student who wishes to specialise and "as a laboratory guide for chemists who are not extensively engaged in oil analysis, or who have to deal with only a limited number of oils" (to use the words of the preface), it fills a decided want, and is evidently written by one who understands the requirements in such a case. The first chapter, on the occurrence and composition of oils, fats and waxes, may at first sight appear to be superfluous, but it deals systematically with so many substances that are unfamiliar to those relying only on the usual chemical textbooks for their knowledge that it forms a really essential introduction to the subsequent chapters.

In the section on glycerin, a table of specific gravities of glycerin of different strengths is given; an error exists here in the specific gravity of 40 per cent. glycerin, 1·020 being evidently a misprint for 1·1020.

The chapter on the chemical properties of oils, fats and waxes from the analytical standpoint includes careful descriptions of the methods of obtaining the so-called constants; the "ether value" is called the "ester value"—a preferable term. An important comparison is given of Hübl's and Wijs's methods of determining iodine values.

A chapter which contains a somewhat extended description of the properties of the more important oils, &c., with the methods of their investigation, is one which is of especial use to those taking up the study of this subject, but it is doubtful how far the author is justified in saying a little, in a book of this character, on such a debated question as the estimation of beef-tallow in lard—one of the most difficult problems that the oil chemist can have put before him.

On the whole, the author appears to have succeeded in the task he has set himself, and the subject-matter is carefully brought up to date. References to original papers are numerous.

The book is very clearly printed, it is got up in very readable style, and the index appears to have been carefully compiled with a view to completeness.

Opere di Galileo Ferraris. Vol. i. Pp. xxviii+492. (Milan: Ulrico Hoepli, 1902.)

THE Italian Electrotechnical Association decided to commemorate its founder, Galileo Ferraris, by publishing his collected works in three volumes, of which the present contains those papers which have the most intimate bearing on electrotechnics. The first, a paper on the use of the compass for galvanometric measurements, was written while Ferraris was assistant lecturer at Turin under Prof. Codazza, the second being his thesis for the doctorate, on the propagation of electricity in homogeneous solids, a mathematical work based on methods similar to those employed by Kirchhoff. The invention of the telephone by Graham Bell, about the year 1877, attracted the attention of Ferraris, who was not slow to read a paper at the Turin Society of Engineers, and to find in the new instrument a means of testing Helmholtz's theorem, according to which the timbre of a sound does not depend on the phases of its components. Another paper is on the intensity of the currents in the telephone. His two elegant theorems on the distribution of constant currents, published in 1879, follow. The introduction of secondary generators or transformers, in 1884, paved the way for his classical memoirs on the Gaulard and Gibbs transformer, on the difference of phase and dissipation of energy in transformers, on some results of experiments with the Ganz transformer, invented by Zipernowsky, Déri, and Bláthy, and an interesting correspondence with Dr. Hopkinson. The alternating current motor forms the subject of the next two papers, and the volume concludes with his treatise on the geometry of vector fields, which was published after his death. This paper affords an example of the spirit in which Ferraris devoted himself to science. His successes as an applied electrician, so far from drawing him aside from theoretical work, seem to have stimulated him to advocate the pursuit of research for its scientific value. From the introductory sketch of his work by Prof. Guido Grassi, we quote the following words:—"Whoever, in scientific researches, always has applications in view never discovers any." Again, at the second conference on electric lighting, in referring to the patient workers that had established the conditions for resolving economically the problem of illumination, Ferraris remarked:—"These men never thought of applications, *and it is for this reason that they discovered them;* they performed the part most important for applications, they provided the applicable things."

A Text-book of Field Astronomy for Engineers. By G. C. Comstock. Pp. x + 202. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 10*s.* 6*d.*

THIS text-book is designed for the considerable class of technical students who need to make practical applications of the methods of spherical astronomy, but cannot devote to the subject the time necessary for a course such as befits those who wish to study astronomy as a science. Teachers who have to undertake the instruction of such students will study with interest the course which Prof. Comstock has adopted after an experience extending over many years, more especially as no attempt is made to reduce the work to mere rule-of-thumb processes. The introductory chapters include the necessary formulæ for the solution of spherical triangles, hints on the orderly arrangement of computations, definitions of coordinates, and a short account of the various corrections to observed data. The methods of observation are classified as rough, approximate and precise according to the degree of accuracy required, and this excellent arrangement not only simplifies the task of the student, but indicates how time may often be saved by avoiding the more refined

processes when a comparatively rough result is sufficient for the purpose in view. Some of the processes described have not usually been introduced into elementary treatises, but all that are given have been found by the author to be well adapted for students. It is not quite clear why the description of instruments is postponed to the part dealing with accurate determinations, seeing that their use is assumed in earlier chapters, but otherwise the sequence is all that can be desired. Some of the "forms" for computation do not seem to be the best that could be devised for beginners, though they are doubtless well adapted to trained workers, and we think they could be made more self-explanatory with advantage to the student. The book deals very completely with the astronomical work involved in surveying, and anyone who masters its contents will obtain a thoroughly sound knowledge of the subject.

A New Student's Atlas of English History. By Emil Reich, Doctor Juris. Pp. vii+55 maps. (London: Macmillan and Co., Ltd.) Price 10*s.* 6*d.*

THIS small and handy atlas will be found of use in the higher forms of schools, for the modern specialising sixth form boy who is going to add to the number of open scholarships which his school can advertise to the world, more especially. Nor will the aspirant after a "first in modern history" find Dr. Reich's book of small use to him by any means. It contains many points that will not be found elsewhere; for instance, the historical summaries facing the maps in most cases will prove very handy. The maps themselves are good and are up-to-date; the latest partition of Africa is given, and the Transvaal and Orange Colony are as red as Natal. We may, perhaps, object to Egypt being described in brackets as "(Turkish)" on map 48; if it is not British, it is Egyptian; the shadowy and hardly even nominal overlordship of Turkey is hardly worth commemoration any longer. Also, there are not enough maps; what there are are so good that we should like more.

As is perhaps natural, however, in a German author, there is a suspicion of pedantry about the book. In the preface there is much talk about "pædagogy" (though "pedagogue" in English is a term of abuse, and the Greek παιδαγωγὸς was a sort of male nursemaid!), and it is obviously directed rather to the address of the schoolmaster than of his pupil. Personally, we think that such a preface should be written for the information of the boy who is going to read the book. But this is a matter of opinion.

The Rational Memory. By W. H. Groves. Pp. vi+115. (Gloucester, Va.: W. H. Groves, n.d.)

FEW could read this useful little book of 115 pages without benefit. The author does not claim originality, but has selected the principles and facts of recognised importance from other works on memory. The author draws special attention to the fact that one man may have a good memory for certain things, and yet be very deficient in remembering others. This fact, though so well known, is constantly overlooked by writers on memory. They can themselves remember, through the possession of some well-developed faculty, and therefore invent a system based on this fact, whereas the majority of persons might find greater difficulty in remembering through the system than through the ordinary method. The author devotes four chapters to the consideration of concentration and observation. There is a very instructive chapter on the necessity of reviewing the knowledge we possess, so as to have it available at any given moment. As we remember entirely from single impressions, it is of the greatest practical importance that when we receive a new impression the previous one be revived. A simple illustration will make this clear: A man may meet another three separate times without remembering that he has met him before; he might subsequently remember that he had met the man on any one of the three occasions, but the remembrance would not be nearly so vivid as if he had recognised his acquaintance each time they met. The chapter on the subconscious or subjective memory contains many statements which will not admit of proof. As a matter of fact, all memory is subconscious; everything is remembered, and may, in favourable circumstances, be brought before the mind. There are some curious errors which the author would do well to correct in another edition, such, for instance, as the use of the word "mneumonics," which occurs repeatedly for "mnemonics," and the reference to Mr. Gladstone as Sir Wm. Gladstone.

Real Things in Nature. A Reading Book of Science for American Boys and Girls. By Edward S. Holden, Sc.D., LL.D., Librarian of the U.S. Military Academy, West Point. Pp. xxxviii + 443. (New York: The Macmillan Company, 1903.) Price 3*s.* 6*d.*

THE subtitle of this book is somewhat misleading, because it may give the idea that Dr. Holden imagines it is possible to teach science by reading lessons alone. An examination of the contents of the volume shows this is by no means the case, for Dr. Holden continually instructs his reader to try experiments bearing upon the statements made in the book. The scope of the volume is very wide, readings being given in astronomy, the various branches of physics, meteorology, chemistry, geology, zoology, botany, human physiology, and the numerous subjects included under the early history of mankind. The book is well and profusely illustrated; it contains a full table of contents, but no index, an omission which rather interferes with the usefulness of the book as a work of reference for pupils.

Castology: a View of the Oolite Period and Earliest Man. By J. Craven Thomas. Pp. 20. (Bromley: Kentish District Times Co., Ltd.)

THIS purports to be a paper read before "The Bromley Naturalist (*sic*) Society" in November, 1902, and we can only marvel. Had it been written two or three hundred years ago we should not have been surprised, but for anyone in the twentieth century to advance seriously the views expressed by Mr. Craven Thomas is astounding. His "science of castology" appears to be the contemplation (we cannot say study) of flint-casts which he regards as belonging to the Oolite period! But it will be sufficient to quote one paragraph from his pamphlet:—"Fossil flint is that which is composed of petrified organisms, with or without a certain amount of integument, such as leaves, branches of trees, fruit, birds, beasts, fishes, and broken parts of man"!!

The New Forest. Its Traditions, Inhabitants, and Customs. By Rose C. de Crespigny and Horace Hutchinson. Pp. viii + 293. (London: John Murray, 1903.) Price 2*s.* 6*d.* net.

THIS pleasantly written book appeals both to lovers of the New Forest and to those who have yet to make the acquaintance of this vast woodland region. Readers who have themselves explored the recesses and solitudes of the forest will be impressed by the wide knowledge of the beauties of this part of Hampshire possessed by the authors; and those who have not yet strolled through the leafy glades of, say, Mark Ash will, after reading the book, be anxious to spend a few pleasant days wandering in the forest.

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.*]

Effects of the Gale of February 26.

THIS district, and so far as I know a large part of Ireland, was in the early hours of the morning of February 26 swept over by a gale of exceptional violence. The maximum occurred between 1h. and 2h. 30m. a.m.

The destruction of trees has far exceeded that caused by any gale within my memory. Nothing at all like it has occurred here since the celebrated storm of 1839. The damage, I should say, certainly exceeds the total during the intervening interval of sixty-three years. No kind of tree has escaped.

What has struck me most is the strong evidence of the fact that it is not the absolute pressure of the wind which does the damage, but the unsteadiness of the pressure, giving rise to oscillating motion which, when the periodicity of the gusts happens to be nearly the same as that of the tree, causes it to succumb.

Owing to the immense number of the prostrate trees on the present occasion, there are exceptional opportunities for testing this. In numerous cases plantations have been practically levelled, but of the few survivors the greater number are usually found on the outside, principally on the weather side.

Single trees standing alone in fields have usually escaped. Of groups of three or four it is rarely the case that that on the weather side has been the one to suffer. I rather think that where the row lay in the direction of the wind there have been more casualties than where it was at right angles to it, but I have not been able to satisfy myself as to this. There are, however, many cases of trees lying nearly parallel to the fence.

The trees in nearly every case lie in a north-east direction. A very few are in various degrees of orientation. The gale seems to have been most unequal in its action. Lanes some forty yards wide, which can be traced for several hundred yards, have been swept down, and on each side, perhaps for 200 yards, little or no indication of the tempest is perceptible. There seems to be no evidence of any rotation of the blast in these lanes.

I think that it is clearly proved that in the case of trees, and probably more or less of artificial structures, unsteadiness of blast is very largely responsible for damage, and that recorded velocity and mean pressure form very fallacious guides as to force to be resisted.

It has been remarked to me by several people that trees in exposed situations, even upon the tops of hills, have escaped, while others have been swept away wholesale in hollows where they were entirely shielded from the direct action of the blast. ROSSE.

Birr Castle, March 14.

Ambidexterity.

IN the "Notes" of NATURE of March 12 you mention an association proposing to teach writing with both hands by the method of upright penmanship. This is quite intelligible, but when it is said that the child by this means will acquire left-handed skill in all other manipulations, this cannot be correct. Left-handedness means that the left hand can be used equally well with the right; this is true, but not in the same way. The course of the cricket ball in a left-handed bowler is not the usual one. When a surgeon is left-handed it is not to enable him to do with his left exactly the same thing as with the right, but something different. After making an incision in the eye with his right hand, he takes the knife in his left to complete what he requires, without altering his position or turning the patient round. A left-handed waiter, after removing the limbs of the chicken on one side, changes the knife and fork to the other hands, and does the same on the other side. It only wants a moment's consideration to see that if the arms are turned round one goes in the right direction and the other in the left, so that if the right hand is used in turning a screw to the right, as screws are all made, a corresponding movement with the left would turn it in the opposite direction. As left-handed screws are not usually made, a left-handed man has to use a different and inferior set of muscles, and works with a disadvantage. In the same way ordinary handwriting cannot be copied by the corresponding muscular and nerve apparatus on the left side; it is done by a totally different apparatus after much time and trouble. It is much easier to use the corresponding set of muscles, but then this produces backward or mirror writing. The only movements common to the two sides must be near the median line. If the corresponding muscular and nerve apparatus be used in both arms, the result is equally good, but it is not the same, as in writing or turning a screw. If one hand imitates the exact movements of the other, it is done by another apparatus and at a disadvantage, as with a child learning the scale and using different fingers for similar notes. There is, therefore, no such thing as ambidexterity, unless, indeed, it is used in another sense, as in the violin player, where he educates each hand for its own particular object. SAMUEL WILKS.

Mendel's Principles of Heredity in Mice.

THE experiments respecting heredity in mice conducted by Mr. Darbishire in the Oxford Laboratory at Prof. Weldon's suggestion, and described in *Biometrika*, ii., parts i. and ii., are of exceptional interest. As the fruitful development of these and similar experiments depends on a true interpretation of the facts so far reached, I offer a few words in supplement to the conclusions deduced by the author.

By crossing Japanese waltzing mice having pale fawn and white coats and pink eyes with ordinary white pink-eyed mice, 154 offspring were produced, of which 137 were grey and white, 1 was grey, 7 were yellow and whitish, 9 black and white or whitish. The colour-patches showed decided variations in amount and in tint. A fact of extraordinary physiological significance (omitted from the preliminary account) is that though the eyes of both parent-forms were pink, the cross-breds *without exception had dark eyes*, a result which, though to some extent paralleled by certain plant cases, is probably as yet unique among animals, at least in degree.

The cross-breds bred *inter se* gave 66 mice, of which 13 were pink-eyed albinos, 17 were pink-eyed with more or less colour in the coat, and 36 were dark-eyed, some (presumably all) having colour in their coats. Bred with albinos the cross-breds gave 111 pink-eyed albinos, and 94 with dark eyes and some colour in their coats. The coat-colour phenomena, though exceedingly important, are too complex for consideration in a few lines. The evidence also, as yet, is in some respects insufficient, but did space permit I should be glad to discuss these facts as far as they go. As to eye-colour, the phenomena are simpler, and from them the following conclusion is drawn by the author:—

"The inheritance of eye-colour is not in accordance with Mendel's results. For since pink eyes occur in parti-coloured mice, the possession of pink eyes must, on Mendel's view, depend on a separate embryonic element from that which determines coat-colour. Pink eyes are, however, not 'dominant,' since the two pink-eyed parents of the first generation always produce dark-eyed young. For the same reason pink eyes are not 'recessive.' Yet although pink eyes disappear in the first generation (the result of crossing two pink-eyed parents) they reappear in the second; but a correlation is then established between coat-colour and eye-colour which is strong in the offspring of hybrids paired together, and at present perfect in the offspring of hybrids and albinos. The behaviour of eye-colour is thus in every respect discordant with Mendel's results."

The purpose of the allusion to "dominance" escapes me. In what circumstances could pink-eye be dominant, or recessive, to pink-eye? The reference to correlation is no less perplexing. The meaning might be clearer if we were told what offspring the writer would have expected if the inheritance *had* been "in accordance with Mendel's results." But a negative conclusion, however acceptable, supplies

imperfectly the place of a positive result. Let us see if a positive interpretation is compatible with the facts.

In face of so emphatic a declaration to the contrary, my opinion may seem over bold; yet I feel no hesitation in believing that the inheritance of eye-colour in these mice, so far as the record reaches, was strictly Mendelian. The first cross proves that when *in this case* an albino (pink-eye) gamete, G, meets a colour-bearing (pink-eye) gamete, G′, in fertilisation we must expect the resulting heterozygote, GG′, to be coloured in coat, with a *dark* eye. When these heterozygotes breed *inter se*, they will form on an average equal numbers of homozygotes, GG and G′G′, and of heterozygotes GG′ and G′G. Of these, the homozygotes will all have pink eyes, but while GG will have a white coat, G′G′ will have some colour in the coat. The heterozygotes, GG′ and G′G, will have dark eyes and some colour in their coats.

Treating GG′ and G′G as identical, we thus expect the ratio

1 GG : 1 G′G′ : 2 GG′.

Therefore the most probable distribution of the 66 mice is as follows:—

16·5 pink-eyed albinos : 16·5 pink-eyed with colour in coat : 33 dark-eyed with colour in coat,

and the experiments gave

13 pink-eyed albinos : 17 pink-eyed with colour in coat : 36 dark-eyed, (? all) with colour in coat.

Similarly, on crossing the hybrids with albinos, we expect equal numbers of GG and GG′. Therefore the most probable distribution of the 205 mice so produced is

102·5 pink-eyed albinos : 102·5 dark-eyed with colour in coat,

and the experiment gave

111 pink-eyed albinos : 94 dark-eyed with colour in coat.

Experiment agrees well with expectation. In what respect are they discordant?

The case is closely comparable with that found by Miss Saunders in Matthiola (Rep. to Evol. Cttee. of Roy. Soc., 1902), when a white hoary form crossed with a white glabrous form gave purple hoary offspring; and with the production by Kölreuter (confirmed by Gärtner, Naudin and Godron) of purple flowered hybrids by the union of two white flowered Daturas, *D. ferox* and *D. laevis*. *Why* in these cases the heterozygotes are atavistic we do not know, but the problem need not be insoluble.

Anyone conversant with Mendelian phenomena can now predict the eye-colour of the future offspring of the various unions with approximate accuracy. Pending further experiments, we cannot predict the particular colours which will appear in the coats, and for various reasons we should perhaps be cautious in declaring that *all* the dark-eyed mice must show colour in their coats.

From incidental comparisons of these new facts with the simpler results of von Guaita an inexperienced reader might suppose that the two sets of experiments had been comparable and had given discrepant results. It would have prevented misconception if the author had stated that while the waltzing mice he used were pale fawn and white with pink eyes, von Guaita's were *black and white with dark eyes*. It is a feature of the Mendelian view of heredity that different specific results may be expected when different specific materials are introduced. W. BATESON.

Grantchester, Cambridge, March 11.

University Education in the United Kingdom and Germany.

WITH reference to the admirable article on "The University in the Modern State" which you published in your issue of March 12, may I point out that the figures you give deal only with university education in Germany in arts, pure science, law, medicine, &c.; they do not include the very large expenditure on technical education of university rank. Both in that country and in the United States such education is given in technical institutions existing side by side with universities, but free from ordinary academic control.

Were these figures added, the comparison you make between the sums devoted to higher education in this country and in Germany would be still more striking. For—to take a single case—side by side with the well-endowed University of Berlin, there is the Technical High School at Charlottenburg, which is one of the finest technical institutions in the whole world, liberally supported by the State, and, notwithstanding the jealous protests of the Prussian universities, wisely authorised by the German Emperor to grant degrees in the main branches of technical knowledge.

J. WERTHEIMER.

Merchant Venturers' Technical College, Bristol, March 16.

[The series of articles referred to of set purpose deals with universities only.—Ed.]

Hygrometric Determinations.

DURING the past week I have made some determinations with regard to the humidity of the atmosphere at this place, and the results, which show a very rapid change, are, if not perhaps unusual for our climate, certainly somewhat striking.

The tests were made with dew point instruments, and I append the figures deduced from my determinations on four days.

	(*a*) Temperature of atmosphere. T°	(*b*) Dew point. T′	(*c*) Elastic force vapour, according to Regnault, in inches. T°	T′
(1) February 12... 11.30 p.m.	52°3 F.	22°5 F.	0·3925	0·1206
(2) February 13... 11 p.m.	48·5	38	0·3414	0·2291
(3) February 15... 12.30 p.m.	48·7	44	0·3439	0·2882
(4) February 16 .. 1.30 a.m.	39	36	0·2382	0·2119

Case.	(*d*) Relative humidity in hundredths.	(*e*) Weight cubic foot air under given conditions (in grains). Corrected to mean barometric pressure of 29·3 English inches	(*f*) Wt. vapour present in cub. ft. air under given conditions (in grains).
(1)	30·7	526·7803	1·3145
(2)	67·1	529·9801	2·4982
(3)	84·5	529·6004	3·1317
(4)	89	540·6601	2·3965

The figures in the last two columns are deduced from the Greenwich observations, while for those in columns (*c*) and (*d*) I am indebted to Regnault.

Unfortunately, I have not the height of the barometer at the time of my determinations, but have assumed a mean pressure, covering the four days on which they were made, equal to 29·3 inches of mercury, and have corrected the figures given in columns (*e*) and (*f*) in accordance with this assumption.

The figures given are open to further correction, while some are but approximations.

In case (3), if the relative humidity be calculated by multiplying the factor 100/F into the elastic force of vapour at the dew point the result, 0·2882 × 100/F = 290·8 = 83·8, is

slightly different; while the values for the elastic force of vapour have not been corrected for the assumed barometric pressure. Nevertheless, a decidedly rapid increase in the humidity of the atmosphere is shown, and in considering the table, it must be borne in mind that the results, if reduced to a mean temperature, would be even more striking.

Barnet, February 18. E. V. WINDSOR.

Lagrange's Equations.

As most of the standard treatises on dynamics contain satisfactory proofs of Lagrange's equations, I do not see that any useful purpose is served by proposing an additional one. The important point is this:—That amongst the numerous forms in which the kinetic energy of a dynamical system can be expressed, there is *only one form* which can be employed in using Lagrange's equations, and that is the *Lagrangian* form in which T is expressed as an n-ary quadric of velocities which are the time variations of the coordinates.

Similarly in using Hamilton's equations

$$\frac{d\Theta}{dt} + \frac{\partial}{\partial\theta}(\mathbb{T} + V) = 0$$

$$\frac{\partial\mathbb{T}}{\partial\dot{\Theta}} = \dot{\theta},$$

there is only one form, viz. the *Hamiltonian* form, which it is permissible to use in which $\mathbb{T}$ is expressed as an n-ary quadric of momenta of the same type as the coordinates of the system. Now the form $\frac{1}{2}(A\omega_1^2 + B\omega_2^2 + C\omega_3^2)$ is neither Lagrangian nor Hamiltonian, and therefore cannot be used in either equations.

A. B. BASSET.

Fledborough Hall, Holyport, Berks, March 6.

A Remarkable Meteor.

I SEND an account of a meteor, to me remarkable because of its extremely slow movement and also because of its apparently reaching the surface of the earth, a little east of north-east of here. The "falling star" was about equal in brightness to Sirius. When first it attracted my attention it would be just below the cluster "Coma Berenices." So slowly was it falling that I first mistook it for the fixed star Arcturus, the resemblance being probably increased by its colour, which was reddish. It slowly dropped vertically downwards, its brilliancy keeping constant; it left no trail. Its line of descent would make a small angle with the line $\delta\beta$ Leonis. I watched it fall right to ground—but it may not have quite reached earth, as there was a rise in the ground before me. About one-third of its distance from the ground it appeared to "wobble," but that may have been an illusion. It fell so slowly as to take quite five seconds. The time was about 7.22 p.m. on March 15, when I was a little more than a mile to the south of Basingstoke. J. E. C. LIDDLE.

Fairfields, Basingstoke, Hants.

Dawn of Modern Geography.

IN the review of my book ("Dawn of Modern Geography," vol. ii.) which appeared in NATURE, November 27, 1902, it is stated (p. 75), by way of repetition from NATURE's review of vol. i. of the same work, that the "revision of the whole of chapter vi. of vol. i., on geographical theory, together with Mr. Beazley's account of the history and use of mediæval maps for the whole book," was "due to Mr. C. H. Coote, of the Map Department of the British Museum." When this unfounded assertion was first made, I wrote (with the entire concurrence of Mr. Coote) and pointed out to the reviewer that he was mistaken. As the misleading statement now reappears, I may say that Mr. Coote never saw a line of the "Dawn of Modern Geography," vol. i.—nor had I any consultation with him on any point therein—until after the last corrections of proof had been made, and the sheets finally returned for press.

C. RAYMOND BEAZLEY.

Nernst Lamps in Lanterns.

IT was suggested to me by a friend to use a Nernst lamp in a lantern. On trying the experiment I have found that a one ampere 220 volts Nernst lamp gives quite a fair result in a small lantern, certainly very much better than could be got with oil wicks, and when put at a small angle from the horizontal the filament gives a very concentrated light. For lantern purposes it would be quite possible to remove the heating coil and to start the lamp by means of an alcohol flame. Indeed, I think that a special Nernst burner could be made for lanterns, giving a high candle power and fitted with a suitable fitting, which would largely replace limelight, and it would even in many cases replace the arc lamp where a powerful light was not required. There can be no doubt whatever about its convenience.

C. TURNBULL.

Electricity Works, North Shields, March 16.

PHOTOGRAPHS OF VOLCANIC PHENOMENA.[1]

THE application of photography to the recording and illustrating of volcanic phenomena has done much to secure accuracy, and the avoidance of those sources of error to which the students of these stupendous outbursts must always be particularly liable. Valuable as are the drawings made under the superintendence of Sir William Hamilton for his classic work, "Campi Phelgræi," they do not carry the conviction to the mind of a reader of the work that actual photographs would do; while many of the drawings of volcanic phenomena in less carefully illustrated works are faulty and exaggerated almost to grotesqueness.

Perhaps the first serious attempts to show the features of a volcanic outburst by means of instantaneous photography were those made by an enterprising photographer of Naples, during the Vesuvian eruption of 1872. He obtained three photographs at different hours, which illustrate very clearly the scale, the principal details and the changes of phase in the outburst. These photographs have since been reproduced in many geological treatises.

During the visit of the Geologists' Association to the South Italian volcanoes in 1890, a number of photographs were obtained by members of the party which demonstrated the value of instantaneous photography in recording all the successive stages of an outburst. Some of these photographs were reproduced in a memoir published by Dr. Johnston Lavis at Naples in 1891.

Dr. Tempest Anderson's contributions to the subject appear to have begun in 1885, when he read a paper, illustrated by admirable photographs, before the Geological Section of the British Association at Aberdeen. This paper dealt specially with the extinct volcanoes of Auvergne. In subsequent years, Dr. Tempest Anderson has visited almost all accessible volcanic districts—Italy and Sicily, the Canaries, Iceland, and various parts of the North American Continent. Last year he volunteered, at his own expense, to join the expedition sent out by the Royal Society to report on the eruptions of St. Vincent and Martinique, and the results obtained by Dr. Flett and himself have just been published in the *Transactions* of the Royal Society.

The work before us consists of reproductions by

1 "Volcanic Studies in Many Lands: being Reproductions of Photographs by the Author of above One Hundred Actual Objects, with Explanatory Notices." By Tempest Anderson, M.D., B.Sc. Lond., F.G.S., F.R.G.S., A.C., Fellow of University College, London, Hon. Sec. Yorkshire Philosophical Society. Pp. xxviii + 202; plates i. to cv. (London: John Murray, 1903.) Price 21s. net.

means of half-tint blocks, for the most part of a very clear and satisfactory character, of photographs taken by the author. Each plate is accompanied by a letter-press description, calling attention to the principal phenomena which are illustrated in the plate. In a short introduction upon "Photographic Methods," the author gives a number of valuable hints, which cannot fail to be of service to every geologist who wishes to go abroad armed with the camera. Dr. Tempest Anderson's remarks on the lenses to be employed, on the importance of the use of a firm stand, and on the relative advantage of plates and films, should be read by everyone desirous of doing good work in this direction.

Of the photographs reproduced in the 105 plates of this volume, seventeen are taken from Vesuvius and the surrounding country, two from Etna, eight from the Lipari Islands, eleven from the Auvergne and Central France, eight from the Canaries, thirty-two from Iceland, five from the Eifel and Central Germany, eight from the Yellowstone Park and other parts of the Western Territories of North America, ten from various ancient volcanic districts in the British Isles, and four from the West Indies.

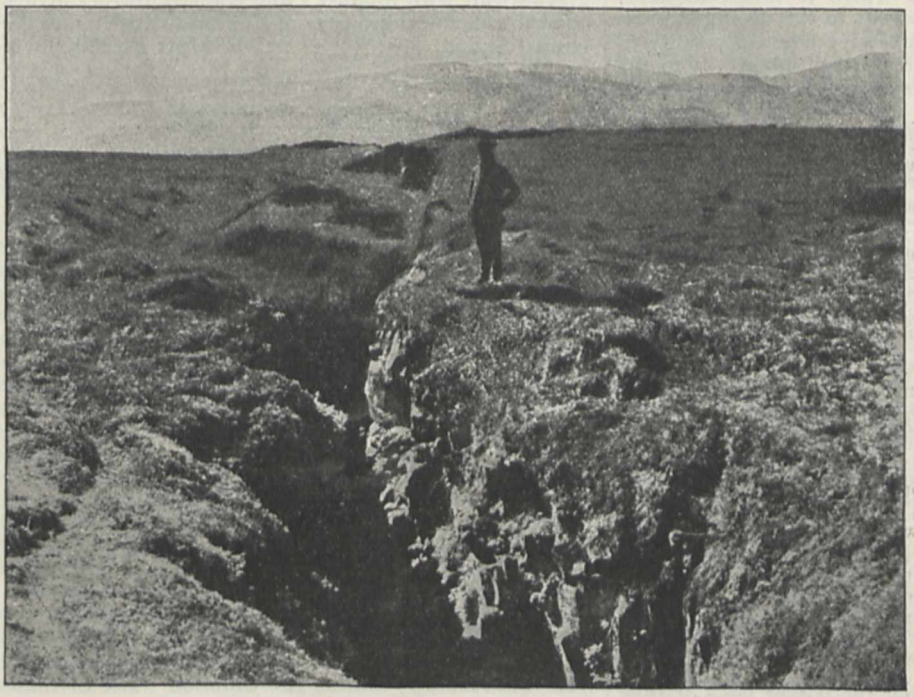


FIG 1.—A Gáj (pronoun Geow), Reykjanes Peninsula, Iceland.

Most of the pictures are wider than the page of NATURE, but the one here reproduced will give a good idea of their general character. Those who have seen reproductions as lantern-slides of these photographs thrown in an enlarged form upon a screen can testify to their excellence and value. The fact that in many cases—notably in Iceland and the West Indies—the work has had to be carried on under most unfavourable conditions, while it increases our admiration for the skill and perseverance of the author, cannot but greatly enhance the value of the results obtained. The author of this work is to be congratulated upon having discovered a field of work in which he is able to make such valuable contributions to science. J. W. J.

THE AFTERMATH OF THE PARIS EXHIBITION.

THE size and importance of the Paris Exhibition of 1900 is beginning to be appreciated in its true significance. Many who visited the exhibition in a casual way were greatly impressed with its vastness and came away with the feeling that the exhibition was a marvellous illustration of the Frenchman's power of organisation; but that, owing to its very immensity, it lost much of its practical value. The aftermath of the exhibition is still with us, and we begin to see—from the number of special reports upon the different departments—that although not a financial success, the exhibition has left its mark upon commerce and science in a way that bids fair to rival, in its economic results, the immense advantages that accrued to this country from the Great Exhibition of 1851, and justly to warrant the enormous labour put forth in its inception and organisation.

In the *Revue générale des Sciences* (November, 1902) Prof. A. Haller, of the Paris University, contributes the first part of a most interesting and suggestive article upon the "Chemical and Pharmaceutical Industries" at the Paris Exhibition. He commences with a reference to the retrospective stand, where apparatus and substances of historical interest were exhibited. Amongst these exhibits were specimens of aluminium as prepared by Wöhler, sulphuric anhydride by Winckler, the first specimen of magnesium which was prepared electrolytically by Bunsen, and many other products and apparatus of historical interest. He then goes on to refer to artificial substances such as ultramarine, synthetical perfumes, pharmaceutical preparations and a very complete collection of coal-tar dyes.

The article is mainly devoted to the German chemical industries, and by far the most interesting paragraphs are those in which Prof. Haller reviews the great advance in German science, and endeavours to assign a reason for this phenomenal development. *En passant*, he regrets that Great Britain did not see her way to send apparatus and specimens of historical interest, which she, who can boast of the great names of Priestley, Cavendish, Davy and Faraday, might so easily have done.

The recent trade depression in Germany has attracted considerable attention, but although many branches of industry have been passing through a period of great difficulty, and the total German exports for 1901 showed a decrease of 240 million marks, the exports of the chemical trade showed *an increase* of 10 million marks. Prof. Haller attributes much of the success of the Germans in the chemical trade to the management and to the employment of men of high scientific

training and attainments. He illustrates his point by giving an outline of the organisation of a typical chemical works in Germany. The management consists of a business man, a chemist and an engineer, and attached to each department is a special research laboratory. Both the laboratories and workshops are splendidly fitted with every appliance necessary for carrying out the most complicated and exact operations. The expenditure upon chemicals, books and apparatus would appear to a British manufacturing company to be absolute lunacy, the Badische Anilin und Soda Fabrik alone spending more than 5000*l.* a year on glass and porcelain apparatus. The consulting library attached to the laboratories of F. Baeyer and Co., of Elberfeld, contains no less than fourteen thousand volumes and twenty-three thousand pamphlets of an original character.

As to the methods of research, when a new compound has been discovered which is found to have, say, dyeing properties, it is sent to the dyeing department, where a chemist, who has made a speciality of that particular branch of chemistry, subjects it to the most exhaustive tests, and tries its behaviour on cotton, wool, silk, paper, leather, &c. Should any of these tests turn out in a satisfactory manner, the substance is then subjected to tests on a semi-manufacturing scale. Again, a new preparation which may be expected to possess therapeutic properties is sent to the medical department, where its physiological effects are tried. These articles having successfully passed through the experimental stages, the business man is called in, and they are placed on the market. Circulars and pamphlets are sent out, which set forth the effects and uses of the articles. These circulars are printed in *all* the European languages, and often in those of Asia. Samples are sent out, and travellers, who are accomplished chemists, visit works and business houses where the articles may be used. These men place their knowledge and skill at the service of the consumer, while they demonstrate how the articles may be used to the greatest advantage. In no case do they endeavour to plant their products upon their customers against their will, and, if necessary, the articles are so far as possible modified to meet their customers' tastes and prejudices. Little or nothing is left to chance; everything that ingenuity and business experience can suggest is resorted to in order to obtain the market.[1]

Prof. Haller recognises that the patent laws of 1878 have been of great benefit to the German manufacturers. But patent laws are only useful when there are inventions to be patented and processes to be protected. He further recognises that the mineral wealth of Germany has been of incalculable value to the nation, because it has, to a large extent, rendered it independent of outside nations for its raw products. For example, the wonderful deposits of Stassfurt enable the Germans not only to supply themselves, but the world at large, with potassium salts.

Prof. Haller considers the scientific training obtainable at the universities and polytechnics to be the main reason of the astonishing development of the German chemical industry. It must not be forgotten that beside the universities and polytechnics, there are special academies where the general outlines of chemistry are taught, and where special applications of science to industry are studied. For example, the Mulhausen School of Dyeing and Printing, the Electrochemical Institute at Darmstadt, the Mining Academy at Freiberg. Then there are purely technical schools, where such subjects as sugar making, brewing, pottery, &c., are taught.

The Germans believe in an aristocracy of brains, and owing to this and the high social standing which follows educational success, many are attracted to the universities, not simply to obtain university polish, but to devote their energies to hard study and scientific research. The British man of science is inclined to look upon the commercial applications of science as beneath him. But is there not a tendency for the German man of science to go to the other extreme, and look upon science as simply an aid to commercial success? We do not want to commercialise science, but we do desire to make commercial methods more scientific.

We await with interest Prof. Haller's further article upon the chemical industry of England, Russia and the United States.

F. MOLLWO PERKIN.

[1] "The British merchant sells the goods which he deals in and has selected himself, and leaves it to the customer to adapt himself to the merchandise. The German individualises and meets the wants of his customers; he adapts his merchandise, credit, conditions of sales, decoration, packing, &c., to the wants and desires of his client. Thus he often gains a start, for the buyer is but seldom in a position to value quality and prices. Another point is forced on the observer, and this is the great start in scientific training which Germany can boast of." (Diplomatic and Consular Reports, No. 2484.)

REMARKABLE WINTERS.

THE period of winter for purposes of the present article may be defined as embracing the six months October to March, although when dividing the year into four seasons, the winter then for meteorological purposes is comprised in the months of December, January and February. Generally speaking, temperature is the most important factor in deciding whether a winter is severe or otherwise, although there are other aspects which render the weather disagreeable. When gales occur with more than ordinary frequence the winter is characterised as stormy, and similarly when rains are heavy and of common occurrence the winter is characterised as wet. Our winters in England vary to so great an extent in their general character that it is not always easy to say with scientific precision whether a winter may or may not be styled as remarkable. It generally happens that when a winter is cold the weather is fairly dry and there are fewer gales than usual, although, on the other hand, the quiet conditions are favourable to fog formation. In a mild winter the weather is usually wet, and storms are of common occurrence, the mild weather being very intimately associated with the arrival of cyclonic disturbances from the Atlantic, and as the common track of these storms takes the centres of the disturbances over the northern portion of our area we, in England, for the most part experience the south-westerly and westerly winds which bring us the moist and warm air from off the ocean to the westward of us. For the purposes of comparison the data used refer almost wholly to Greenwich, where the long series of observations made at our national observatory is eminently suitable, and, so far as the weather of a winter is concerned, there is probably no real disadvantage in restricting the area of comparison to one locality, since in a general sense it would be equally applicable to most other parts of England. The coldest winters of recent years are those of 1890-1 and 1894-5, in which there were respectively ten and eleven days with the temperature below 20° F. at Greenwich. In the last sixty years there have only been two other winters with so low a temperature on ten days; these were 1854-5 with twelve such cold days, and 1880-1 with ten days. The greatest number of days with frost during the period of sixty years was eighty in the winter six months of 1887-8, and the winters with seventy or more days of frost were 1844-5, 1846-7, 1854-5, 1874-5, 1878-9, 1879-80, 1885-6, 1886-7, 1887-8 and 1890-1. Using this as a test for the mildness of the winter, the least number

of frosty days was nineteen in the winter of 1883-4, and there were fewer than thirty-five days with frost in the winters of 1845-6, 1850-1, 1858-9, 1862-3, 1865-6, 1876-7, 1881-2, 1883-4, 1895-6 and 1897-8. In the five out of the six months already elapsed of the present winter there have been twenty-one days with frost, and as yet the screened thermometer has not fallen below 23°·6. The winter (six months) with the lowest mean temperature at Greenwich is 1844-5, when the mean was 38°·8, and the winters with the mean below 40° were 1844-5, 1854-5, 1878-9, 1885-6, 1887-8 and 1890-1. The winter with the highest mean temperature was 1898-9, when the mean for the six months was 45°·4, and the mean for each of the six months, with the exception of March, was above the average. The winters with the mean temperature above 44° were 1845-6, 1847-8, 1848-9, 1862-3, 1876-7, 1883-4, 1897-8 and 1898-9. The mean for the five out of the six winter months already elapsed (1902-3) is 44°·6, so that it is most highly probable that the present winter will rank as one of the foremost for its general mildness.

Limiting the winter to a period of three months—December, January and February—the coldest winter in the last sixty years at Greenwich is 1890-1, with a mean temperature of 34°·3, or 5° below the average, and during this period the mean temperature for December was 29°·9, January 33°·9 and February 39°·1. The second coldest winter was 1846-7, with a mean of 34°·5, or 4°·8 below the average. In 1894-5 the mean temperature for the winter was 35°·1, or 4°·2 below the average, and February, 1895, with a mean temperature of 29°·3, was the coldest of any winter month since 1841, with the exception of 29°·2 in February, 1855, and during this month (February, 1895) frost occurred in the screen on twenty-three nights, the lowest shade temperature being 6°·9, and for six consecutive days the thermometer did not once rise above the freezing point. The warmest winter (three months) was 1868-9, with a mean of 44°·4, or 5°·1 above the average. The second warmest winter was 1876-7, with a mean of 43°·7, which is 4°·4 above the average. The winters (December to February) with the mean 3° or more below the average are 1844-5, 1846-7, 1854-5, 1864-5, 1878-9, 1879-80, 1885-6, 1890-1, 1894-5. The winters with the mean 3° or more above the average are 1845-6, 1848-9, 1862-3, 1865-6, 1868-9, 1876-7, 1898-9, and the present winter, 1902-3, when the mean temperature was 3°·1 above the average. The mean temperature of February, 1903, was 45°·3, which is the warmest since 1869, and it was 16° warmer than 1855 and 1895. February had been cold for the previous three years, and it seemed probable that it would have been so this year, but experience has proved otherwise. At the commencement of the present winter, it was pretty confidently believed by many meteorologists that the winter would be severe, but such a belief has proved a most complete failure. It is, however, hoped that in the somewhat near future long period weather forecasts may be attempted. At present the forecaster is bound to admit his utter inability to form anything like an accurate estimate of our coming weather in England for more than twenty-four hours in advance, except when we are experiencing pronounced cyclonic or anticyclonic conditions, when we may with fair safety venture an opinion for, say, a week. The absolutely lowest winter temperatures at Greenwich (below 10°) are 4°·0 January 9, 1841; 7°·7 February 12, 1845; 8°·0 December 25, 1860; 6°·6 January 5, 1867; 9°·8 December 25, 1870; and 6°·9 February 8, 1895. The absolutely highest temperatures in each of the three winter months are December, 1848, 62°·4; January, 1843, 57°·0; February, 1846, 62°·3; 1868, 61°·7; 1869, 61°·6; 1878, 60°·5; 1891, 62°·1; 1899, 63°·9. The winter of 1885-6 was severe and very prolonged, and it is apparently the only winter with skating on the waters around London in each of the four months December to March.

The average rainfall at Greenwich for the winter six months for the last sixty years is 11·82 inches, and the winters with the aggregate rainfall in excess of 14 inches are 1852-3, 1865-6, 1868-9, 1872-3, 1876-7, 1880-1, 1882-3, 1896-7, 1899-1900. The wettest winter of the whole series was 1876-7, with an aggregate rainfall of 18·72 inches. The driest winters, with a rainfall below 8 inches, were 1858-9, 1873-4, 1879-80, 1890-1 and 1897-8. The driest winter was 1879-80, with a total rainfall of 5·54 inches. The aggregate rainfall for five out of the six winter months of the winter 1902-3 is 7·3 inches, which is 4·5 inches less than the average for the six months during the last sixty years, and it is exceedingly improbable that the whole winter (October to March) will prove to be wet. Only two years have been wet at Greenwich out of the last fourteen years, but seven of the last fourteen winters have been wet, and ten of the last fourteen Decembers have been wet. The tail end of the present winter is proving very stormy, and for their destructive character the recent gales, as shown by the publications of the Meteorological Office, seem likely to prove as generally disastrous as any experienced for a long time past.

CHAS. HARDING.

A UNIQUE VARIABLE STAR.

MESSRS. MÜLLER and Kempf, of the Astrophysical Observatory of Potsdam, have recently announced the discovery of a variable star of so short a period that it must take a unique position among this class of phenomena. Up to this time the variables which went through a complete cycle of their light phases in the shortest time were those two stars situated in the rich star cluster ω Centauri; these bodies completed their periods in 7h. 11·4m. and 7h. 42·8m. Another variable running these rather close is that of S. Antliæ, the period of which is 7h. 46·8m. The new variable is, however, of a much shorter period than any of these, nearly one-half as short, occupying only four hours and a few seconds to complete its light changes.

The discoverers of this variable had their attention first brought to this object in their work on the photometric survey, in which it was noticed that there was a great difference between two measures of this star (B.D. + 56°1400, R.A. = 9h. 36m. 44s., Decl. + 56° 24′·6, 1900) that exceeded the usual error of observation. A closer examination of the star itself was then undertaken, and a series of observations extending over the year 1902, and part of this year, was made. The account of this research, recently published (*Sitz. Ber. der K. Preuss. Ak. der Wiss.*, February 5, 1903, vii.), gives the details of the observations and the conclusions arrived at.

The diagram accompanying the paper shows that the light-changes at an epoch of minimum vary very quickly, the curve being quite pointed at these times. From minimum to maximum the light changes at rather a slower rate than from maximum to minimum, and at about maximum the star apparently changes its magnitude very little, so that the exact epoch of the maximum is not so easy to determine as that of the minimum. During these changes the magnitude varies from 8·58 to 7·9, and the length of the period, as at present determined, is 4h. 0m. 12·8s., with an error, as stated, of probably about 0·5s. For computing the times of minima the following equation is given :—

Min. = 1903 January 14, 4h. 32m. (Greenwich mean time) + 4h. 0m. 12·8s. E.

The discoverers suggest that the hypothesis of stellar variability, which best seems to explain this light curve, is that which involves two bright bodies revolving at a small distance round their centre of gravity, the plane of revolution being nearly in the line of sight. It will be interesting, therefore, to examine this variable spectroscopically and see whether the spectrum changes and if so in what manner.

WILLIAM J. S. LOCKYER.

NOTES.

THE French Congress of Scientific Societies will hold its forty-first annual meeting at Bordeaux on April 14–18.

THE deaths are announced of Prof. C. Dufour, professor of astronomy at the University of Lausanne, and of Prof. René Mamert, professor of chemistry at the University of Freiberg.

IT is announced in *Science* that Prof. George B. Shattuck, professor of physiographic geology of the Johns Hopkins University, has been authorised to organise an expedition for a systematic scientific survey of the Bahama Islands.

THE executive committee of the Carnegie Institution has approved a grant of 300*l.* to Mr. G. R. Wieland, of the Yale University Museum, for the continuation during the year 1903 of his researches on the structure of the living and fossil cycads.

PROF. J. B. TINGLE, professor of chemistry at Illinois College, Jacksonville, Ill., has received a grant of 100*l.* from the Carnegie Institution to enable him to continue his investigations of derivatives of camphor and allied compounds.

THE Academy of Sciences at Berlin has made grants of 200*l.* to Prof. Landolt and of 150*l.* to Dr. Marckwald, both of Berlin, for work in chemistry; of 100*l.* to Dr. Danneberg, of Aachen, for work in mineralogy; and of 80*l.* to Prof. Kobert, of Rostock, for work in pharmacology.

THE council of the Iron and Steel Institute has resolved to award the Bessemer gold medal for this year to Sir James Kitson, M.P., past-president, in recognition of his great services to the iron and steel industry of Great Britain. The presentation of the medal will be made by Mr. Andrew Carnegie at the annual meeting on May 7.

THE Paris Natural History Museum has received a gift of an important collection of Lepidoptera, containing about twenty thousand specimens, from M. E. Boullet. The donor desires that his collection be incorporated with the specimens already possessed by the Museum, so that in this way a series worthy of the Paris museum may be formed.

THE Lucy Wharton Drexel medal of the University of Pennsylvania has been presented to Prof. F. W. Putnam. The medal was established four years ago, but no awards were made until this year, when four were awarded at one time, the other recipients being Prof. Petrie, for his work at Abydos; Dr. Evans, for his excavations at Crete; and Prof. Hilprecht, for work in Babylonia.

WE learn from *Science* that the Bill creating a department of commerce in the United States, with a secretary in the Cabinet, has passed the House and Senate. The new department will include, with other departments, the Lighthouse Board, the Lighthouse Establishment, the Bureau of Navigation, the Bureau of Standards, the Coast and Geodetic Survey and the Bureau of Foreign Commerce (now in the Department of State).

IT was reported last week that Vesuvius was in eruption. The following messages have since been received:—Wednesday, March 11.—Eruption increased in intensity. Huge columns of vapour emitted from the crater with blocks of incandescent lava. Friday, March 13.—Eruption continues, but with decreased intensity. Two rents have opened in the central crater, and from these molten lava and pumice are ejected at half-minute intervals. The bombs are sometimes thrown to a height of 1000 feet.

A DIVISION OF HYDROLOGY has recently been added to the Hydrographic Branch of the United States Geological Survey. The work of the division will include the gathering and filing of well records of all kinds, the study of artesian and other problems relating to underground waters, and the investigation of the stratigraphy of the water-bearing and associated rocks. In addition to the gathering of statistics relating to the flow, cost, &c., of the wells, it is hoped in the future to give especial attention to the geological features which govern, or which are related in any way to, the supply of water.

M. BIALYNITSKY-BIROULIN, the zoologist of Baron Toll's Arctic expedition, has stated to the Irkutsk branch of the Russian Imperial Geographical Society that Baron Toll left the yacht *Sarja* on June 9 on the islands of the north coast and proceeded to Cape Wyssoki, where he arrived on July 10. Here he deposited a statement to the effect that all was well with him and his followers, and that the dogs were in good condition. Baron Toll started for Bennett Land on July 13 with three sleighs and forty-five dogs. If a passage through the ice to the *Sarja* should not be open, M. Biroulin says that Baron Toll intended wintering in Bennett Land.

THE fourth annual general meeting of the National Association for the Prevention of Consumption and other forms of tuberculosis was held on Tuesday. Lord Derby occupied the chair, and in moving the adoption of the report, he referred to the interest which was taken by foreign countries through communication with the association in connection with the International Bureau. The report showed that the death rate from tuberculosis in Prussia had decreased since 1886, and, although a decrease had occurred in England, and the death rate was still lower than that of Germany, the decrease had not been so great as that in Prussia. The council expressed the opinion that the greater drop in the death rate from tuberculosis in Prussia was due to the widespread knowledge of tuberculosis, the preventive measures taken in that country, and the large number of sanatoria established during recent years. In Germany the individual was taken care of, and was watched by the State through all periods of the existence of the disease.

A REUTER telegram from Vienna states that Prof. Hanos Molisch, of Prague, "has reported to the Vienna Academy of Sciences the discovery of a lamp lighted by means of bacteria." It will be remembered that, at the Royal Society conversazione in May, 1901, Mr. J. E. Barnard and Dr. Allan Macfadyen exhibited several striking experiments with luminous bacteria from the bacteriological laboratory of the Jenner Institute of Preventive Medicine. A year ago (April 10, 1902) Mr. Barnard contributed an account of luminous bacteria to these columns, and his remarks were illustrated by reproductions of cultures of these organisms. Prof. Molisch's lamp would seem to offer another instance of the industrial application of the results of research in pure science. According to the Reuter message, "the lamp consists of a glass vessel, in which a lining of saltpetre and gelatine inoculated with bacteria is placed. Two days

after inoculation the vessel becomes illuminated with a wonderful bluish-green light, caused by the innumerable bacteria which have developed in the time. The light will burn brilliantly for from two to three weeks afterwards, diminishing in brightness."

THE following annual awards have been decided by the council of the Royal Geographical Society, and the King, as patron, has approved of the award of the two Royal medals. The founder's medal to Mr. Douglas W. Freshfield, for his explorations in the Caucasus and the Himalaya, and for his persistent efforts to extend the scope and raise the standard of geographical education.—The other Royal medal to Captain Otto Sverdrup, the leader of the *Fram* expedition, extending over a period of four years, which has done much to complete our knowledge of the geography of the Arctic regions. Captain Sverdrup was captain of the *Fram* during Dr. Nansen's great expedition, and assumed command when Nansen left the ship.—The Victoria medal for geographical research to Dr. Sven Hedin.—The Murchison grant to Mr. Isaachsen, a lieutenant in the Norwegian army, who accompanied Captain Sverdrup on his last expedition.—The Gill memorial to Mr. Ellsworth Huntington, an American traveller, for his journey through the Great Cañon of the Euphrates River, during which he made valuable observations in physical geography.—The Back grant to Dr. W. G. Smith, of Yorkshire College, Leeds, for his investigations into the geographical distribution of vegetation in Yorkshire, embodied in maps and a paper which will shortly be published.—The Peek grant to Major Burdon, who has compiled a number of excellent route maps as the result of his journeys in Northern Nigeria.

WE have received a paper on "A Scale of Interference Colours," by M. Camille Craft, reprinted from the *Bulletin de l'Académie des Sciences de Cracovie*. The object of the author was to examine the interference colours produced by thin films, and to observe the positions and breadths of the black bands in the spectra of these colours. A Biot's compensator was employed, composed of three quartz plates cut parallel to the axis, two plates being slightly wedge-shaped so that the thickness could be adjusted within considerable limits. The plates were immersed in essence of anise, which has a refractive index nearly equal to that of quartz, and the light traversing the compensator was polarised and analysed by means of Nicols. Spectra of the colours were formed by the aid of a Rowland grating. Tables and curves are given for five different sources of white light. Further, the correspondence of the interference colours produced in the above manner with those due to a thin air film are also tabulated.

THE first part of the report of the expedition, consisting of Dr. Tempest Anderson and Dr. J. S. Flett, that was sent out last year by the Royal Society to investigate the eruptions of the Soufrière in St. Vincent has just been published as a separate paper from the *Philosophical Transactions*. The report occupies two hundred pages, and is illustrated by eighteen fine plates representing the characteristics and effects of the eruptions. The preliminary report of the expedition was summarised in NATURE of August 21, 1902 (vol. lxvi. p. 402).

THE dust fall recently recorded in many parts of the south of England and Wales seems to have been more extensive than was at first supposed. Information is now coming to hand to show that some parts of the Continent were also visited. In Austria (*Meteorologische Zeitschrift*, Heft ii., February, 1903) the dust fall seems to have been on quite a large scale, judging by the accounts given in the above-mentioned journal. At Kremsmünster, for instance, dust fell both on February 22 and 23, with the wind in the west, and there was a haze described as smoke-like. In Lower Austria, at Loosdorf, on the afternoon of February 23, all the trees were covered with a yellow dust. Similar phenomena were recorded at Pyhrn (Upper Austria), at Graz and other places.

WE have received in the form of a supplement to "Wragge," January 22, 1903, a letter addressed to the people of the Australian Commonwealth by Mr. C. L. Wragge. It deals with the circumstances under which the grant for the maintenance of the observatory, established in December, 1897, through Mr. Wragge's exertions, upon the summit of Mount Kosciusko, was withdrawn. It protests against the treatment which the enterprise has received from various Government authorities, and appeals to the Australian people to take over the pecuniary obligations in connection with the maintenance and dismantling of the observatory, which have apparently been surcharged upon the director.

THE summary of the weekly weather report (appendix i.), issued by the Meteorological Council, giving the rainfall values for the whole year 1902, and the means for thirty-seven years, 1866 to 1902, shows very clearly the differences from the average in the eleven districts into which the British Islands are divided for the purposes of weather forecasts. It is seen that in only two districts, the north and west of Scotland, the rainfall exceeded the average (in the latter case to the extent of nearly seven inches). In the north-west of England the deficit was nearly nine inches, and in the south-west of England nearly eight inches; in all other districts the deficit varied from two to four inches. In the principal wheat-producing and grazing districts, and for the whole of the British Islands, the general means for the year 1902 were about three inches below the average.

FATHER BAUR, director of the Ignatius College Observatory at Valkenburg, Holland, and Father Cortie, of Stonyhurst College, have written to us with reference to the English version of Dr. Paul Bergholz's "Orkane des fernen Ostens," revised by Dr. R. H. Scott and reviewed in NATURE of May 15, 1902 (vol. lxvi. p. 51). They point out that Dr. Bergholz's work is itself an abridged translation of one by Father José Algué, director of the Manila Observatory, entitled "Baguios ó Ciclones Filipinos," which appeared in 1897. Dr. Bergholz acknowledges his indebtedness to Father Algué in his preface, but the relationship between the German and the Spanish books is not clearly stated, and neither our reviewer of the English edition nor meteorologists generally were aware of it. The following letter, which Dr. Scott has kindly sent us, shows that Father Algué must be given the credit for the original work:—"With reference to the work by Dr. Bergholz, I can only say that when, in March, 1900, I commenced the revision of the English version of the book, 'Hurricanes of the Far East,' to correct the German idioms in the sheets sent to me, I had not seen the work by Padre Algué, 'Baguios ó Ciclones Filipinos,' for no copy of it had reached the Meteorological Office at that date. I noticed frequent reference to the Spanish work in Dr. Bergholz's proofs, and supposed that an understanding existed between him and Padre Algué, which it appears is not the case. Dr. Bergholz, in his preface, acknowledges that he has used Padre Algué's work freely."

PROF. G. HELLMANN, of the Prussian Meteorological Institute, has recently published another rain-chart in addition to those that have already appeared. In the present instance

the region surveyed in this way is the province of Westphalia, including Waldeck, Schaumburg-Lippe, Lippe-Detmold and the neighbourhood of Rinteln. The chart, which is published by Messrs. Dietrich Reimer in Berlin, contains, besides tables, an explanatory text describing much useful information concerning the monthly and yearly rainfalls of the various districts. The mean values employed are those that have been determined from a reduction of observations extending over the ten years 1892-1901, and 201 stations have been included in the discussion. Although the period of ten years is rather short for some purposes of deduction, when it is considered that there is a secular variation of rainfall of about thirty-five years, yet Prof. Hellmann gives some interesting figures in respect to the variation of rainfall in this decade. Thus he says that for all practical purposes it can be assumed that in the province of Westphalia the yearly fall varies between 134 and 66 per cent. of the mean value, or that during the wettest year twice as much rain fell as in the driest year. From the statistics of two stations, as Gütersloh and Arnsberg, extending from 1836 and 1866 respectively, the wettest years were 1841, 1843, 1867, 1880, 1882 for the former, and 1867, 1880, 1882, 1895, 1898 for the latter. The driest years for the two places were 1847, 1857, 1865, 1874, 1885, and 1874, 1887, 1892 respectively.

Two simple lecture experiments described by Dr. Garbasso, of Turin, in the *Nuovo Cimento* are worthy of notice. One consists in arranging three Bunsen coils, of E.M.F. 1·8 volts and internal resistance 0·1 ohms, successively in series and in parallel, first with a wire of resistance 0·009 ohms, and secondly with a lamp of resistance 10 ohms. A calculation of the currents produced in the four cases is confirmed by the experimental result that the wire glows when the cells are in parallel but not when they are in series, while the lamp glows when they are in series but not when they are in parallel. The second experiment consists in showing the dynamical action between unlike parallel elements of the same current by means of a so-called "plane spiral," which consists of a wire bent so as to form branches alternately to the right and left, separated by vertical portions. When a current is passed through the wire the "spiral" becomes elongated, and that this effect is not due to heating is shown by breaking the current; if the latter has been of short duration, the spiral will resume its previous length. The spirals of Roget utilised by Róiti in his interrupter show the attractive force between elements of like parallel currents; in the present case the current elements are unlike, and they repel each other.

Considerable uncertainty has in the past prevailed regarding the limits of combustibility of different flames as measured by the percentage of carbon dioxide and other combustion products at the instant when extinction occurs. Different writers have given numbers varying from 1·7 per cent. of carbon dioxide for a small petroleum lamp up to 14 or even 25 per cent. for a candle. A series of experiments described by MM. L. Pelet and P. Jomini in the *Moniteur scientifique* tends to throw light on the question. The combustible was in every case burnt in a bell glass, and the gases remaining analysed after extinction. The general conclusion is that the limit of combustibility is not always the same for the same substance. It depends (*a*) on the nature of the substance, (*b*) on the temperature of the flame, (*c*) on the quantity of combustible gas introduced into the flame per unit of time, and (*d*) on the temperature of the surrounding air. The first three factors, however, are dependent to a large extent on each other, especially for liquid and solid combustibles, and it results that the chemical equilibrium between the combustibles, the oxygen and the products of combustion is a function of the temperatures alone. A practical application of the results to bath-heaters is considered.

An article on the "Common Basis of the Theories of Microscopic Vision," contributed to the *Zeitschrift für wissenschaftliche Microscopie* by Mr. Julius Rheinberg, has been translated by the author and published in pamphlet form. The method of formation of an image by a microscope objective is considered in detail, from the point of view of the wave theory of light. By the use of carefully drawn diagrams, mathematical analysis is entirely dispensed with, while yet clear quantitative results are obtained. The general effect of a lens in altering the curvature of light waves passing through it is now generally known, but the conditions determining the resolving power of a lens might be popularised with advantage, and the pamphlet before us is well adapted to this end. Even those possessing the knowledge requisite to pursue the mathematical investigation of the subject will find it interesting and profitable to follow the author in his lucid and painstaking effort to obtain an explanation directly from first principles. Several reproductions of photographs are given, and these render the argument more effective. Those unacquainted with the wave theory will be surprised to find that, on looking through a microscope at a number of lines ruled on glass, it is possible, under suitable conditions, to see more lines than are actually in existence; so far from being true is the old adage that "seeing is believing."

We have received two parts of the *Nat. Hist. Trans.* of Northumberland, Durham and Newcastle. In the one (vol. xii. part ii.) Mr. J. E. Robson completes the first volume of his catalogue of the Lepidoptera of the district. The second (xiv. part i.) includes a report on dredging and other marine researches undertaken by the Society in 1901. It is suggested that some of the flagellate infusorians met with in parts of the North Sea where there is no plankton may subsist on dissolved salts, like algas, and thus form the means whereby inorganic are converted into organic substances. This account is supplemented by the report on the scientific investigations carried out during 1902 under the direction of the Northumberland Sea Fisheries Committee. As regards fishing, the committee has to record an unusually successful season, and it gives an elaborate return of the number of marketable fishes captured. The report includes an account of the structural changes which take place in the common crab during the shedding of its shell, and likewise a description of its normal growth.

Prof. Grenville Cole has contributed to a work entitled "Ireland: Industrial and Agricultural" an interesting sketch of the topography and geology of the country, and an account of Irish minerals and building stones.

In a report upon the present condition of Rhodesia, presented to the Directors of the British South Africa Company (1903), Mr. J. F. Jones, C.M.G., expresses a sanguine opinion about the future of the country. There appears to be plenty of good coal, the auriferous deposits are of a "highly payable nature," while the "copper, zinc and lead deposits promise to rank among the richest in the world."

Dr. A. von Krafft describes the "Exotic Blocks" of Malla Johar in the Bhot Mahals of Kumaon (*Mem.* Geol. Surv. India, vol. xxxii. part iii., 1902). These blocks he attributes to volcanic outbursts, they being fragments torn from rocks *in situ*, through which the volcanic material

was forced. Many of the blocks exceed ten feet in diameter, while the smaller blocks are innumerable. Most of them are limestones, and some are sandstones, and they belong chiefly to Permo-Carboniferous, Trias, Lias and Flysch.

IN the *Proceedings* of the Nova Scotian Institute of Science (vol. x. part iii., 1902) Mr. W. H. Prest, who contributes an article on drift ice, states his conclusion that the Grand Banks of Newfoundland are almost solely the products of the period of maximum ice-erosion; they are principally due to prolonged wave action on true glacial moraines, and receive very little débris from the modern polar ice. Dr. H. M. Ami describes some tracks on a slab of Devonian sandstone, evidently made by a fin or spine-like appendage, possibly of a fish. There are sundry other papers dealing with local geology and natural history.

MR. T. H. HOLLAND contributes an interesting and important article on "The Mica Deposits of India" to the *Memoirs* of the Geological Survey (vol. xxxiv. part ii., Calcutta, 1902). He discusses the mineralogical and chemical characters, the geological occurrence and distribution, the uses of mica, and the mining practice. Crystals or "books" of muscovite-mica have been obtained in Nellore district, measuring ten feet across the basal planes, but usually they are much smaller. This mica occurs in granite-pegmatite, and being the most delicate mineral in the rock, it is the first to show the effects of crushing earth-movements, so that large quantities of valuable mineral have been destroyed; but the author observes it is on account of the remarkable stability of the Indian Peninsula, the geologically long and perfect quiescence it has enjoyed, that India is able to boast of the finest mica deposits in the world.

WE have received the annual report for 1901 of the Iowa Geological Survey, with accompanying papers. Mr. Samuel Calvin, the State Geologist, refers to the fact that the succession of events during the Glacial epoch is more clearly recorded in Iowa than elsewhere in America. Five Glacial and four inter-Glacial stages are recognised. He refers also to the subject of petroleum and natural gas, which occupy a large share of public attention; and remarks that it was not until the Trenton period of the Ordovician that life existed in such profusion as to furnish organic matter in sufficient amount to give rise to considerable quantities of gas or oil. Of succeeding formations those of Carboniferous, Cretaceous and Tertiary age are the most prolific in oil and gas. Statistics of the mineral production of Iowa for 1901 are contributed by Mr. S. W. Beyer. The geology of Webster county is dealt with by Mr. F. A. Wilder, who gives a particular account of the gypsum industry in Iowa, and a chapter on that of Germany. In Iowa, gypsum available for economic purposes is said to occur over at least forty square miles, and the average thickness of the mineral suitable for plaster is ten feet. Mr. T. E. Savage, who describes Webster county, gives particulars of the Carboniferous Limestone fauna, a subject also dealt with by Mr. J. A. Udden in reference to Jefferson county, and by Mr. A. G. Leonard in describing Wapello county. In Cherokee and Buena Vista counties the Pleistocene deposits and those of recent age occupy the entire region, and they are described by Mr. T. H. Macbride. The volume is well illustrated with maps, diagrams and pictorial views.

THE Indian *Monthly Weather Review* for July of last year gives an interesting account of some severe earthquake shocks which were experienced at Bunder Abbas, in the Persian Gulf, on July 9, 13, 18 and 20, of which the following is an abstract. The first shock, which was felt on July 9, was preceded by a strange rumbling noise, like thunder or the roar of big guns away out at sea, proceeding from the direction of the island of Kishm. The people in Bunder Abbas, astonished and alarmed, rushed from their houses and looked towards the island from which the noise seemed to come. Suddenly the first shock was felt, and this brought down a house in the vicinity of the bazaar with a crash, nearly killing a passer-by. The shocks were almost continuous, and kept the buildings in motion for nearly two minutes; they brought down some big boulders from the Portuguese fort, in which the governor resides, and these in turn unroofed the adjoining Customs Office. The tall buildings and wind towers either collapsed or remained in dangerous conditions. At Socr suburb, distant two and a half miles, the ground opened and water poured in. Most of the buildings were destroyed and several lives lost. Information from Kishm recorded the total destruction of most of the houses, but no loss of life. In Ormuz part of an old fortress collapsed, and slight shocks were felt at Minan, forty miles away. The earthquake was felt also on the hills behind the town of Bunder Abbas, and a cloud of dust obscured everything. On July 13, 18 and 20 more shocks were felt, all of which brought down numerous buildings, and after that the shocks continued almost daily. It is stated that there was not a building in Bunder Abbas which had not suffered. The bazaars and shops were closed and provisions difficult to obtain. Houses were abandoned, and everybody encamped in huts on the Maidan behind the town, at Naiband, or on the coast.

THE thirty-third annual report shows that the Wellington College Natural Science Society continues to flourish. The meteorological report for 1902 is a useful and instructive record, and the abstracts of lectures delivered before the Society show that interest is taken in the progress of knowledge.

THE sixteenth annual issue of the "School Calendar" has been published by Messrs. Whittaker and Co. at 1s. net. It contains complete and up-to-date particulars of available scholarships at the universities and colleges of Great Britain, in addition to other information likely to be of assistance to persons engaged in educational work.

THE Home Office has issued a set of tables relating to the output of coal and other minerals, and the number of persons employed during the year 1902 at mines under the Coal and Metalliferous Mines Regulation Acts. It is noteworthy that the output of coal, which was 219,037,240 tons in 1901, was 227,178,140 tons in 1902, showing an increase of 8,140,900 tons.

THE sixty-third volume, being that for 1902, of the *Journal* of the Royal Agricultural Society of England, has now been published by Mr. John Murray. Among the special articles of interest are those by Mr. Cecil Warburton, on orchard and bush-fruit pests and how to combat them; and by Dr. N. H. J. Miller, on the experiments at Rothamsted on the changes in the composition of mangels during storage. The official reports, which form the second part of the volume, include one by Dr. J. A. Voelcker, describing the field, the feeding and the pot-culture experiments at the Woburn experimental station of the Royal Agricultural Society. The third part of the volume contains, with much other important information, a summary by the editor of the recent evidence as to the identity of human and bovine tuberculosis, and reviews by Mr. W. Carruthers, F.R.S., of new works on agricultural botany, and by Dr. H. B. Woodward, F.R.S., of a work on agricultural geology.

THE additions to the Zoological Society's Gardens during the past week include two Magellanic Foxes (*Canis magellanicus*) from South America, presented by Baron Adolp Ott; a European Pond Tortoise (*Emys orbicularis*), European, presented by Mr. E. A. Hambro; two Smooth-headed Capuchins (*Cebus monachus*) from South-east Brazil, a Negro Tamarin (*Midas ursulus*) from Guiana, two Grant's Zebras (*Equus granti*) from North-east Africa, four Hutchin's Geese (*Bernicla hutchinsi*) from Arctic America, six Dark-green Snakes (*Zamenis gemonensis*), two Lacertine Snakes (*Coelpeltis monspessulana*), a Vivacious Snake (*Tarbophis fallax*), European, deposited.

OUR ASTRONOMICAL COLUMN.

NEW SPECTROSCOPIC BINARIES.—In a paper communicated to the Astronomical and Astrophysical Society of America Profs. Frost and Adams announce the discovery of six stars of the Orion type having variable radial velocities, and two or three stars of the same type which are supposed to be spectroscopic binaries.

Of the former, δ Ceti shows a range of velocity from +6 to +16 km. per second, and its period is short; the velocity of ζ Tauri has a range of +7 to +34 km. per second, and a probable period of about fourteen days; the spectrum of this star is rather peculiar, in that the hydrogen lines β and γ are sharp and strong, whilst the other lines (some of them metallic) are faint. In the case of υ Eridani a variation in the velocity of + 3 to +26 km. per second is indicated.

Two or three other stars of the Orion type are suspected of having variable radial velocities, but the facts are not yet fully established. The proportion of spectroscopic binaries found amongst the stars of this type which have hitherto been examined is 1 : 5 (*Science*, n.s., vol. xvii. No. 426).

THE SPECTRUM OF COMET 1902 *b*.—In a communication to the March *Bulletin de la Société de France*, M. de la Baume Pluvinel discusses the spectra of comet 1902 *b*, which he has obtained, using a prism of 20° 18′, mounted in front of an objective the focal length of which was four times its aperture.

In a spectrum obtained on October 24, with one hour's exposure, the positions of fifteen condensations (*i.e.* images of the comet) were found to be measurable; the spectrum of Vega was photographed on both sides of the cometary spectrum as a comparison.

Two condensations at λ 472 and λ 389 respectively were found to be by far the strongest, these radiations evidently accounting for almost all the actinic light emitted by the comet, and, therefore, in photographing such objects it would be advisable to use an objective which brings these two radiations to the focus simultaneously.

Of the other condensations measured, the most important one extends from λ 409·2 to λ 400·0, and was far more intense on a negative obtained on October 13, when the comet was at a greater distance from the sun, than on the one obtained on October 24.

The conclusion arrived at from the detailed examination and discussion of the spectrum is that in the light emitted by this comet occur (1) the chief radiations emitted by carbon in the electric arc, viz. λ 564, λ 518 and λ 472 belonging to the spectrum of hydrocarbons, and λ 389 belonging to the cyanogen (?) spectrum; (2) the radiation λ 431·2, which appears in the flame spectra of the hydrocarbons; and (3) a group of radiations, λ 409·2 to λ 400·0, which corresponds to no carbon group.

MISSING ASTEROIDS.—In *Circular* No. 69 of the Harvard College Observatory Prof. E. C. Pickering directs attention to the fact that of the five hundred minor planets already discovered, sixty-eight have not been observed for the last five years, and the last observations of about twenty-five of them were made from ten to thirty years ago. He then proceeds to point out the danger that may arise from allowing these objects to remain unobserved, and their elements and ephemerides uncomputed, for an observer can never be certain whether the object he is observing is a new discovery or not, and so might pass over such an object as Eros, supposing it to be one which had been recorded previously.

Prof. Pickering concludes that it is a much more important work to rediscover all those minor planets previously recorded and determine their elements than to go on adding to the list by the discovery of new ones. Acting on this conclusion the Harvard observers prepared a list of all the asteroids, brighter than the eleventh magnitude, which have not been observed during the last five years, and have already photographed (21) Lutetia and (22) Kalliope (on plates obtained on January 21 and 22), which were last observed in 1897 and 1896 respectively, and they find that the error of the ephemeris given for the latter is large enough to render the finding of this object a difficult matter.

A RICH NEBULOUS REGION IN THE CONSTELLATION LYNX.—Whilst pursuing a photographic search for the minor planet (475) Occlo with the Bruce telescope, Prof. Max Wolf has discovered from his plates a region situated on the borders of Ursa Major and the Lynx which is especially rich in small nebulous patches. One particularly dense region is about the point α=8h. 2m., δ=+46°·5 (1855), the centre lying between the two stars B.D.+48°.1366 (8·5m.) and B.D.+48°.1368 (8·4m.), where, in a circle having a radius of thirty minutes of arc, he was able to count at least forty small faint nebulæ.

Two of the nebulæ, having the positions α=8h. 3·0m., δ=+46° 25′ and α=8h. 3·7m., δ=+46° 9′ respectively, are worthy of particular notice. The first was observed by W. Herschel, and appears in his catalogue as iv.,55. It is bright, apparently round, has a diameter of about 1′ and several condensations, and should appear as a beautiful object in a large reflector.

So far as Prof. Wolf is aware, the second has hitherto not been recorded. It has a length of about 3·5 minutes of arc, is rectilineal and very narrow, and is moderately bright. It includes in its northern boundary a faint star the position angle of which is 350°, and lies about 1′ west of the star B.D.+46°.1371 (9·3m.) (*Astronomische Nachrichten*, No. 3847).

THE BIRDS OF BEMPTON CLIFFS.

A VERY interesting and beautifully illustrated account of the birds frequenting the chalk cliffs of Bempton, Yorkshire, and of the egging industry carried on by the natives, appears in part i. of the *Transactions* of the Hull

FIG. 1.—Newly-hatched Puffin. (From the "Birds of Bempton Cliffs.")

Scientific and Field Naturalists' Club. The author, Mr. E. W. Wade, commences by waxing enthusiastic over the wonderful sight presented by these precipitous cliffs when they are visited, in spring and summer, by swarms of sea-birds, among which guillemots are now predominant. In

former days the bird-life appears, however, to have been even more abundant than at the present day, this being especially the case with regard to kittiwakes, which were once found in thousands where there are now hundreds. So numerous, indeed, were these birds that there is a record of the heaps of twitch left in a field on a Saturday to be carted on the Monday having been carried off in the meantime by the gulls for nest building. The usual ruthless massacres of the old days were, however, responsible for so reducing the numbers of these birds that they were well-nigh exterminated by the time the Protection Acts once more gave them a chance.

After referring briefly to the puffin and the razorbill, accompanying his notice of the former by an excellent figure of a young bird (herewith reproduced), the author treats in considerable detail of the breeding habits and eggs of the guillemot. Attention is called to the number of young ones and eggs which are destroyed by falling down the cliffs when the birds are suddenly frightened, the author expressing his belief that a guillemot will intentionally roll its egg from the ledge on which it rests if she thinks it is about to be carried off. The remarkable variation displayed by guillemot eggs naturally claims a share of attention, although the author confesses that he is unable to give any reason for the phenomenon. In this connection it may be

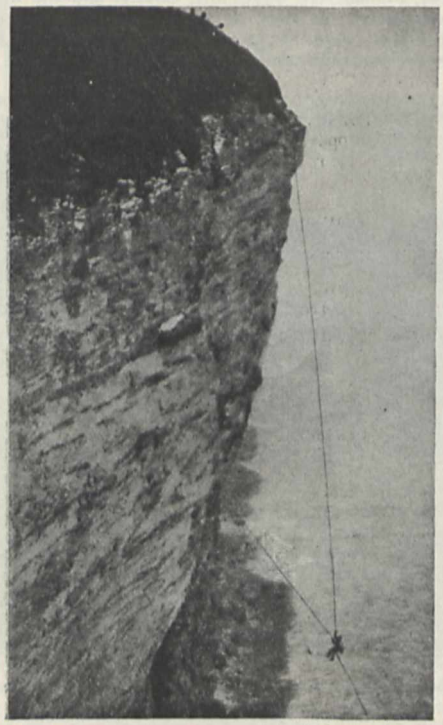


FIG. 2.—A descent in search of eggs. (From the "Birds of Bempton Cliffs.")

mentioned that a magnificent series of these eggs, showing nearly all the chief types of variation, has recently been placed on exhibition in the Natural History Museum.

Cliff-climbing in Yorkshire is always effected by means of ropes, the author describing it as the most delightful and exciting form of gymnastics. Judging from the illustration here reproduced, some of our readers might think it a trifle too exciting. At the present time from 300 to 400 eggs are collected daily during the season, the total take being about 130,000. In spite of this drain the numbers of the birds annually increase. The price of the eggs varies from twelve to sixteen a shilling, abnormally marked specimens fetching from 2*d.* to 7*s.* 6*d.*, or even more, each. R. L.

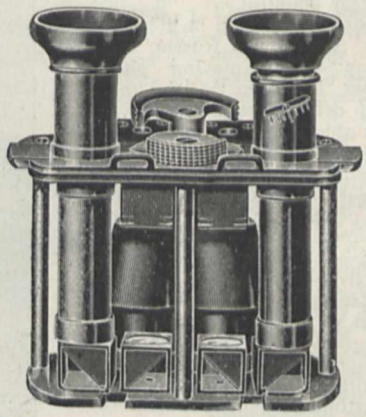
A NEW BINOCULAR.

A NEW form of prismatic binocular, styled the "Service," has recently been issued by Messrs. J. H. Dallmeyer, and there are many interesting features about it for which special advantages may be claimed. As a rule, binoculars consist of two independent optical trains in separate coverings, either hinged together to allow for the different gauges between the separation of human eyes, or made in different sizes to suit these various distances. In the present form the whole optical arrangement is enclosed in one cover, and in consequence of this, six out of the eight prisms employed and the two objective sliding tubes can all be fixed rigidly to one frame, thus ensuring maintenance of adjustment and strength in adverse circumstances.

The separation of the eye-pieces is secured by a screw adjustment situated between them, by which each eye-piece with one prism slides in strong grooves in a lateral direction. For any one individual this adjustment is constant, so that when once the correct position has been attained a permanent mark can be made, and this position quickly regained at any other time; the maximum separation between the centres of the eye-pieces is 70 mm. and the minimum 55 mm., so plenty of latitude is available for abnormal eyes.

There is another screw adjustment for the ordinary focusing, and one of the eye-pieces can be separately adjusted by means of a graduated spiral movement in case the observer's eyes are not similar. All these different manipulations can be easily made when only one hand is available, and the whole mechanism can be fully exposed for cleaning the optical surfaces by simply taking out four screws which in no way interfere with any of the adjustments.

Constructed chiefly of magnalium, and in parts of gun-



metal, the glasses are light in weight, and it is claimed that they are smaller, power for power, than any other prismatic glass yet made. There are five sizes on the market varying in magnifying power from four to twelve times, the former weighing thirteen and the latter sixteen ounces; the smaller sizes are suitable for theatre or night use.

SEISMOLOGICAL NOTES.

THE last publication of the Earthquake Investigation Committee of Japan, issued this year, is of special interest to those engaged in seismometry. In it Prof. A. Tanakadate describes a vertical motion seismometer, in which a mass is so suspended that it is not affected by tilting or by horizontal shocks, and remains in neutral equilibrium for vertical displacements of considerable magnitude. Until this instrument was devised, for large earthquakes at least, vertical spring seismographs, and for that matter horizontal bracket seismographs, have responded to the changes in inclination of their supports, with the result that they have

behaved as clinographs, and components of vertical and horizontal movements have not been faithfully recorded. Mr. Imamura gives results relating to the speeds at which earthquake motion has been propagated over the Tokio area. At four stations, from 2 to 10 kilometres apart, and connected by telegraph, seismographs were arranged each of which gave an open diagram on a surface marked by time intervals sent from the Seismological Institute. From the differences in time at which the same wave was recorded at different stations, the speed of that wave was determined. The surface velocity arrived at is that $V = 3{\cdot}28 \pm 0{\cdot}05$ kilometres per second, but as to whether different waves in the same earthquake travel with the same speed, which we think is not the case, we are left in darkness. In a paper on after shocks, Prof. Ōmori shows that the expected or calculated number of such settlements for a given period closely accords with observation. By maps and diagrams he also shows the space distribution of after shocks, there being, as might be expected, fewer of these disturbances recorded at places distant from a *focus* than at those comparatively near.

In a paper on pendulum seismographs (*Bollettino della Societa Sismologia Italiana*, vol. vii.) Dr. Agamennone eulogises the work of the Seismological Society of Japan for the revolutionary effect it has had upon seismometry. For 130 years prior to the existence of this Society the ordinary instrument employed to record earthquakes was a vertical pendulum. Subsequently horizontal pendulums were used, and seismometers took the place of seismoscopes. The results which have been achieved by the new types of instruments as recorders of movements that can be felt are well known, but the value of the records relating to earthquake motion which has radiated to great distances, beyond timing certain phases of motion, is very doubtful.

The horizontal pendulum largely used in Germany, Austria and Russia, when recording on slowly moving photographic paper, has been referred to as a species of delicate seismoscope. To some extent this may be true, but yet it records certain phases of motion, and frequently picks up small disturbances which are not recorded by more cumbrous forms of apparatus. In his paper Dr. Agamennone gives three seismograms obtained from ordinary pendulums, respectively 16, 8 and 3 metres in length, written upon surfaces moving at rates of from 26 to 40 metres per hour. Such seismograms show the earthquake vibrations superimposed upon those due to the swinging of the pendulums. For recording earthquakes at great distances from their origins, Dr. Ōmori not only advocates the use of quickly moving surfaces, but that a horizontal type of pendulum should be employed the period of which should be long. On account of the diurnal and other wanderings of such a pendulum, for most foundations this period is, however, limited to about thirty seconds.

Other seismologists have also suggestions, and when it is remembered that in a given earthquake continuing for several hours there are groups of waves with periods varying between a fraction of a second and a minute, it is easy to imagine that this should be the case.

In short, so far as the recording of the period and amplitude of unfelt earthquakes are concerned, seismologists are not in step, and until opinions are less divided, which is not likely to be the case until more experiments have been made, to impose a type of instrument upon the world for the purposes specified seems likely to prove detrimental to seismometrical inquiry.

In the last issue of the *Bollettino* of the Seismological Society of Italy, vol. viii. No. 6, M. Alippi gives a short paper on subterranean sounds. The mysterious detonations heard in Holland and on the shores of the North Sea known as *mist poeffers* are atmospheric phenomena. These, which may be the same as the sounds called *barisal guns*, must not be confounded with sounds originating in the earth. These latter, which by no means necessarily accompany earthquakes, are in Italy referred to as *rombo, bombio, bonniti* and other expressions clearly of onomatopoetic origin.

The remaining pages of the number contain the seismic register of Italy for March and April, 1901. The late appearance of this register is on account of the fact that it practically includes all observations made upon earthquakes which have been recorded in the Italian peninsula, and as these include world-shaking disturbances, the collection of material from foreign countries occupied considerable time.

As this publication stands *facile princeps* amongst its kind, Prof. Pietro Tacchini and his staff are to be congratulated on their useful work.

THE NEW BIOLOGICAL STATION AT PORT ERIN.

THE sixteenth annual report of the Liverpool Marine Biology Committee,[1] which records the completion and occupation of the new buildings at Port Erin, opens a fresh period in the history of this Committee, which was constituted in March, 1885, at a public gathering of the local naturalists from Liverpool, Manchester, Southport, Chester and the neighbourhood, summoned by Prof. Herdman for the purpose. The declared objects were "to investigate the marine fauna and flora (and any related subject such as submarine geology and the physical condition of the water) of Liverpool Bay and the neighbouring parts of the Irish Sea, and, if practicable, to establish and maintain a biological station on some convenient part of the coast." These ends have been kept steadily in view for the last seventeen years. At an early stage of the investigations, in 1887, the Committee established a small biological station on Puffin Island, off the north coast of Anglesey, and during the next five years this laboratory was kept up, and dredging and other exploring expeditions were carried on from it.

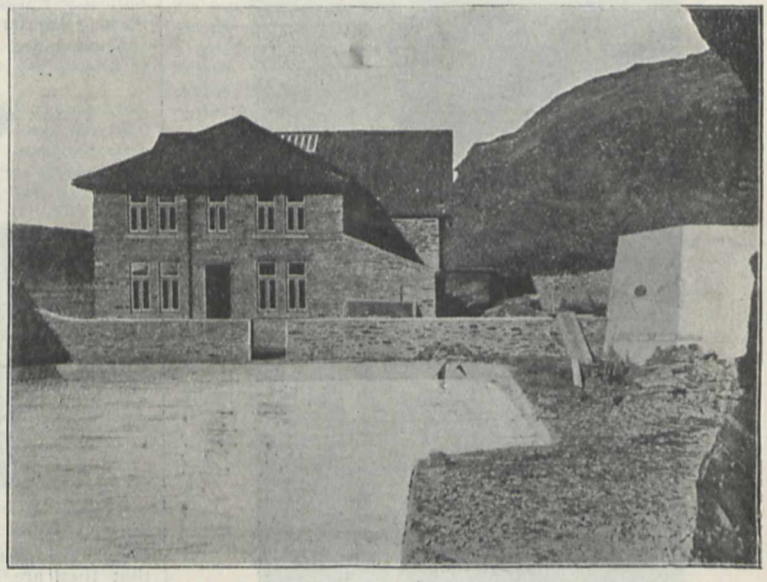


FIG. 1.—Western End of Station, showing Spawning Pond and Hatchery Entrance.

Then the centre of the Committee's field work was transferred from Anglesey to the Isle of Man—"from the Mona of Tacitus to the Mona of Cæsar." Here a small biological station was built on the northern side of Port Erin Bay and was formally opened for work on June 4, 1892, by Sir Spencer Walpole, then Governor of the island. Notices of the work carried on in this laboratory and of the dredging expeditions in the Irish Sea

[1] Liverpool: Tinling and Co., December, 1902.

during the last ten years have appeared from time to time in the pages of NATURE.

The alliance between a committee appointed by the Manx Government and the Liverpool Committee, which has now resulted in the provision of a much larger biological station on a better site at the southern side of Port Erin Bay, had its origin in the sea-fisheries work carried out on an experimental scale in the old station for the purpose of obtaining information for the Lancashire Sea-fisheries Committee.

The details of the arrangement concluded between the Manx and Liverpool committees are given in the report. It may suffice to say that the two committees have evidently worked most harmoniously together, and will no doubt continue to cooperate cordially and usefully. Of the three departments in the institution, the laboratory block will be wholly under the control of the Liverpool Committee, the fisheries block will belong solely to the Manx Committee, and the aquarium in the centre will be managed as a joint concern in the interests of both the scientific and economic work. The curator of the old biological station (Mr. H. C. Chadwick) has become curator of the whole institution, with a practical fisherman assistant under him, and the hon. director and chairman of the Liverpool Committee (Prof. Herdman) is recognised as being director also of the whole. This should secure unity of aim and economy of working, and will result in the various departments being mutually helpful. The fishery work will be instructive to the scientific students, and the investigations in the laboratory and experiments in the aquarium will be useful in connection with fishery problems. The aquarium, which, with its museum of local marine animals and plants in the gallery, occupies the large central block of the building, is the only part open to the public, and will, it is hoped, be useful alike (1) to the scientific workers in the laboratory, (2) for experiments and observations bearing on fishery questions and practice, and (3) as an educational influence which will be appreciated by the more intelligent visitors, and may, it is hoped, be taken advantage of by local schools for instruction in nature-study.

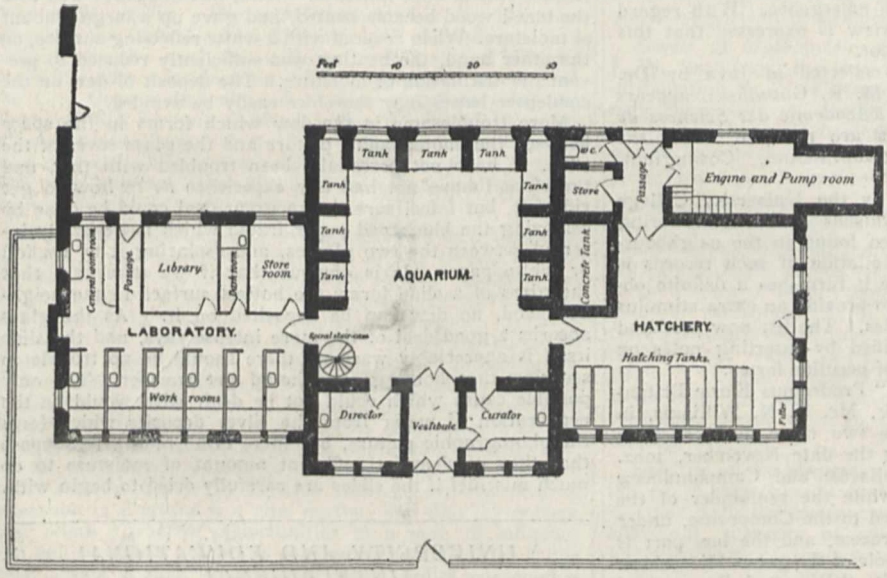


FIG. 2.—Plan of Ground Floor of Station.

The station is a plain but substantial two-storied stone building of nearly 100 feet in length by more than 40 feet in breadth, with a light railing in front and a large yard, enclosed by a wall, behind. At the western end (Fig. 1) is a large pond excavated in the rock, measuring about 90 feet in length, nearly 50 feet in breadth, varying from 3 to 10 feet in depth, and capable of containing about 130,000 gallons of sea-water.

The plan (Fig. 2) shows the division of the building into a central aquarium and lateral laboratory and fisheries wings, and gives the arrangement of the rooms on the ground floor. The upper storey has a broad gallery round the aquarium and large laboratories in the wings. Of the six small workrooms to the front on the ground floor, four are now permanently engaged by universities, leaving two still vacant. The junior laboratory on the floor above, it is announced, will be occupied by a class for school teachers during the Easter vacation.

For the information of students and other naturalists who may propose to visit the new biological station, it may be well to state that Port Erin is at the south-west end of the Isle of Man and occupies a fairly central position in the Irish Sea, being about 30 miles from Ireland, 33 from Scotland, 40 from Wales and 45 or so from England. The bay faces nearly due west, has sand at the end, and is bounded by precipitous cliffs both to the north and south. From its position and the shape of the land, Port Erin has within a distance of a couple of miles in three directions—to Fleshwick Bay, to the Calf Island and to Port St. Mary—a long and varied coast line with a number of small bays furnishing good collecting ground and shallow water for dredging. Two of these bays, Port Erin and Port St. Mary, have harbours with sailing boats and face in nearly opposite directions, so that in most winds one or other is sheltered and has a quiet sea.

The rich fauna round the Calf Island and off Spanish Head is within easy reach; while at a distance of three to four miles from the biological station are depths of 20 to 30 fathoms, and at 14 miles 60 to 70 fathoms depth is found.

The aquarium of the new station was opened to the public in the middle of August, and in October more than six hundred visitors had already paid for admission.

The report from which these remarks are extracted gives also an account of the scientific work undertaken by the Committee during the last year and records many additions to the local marine fauna, chiefly amongst the microscopic crustaceans worked out by Mr. A. Scott.

The report points out, finally, that while the change to the new building is advantageous in giving better accommodation and larger opportunities, it also gives increased labour and responsibility and in no way relieves the Liverpool Marine Biology Committee of financial burdens. The Committee retains its identity and constitution exactly as before, and the subscriptions from those who are kindly supporting the work will be required fully as much in the new building as they were in the old. The Manx Government subsidy will be entirely applied to the economic work in connection with the local sea-fisheries and will not be available for the purely scientific work of the biological station.

BOTANICAL NOTES.

UNDER the title of "Vegetationsbilder," Messrs. Gustav Fischer, of Jena, announce a series of photographic reproductions which will illustrate characteristic types of vegetation. Each part, consisting of six plates and the explanatory text, will be devoted to one region or formation, and will be complete in itself. The photographs were taken by Drs. Schenck and Karsten, who undertake the arrangement of the work. The first and second parts now received depict the scenery of South Brazil and of the Malay Archipelago; other parts of the eight projected will illustrate botanical features of South-West Africa, Mexico, tropical economic plants, &c. The photographs are reproduced nearly full-plate size, and recall the illustrations of Schimper's "Pflanzengeographie," which is published by the same firm.

The Yorkshire Naturalists' Union is fortunate in enlisting the services of specialists to assist in the compilation of county records, both botanical and zoological. Several series representing different branches of natural history have been, and are being, published in its *Transactions*. One part, lately issued, completes the county list of fresh-water algæ, which has appeared in four instalments, and for which Mr. W. West and Mr. G. S. West are responsible. Another volume, which is produced under the joint authority of Mr. G. Massee and Mr. C. Crossland, constitutes the first instalment of the "Fungus Flora of Yorkshire," and enumerates the Gasteromycetes and Agaricineæ. Although only a small portion of the county has been thoroughly explored, the list will summarise the results obtained during several successive annual forays, and will also include the records noted by independent collectors.

At the meeting of the American Association held in Washington last December, Prof. Douglas Campbell selected as the subject of his address "The Origin of Terrestrial Plants." The subject is one to which the writer has contributed many valuable suggestions and arguments, but on the present occasion no new ideas are presented. It may be noted that although Prof. Campbell alluded to the possibility of the leaf arising by mutation as a sudden outgrowth on the sporophyte, he looks upon the apophysis of the moss capsule as an early form of such emergence. With regard to the origin of the root, the view is expressed that this arises as a modification of the foot.

A list of fresh-water algæ, collected in Java by Dr. Raciborski, and named by Mr. M. R. Gutwiński, appears in the *Bulletin International de l'Academie des Sciences de Cracovie*. Sixteen new species are recorded under the genera Closterium, Penium, Xanthidium, Cosmarium, Staurastrum and Spirulina.

A small brochure, published by the University College of Wales Scientific Society, furnishes a list of flowering plants and ferns which have been found in the neighbourhood of Aberystwyth. The compilation of such records is to be strongly commended, since it furnishes a definite objective, and is therefore certain to provide an extra stimulus for the excursions of local societies. The list now produced may, with advantage, be amplified by inserting notes on habitats, dates and descriptions of peculiar forms.

The first specimen-part of the "Prodromus Floræ Britannicæ" was issued by the author, Mr. F. N. Williams, in June, 1901, and since that date two more numbers have been published, the last bearing the date November, 1902. The orders Cucurbitaceæ, Lobeliaceæ and Campanulaceæ appeared in the first portion, while the remainder of the work, so far as it goes, is devoted to the Compositæ, under the disguised name of the Asteraceæ, and the last part is given up to and contains the whole of the genus Hieracium.

The presidential address on the "Rise and Progress of Ecology," delivered by Prof. V. M. Spalding before the Society for Plant Morphology and Physiology at the Washington meeting, appears in *Science*. The writer indicates two phases of the subject, the compilation of facts and the subsequent incorporation of these into conclusions, and refers to a recent paper, by Mr. Paul Jacquard, on alpine plants.

The Annual report of the Board of Agriculture and Department of Public Gardens in Jamaica, for the year 1901-2, also an authorised Guide to Hope Gardens, have been received. In the former certain changes in the disposition of the staff are recorded, and also the approval of the legislative council for the purchase of land on St. Jagos estate, part of which may possibly be utilised for experimental work. A survey is given of horticultural experiments and educational work. The Guide includes a description of the botanic gardens by Mr. W. Jekyll.

In the current number of the Trinidad *Botanical Bulletin* there appears an instructive article on the care of pastures. It is pointed out that native grasses are likely to be more successful than those grown from imported seed, or if imported they may with advantage be introduced from countries which possess a similar climate. For the destruction of parasol ants, carbon bisulphide, used with due precaution, is recommended. In connection with this and other uses, such as a seed fumigator, an article giving American experience is reprinted.

THE PREVENTION OF DEW DEPOSITS ON LANTERN SLIDES.[1]

LANTERN slides are so commonly used in lecture illustrations that the following hints may prove to be useful:—

The deposit of dew which frequently takes place is very annoying, but its cause is easily traced, and, I believe, can easily be removed. Dew means that the surface on which it is deposited is colder than some other surface with which the air must have previously been in contact, and at which it has become saturated with moisture; hence the problem consists in discovering that surface, and in preventing its becoming hotter than the glass slide.

There is a kind of tradition amongst makers of lanterns and their accessories that every surface should be black. There is no reason at all for this practice, which is probably in all cases the cause of the trouble I am dealing with. My attention was called to the subject by a lantern used for the projection of objects much larger than the ordinary slides. When these were used, they were put in a wooden frame which presented a large carefully blackened surface to the condenser. The condenser always became quickly covered with dew. On pasting a sheet of white paper over the blackened wood of the frame which held the slides, the trouble was at once removed. What had happened was that the black wood became heated, and gave up a large amount of moisture. When covered with a white reflecting surface, on the other hand, the heating was sufficiently reduced to prevent the distillation of moisture. The deposit of dew on the condenser lenses may therefore easily be avoided.

More troublesome is the dew which forms in the space between the photographic picture and the glass cover of the slide. I have not personally been troubled with this, and therefore I have not had any experience as to how to get rid of it, but I feel sure that a great deal could be done by removing the blackened paper frame which is generally inserted between the two glasses, and replacing it by tin foil or white paper. It is obvious that if we take care that the glass of a slide forms the hottest surface in the neighbourhood, no dew can be deposited on it. As the glass absorbs a good deal of the more intense rays, and the slide itself is appreciably warmed, there should be no trouble in securing that nothing else should get warmer. The only possible cause which could not be dealt with would be the evaporation of water from the silver deposits which form the photographic picture, but there is no reason to suppose that they condense a sufficient amount of moisture to do much mischief if the slides are carefully dried to begin with.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR MICHAEL FOSTER has resigned the chair of physiology at Cambridge, which he has held since 1883, when the professorship was established.

PROF. J. A. EWING, F.R.S., professor of mechanism and applied mechanics in the University of Cambridge, has been appointed Director of Naval Education, under the new scheme of training. The scheme was discussed in connection with the Navy Estimates on Monday, and an amendment disapproving of it was moved, but upon a division the amendment was rejected.

THE Liverpool Marine Biology Committee has, in consultation with the Nature-Study Association of Teachers of Liverpool, issued a circular expressing its willingness to make arrangements for a special class in elementary marine biology, to illustrate the principles of nature-study, and to be held at the Port Erin Biological Station during the Easter holidays. The course will extend from April 10–17. Intending students should communicate with Mr. F. J. Cole, University College, Liverpool.

AT the annual meeting of the National Home-Reading Union on March 13, Dr. Richard Garnett delivered an address in which he dealt with the community of aim and feeling between the Union and the public library system. One great wish of the Union is through the systematic

[1] Read at the British Association Meeting in Belfast, September, 1902, by Prof. Arthur Schuster, F.R.S.

inculcation of good reading habits and the systematic dissemination of superior literature, not merely to make this literature better known, but to create an atmosphere in which—except in the case of thoroughly inferior minds—inferior literature will not be able to exist.

IN 1901 a central committee was formed in Berlin for the purpose of organising gratuitous post-graduate courses in medical science throughout Prussia. This committee, of which Prof. von Bergmann is the chairman, has now instituted such courses in twenty-three towns, and has acquired a collection of medical books and instruments to be lent to the local committees in small places where such means of instruction are not sufficiently available. A building, to be called the Empress Frederick House for Post-graduate Training, will be erected in Berlin to serve as the headquarters of the organisation in Prussia. The Emperor has expressed complete approval of the plans of the committee.

THE eleventh annual report for the year 1902 of the Technical Instruction Committee of the City of Liverpool shows an increase of 1040 in the number of registered students of the evening science, art and technological classes. The total number of entries to the classes held at the Central Technical School was 3625. This increase is to be attributed in some measure to an exhibition of students' practical work held just before the commencement of the session, and it is in contemplation to continue the exhibition and extend it to other centres. The establishment of a day technical school in the central school building, and of improved local buildings in the south end and on the east side of the city are still under consideration. The report also shows that the City Council has devoted to educational purposes the whole of the amount received under the Local Taxation (Customs and Excise) Act, 1890, with the exception of a sum of 7000*l.* paid to the credit of the City fund in 1892. The total amount thus allocated to educational purposes during the twelve years, 1890–1902, is 225,450*l.* 19*s.* 4*d.*

THE platitudes often expressed by speakers on educational subjects, and the verbose character of the larger part of educational literature, are responsible for the suspicion and want of respect with which many practical teachers regard any attempts to construct an educational science. What is wanted at the present time is a centre where the aims and practice of education can be studied without the limitations of traditional doctrines, and with modern requirements well in mind. The University of Birmingham seems to offer an opportunity for work of this kind in connection with the new chair of education, for which applications are invited. In the particulars issued to candidates for the post we read :—"The University believes that the improvement of education in England is a vital matter, and that the present post offers attractive opportunities to a man of influence and ability who is willing to cope with the difficulties of the task. Such a man would meet with cordial cooperation and assistance, and might be able to accomplish a worthy piece of work." The professor will be required to take control of the training of secondary teachers and to organise the inspection and examination of secondary schools. It should thus be possible for the successful candidate to establish a system of training of teachers in the science and art of education which would have a decided influence upon the work of secondary schools.

A CONFERENCE of representatives of county and county borough councils was held on Tuesday, under the auspices of the National Association for the Promotion of Technical and Secondary Education, to consider the question of higher education. Lord Avebury presided, and the following resolutions were adopted :—(1) That this conference of representatives of local authorities and educational bodies recognise the great importance of suitable, adequate and systematic provision being everywhere made for the supply of facilities for higher education by means of continuation schools, secondary schools, technical institutes, and classes, and by access to the universities, such facilities to include a sufficient number of scholarships and exhibitions, and, where suitable funds exist, to provide for a post-graduate course and the endowment of original research; (2) that every effort should be made to secure proper cooperation between local authorities and educational bodies in promoting higher, including university, education; (3) that it is urgently necessary for the improvement of education that more suitable means should be provided for the training of all grades and classes of teachers. Mr. J. Bryce, M.P., was one of the speakers, and in the course of his remarks train for the universities; and in towns of 100,000 people what they might call a grammar school, providing the elements of technical instruction; in towns of 40,000 or 50,000 population there ought to be a school competent to train for the universities; and in towns of 100,000 people there should be a completely equipped technical institute to fit boys for a science profession and for the pursuit of science. He added that in towns of 300,000 there should be a university college.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xxv. No. 1, January.—D. N. Lehmer, parametric representation of the tetrahedroid surface by elliptic functions. Various properties of the singular points, lines and planes.—E. B. Skinner, on ternary monomial substitution-groups of finite order with determinant ± 1. All the groups can be got from three generators or less, one of order two, and conversely.—V. Snyder, forms of sextic scrolls (two papers). There are sixty-eight types of such scrolls which are unicursal, and thirty-two of genus 1.—E. D. Roe, note on symmetric functions.—A portrait of Cremona accompanies this part.

Annals of Mathematics (2), vol. iv. No. 2, January.—J. W. Bradshaw, the logarithm as a direct function (with introduction by W. F. Osgood).—P. Saurel, positive quadratic forms.—E. A. Hook, multiple points on Lissajous's curves in two and three dimensions.—C. C. Engberg, a special quadri-quadric transformation of real points in a plane ($x=x'$, $y=\pm\sqrt{x'^2+y'^2}$).

Bulletin of the American Mathematical Society (2), vol. ix. No. 5, February.—W. F. Osgood, transformation of the boundary in conformal mapping.—V. Snyder, quintic scroll with three double conics.—L. P. Eisenhart, surfaces referred to their lines of length zero.—E. R. Hedrick, note on calculus of variations.—E. B. Wilson, synthetic treatment of conics at the present time. The author (very properly) emphasises the value of v. Staudt's methods.—Reviews: Brown's "Lunar Theory" (F. R. Moulton), Geissler's "Die Grundsätze u. das Wesen des Unendlichen" (E. R. Hedrick), recent German text-books in geometry (P. F. Smith).

Bulletin of the American Mathematical Society (2), vol. ix. No. 6 (March).—L. E. Dickson, the abstract group isomorphic with the alternating group on six letters.—H. F. Blichfeldt, property of conics.—R. W. H. T. Hudson, analytic theory of displacements.

Transactions of the American Mathematical Society, vol. iv. No. 1 (January).—F. Morley, orthocentric properties of the plane n-line.—L. E. Dickson (two papers), definitions of a field by independent postulates; definitions of a linear associative algebra.—E. V. Huntington (two papers), definitions of a commutative group and of a field.—C. N. Haskins, invariants of differential forms of degree higher than two.—A. Loewy, reducibility of groups of linear homogeneous substitutions.—A. B. Coble, the quartic curve as related to conics.—E. Kasner, cogredient and digredient theories of multiple binary forms.—R. E. Allardice, envelope of axes of conics through three fixed points.—W. F. Osgood, a Jordan curve of positive area.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 19.—"The Evaporation of Water in a Current of Air." By Dr. E. P. **Perman.** Communicated by Prof. E. H. Griffiths, F.R.S.

The object of this investigation was to discover with what accuracy the vapour-pressure of water could be calculated from the amount of water vapour carried off by an air current passed through the water, the temperature being maintained constant. The method adopted was to aspirate air, at a rate of not more than 0·1*l.* per minute, through

a succession of wash-bottles containing water and placed in a thermostat. The water carried off by the air was absorbed by means of concentrated sulphuric acid and weighed. The results obtained show in every case a close agreement between the calculated vapour-pressure and that commonly accepted. Experiments were made at temperatures varying from 20° to 90° C. It may be concluded from this that in air saturated with moisture (under the conditions used in the experiments) the pressure of the aqueous vapour is the same as the vapour-pressure of water when no other gas is present, also that the density of the aqueous vapour in the mixture is normal. It follows also that the density of saturated aqueous vapour, *without* admixture of any other gas, is approximately normal. This conclusion is confirmed by calculations of the density from the thermodynamical equation $L=T/J(s'-s)dp/dT$, using Griffiths's values of L and J and the latest determinations of vapour-pressure at the Reichsanstalt for the values of dp/dT.

Mathematical Society, March 12.—Dr. E. W. Hobson, vice-president, in the chair.—Mr. G. H. **Hardy,** On the convergence of certain multiple series. The paper contains an investigation of the analogue for multiple series of a theorem (due to Abel) concerning the partial summation of simple series. Most of the ordinary tests of convergence for simple series are founded on this theorem. Proofs of convergence of certain classes of multiple series are obtained, in particular of the class in which the general term is of the type $(b_1r_1 + b_2r_2 + \ldots + b_nr_n)^{-\mu} \exp\iota(a_1r_1 + a_2r_2 + \ldots + a_nr_n)$.—Mr. S. M. **Jacob,** On certain sequences for determining the nth root of a rational number. The paper contains a systematic development of a method used by Dedekind (in the case of the square root) to obtain sequences of the kind in question. If D is any rational number, and x is a rational approximation by excess or defect to the nth root of D, it is shown how to construct a rational number y which lies between x and the nth root of D.—Prof. H. **Lamb,** Note on the approximate calculation of the frequencies of a vibrating circular plate. The method of Rayleigh ("Theory of Sound," § 88) is applied to calculate the frequencies of the gravest modes of vibration of a plate by means of the assumption of very simple hypothetical types. The agreement of the results with those calculated by Kirchhoff from the exact equation for the frequencies is remarkably close.—Prof. A. R. **Forsyth,** On surfaces which have assigned families of curves as their lines of curvature. The paper contains a new method of investigating the conditions that a given family of curves may be the lines of curvature of a surface, and of determining the character of the surface from that of the lines. The method is illustrated by the example of Dupin's cyclide.—Mr. E. T. **Dixon,** Note on a point in Hilbert's "Grundlagen der Geometrie."—Mr. J. H. **Grace,** Extension of two theorems on covariants.—Prof. T. J. I'A. **Bromwich,** Note on double limits and on the inversion of a repeated infinite integral. The object of the note is to determine the conditions which are necessary and sufficient for the change of order of integration in an integral with infinite limits, and for the existence of a double integral with such limits. The continuity of a definite integral with infinite limits, considered as a function of a parameter contained in the subject of integration, is discussed.—Prof. W. **Burnside,** On the representation of a group of finite order as an irreducible group of linear substitutions, and the direct establishment of the relations between the group characteristics. The paper deals with the representation in question from a self-contained point of view, without introducing considerations which are foreign to the conceptions of an abstract group of finite order and of a group of linear substitutions. The arrangement of the subject from this point of view is materially different from that in previous discussions of it. The complete reducibility of a group of linear substitutions of finite order is taken first, the number of distinct irreducible representations and the composition of them follow, and the group-characteristics and their properties occupy the last place.

Geological Society, February 20.—Prof. Charles Lapworth, F.R.S., president, in the chair.—Annual General Meeting.—In his anniversary address the president dealt with the relation of geology to its fellow-sciences. In the course of the address the president remarked that the study of geology shows that the corporate geological organism has three necessary functions—research, practice and education. So long as all three functions are naturally and healthfully performed, so long will geology live and flourish. The work and influence of Werner and De la Beche show that the progress of the science is at its swiftest and surest when none of the three functions suffer from disuse.

February 25.—Prof. Charles Lapworth, F.R.S., president, in the chair.—On the occurrence of Dictyozamites in England, with remarks on European and eastern floras, by Mr. A. C. **Seward,** F.R.S. The specimens described as a new species of Dictyozamites were obtained from a bed of ironstone on the northern face of the Upleatham outlier, near Marske-by-the-Sea. The genus is also found in the Rajmahal Series of India, in Central Japan and at Bornholm. Its probable taxonomic position is best expressed by placing it as a member of the Cycadophyta. A comparison of the Bornholm, Indian, Japanese and English floras is made, and a special list of these floras has been prepared, in which, while the names at present in use are indicated, it is pointed out where obscured identities or resemblances exist. The author concludes that there was a greater similarity between the vegetation of eastern and western regions, during part at least of the Mesozoic era, than is usually admitted. The most noteworthy exceptions are afforded by the Mesozoic representatives of the two isolated recent ferns Matonia and Dipteris; these two families—each with a surviving genus—played a conspicuous part in the vegetation of the Rhætic and succeeding Jurassic epochs in Europe, and to a less extent in North America, but there are no satisfactory records of their existence in India or Japan.—The amounts of nitrogen and organic carbon in some clays and marls, by Dr. N. H. J. **Miller.** Analyses of soils are given to show that decaying vegetable matter in soil tends to become more nitrogenous, on account of the greater ease with which gaseous compounds are formed with carbon than with nitrogen. Hilgard's experiments throw light on the effects of extreme conditions of climate, the amount of soluble humus being much greater in soils in humid than in arid climates. The large areas of peat-land known as "Hochmoor" contain larger proportions of carbon and nitrogen at depths of seven and fourteen feet than at the surface. The organic matter of soils is of two kinds—the humous portion and the bituminous, the latter being regarded as belonging to the original deposit from which the soil is derived. Analyses of soils and subsoils are given to illustrate this point. Further light on this subject is derived from the analysis of specimens obtained through the kindness of Sir A. Geikie from borings in the possession of the Geological Survey. Apart from the interest due to the great depths from which the samples were obtained, and the evidence which they afford of the enormous accumulations of combined nitrogen, they possess the further and greater value of representing the materials out of which large areas of soils have been derived. It would be important to determine, in the case of these older deposits, whether any of the organic matter at all is in the form of humus.

Zoological Society, March 3.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—A communication was read from Mr. E. R. **Sykes** on the operculate Land-Mollusca collected during the "Skeat Expedition" to the Malay Peninsula in 1899-1900. Fourteen genera were represented in the collection by examples of twenty-three species, eight of which were described as new.—Mr. R. **Lydekker** communicated a paper on the callosities of the limbs of the Equidæ, in which it was urged that the view of the callosities being vestigial foot-pads was untenable. The author maintained that they were probably decadent glands, and that possibly the one on the hind limb might correspond to the tarsal gland of deer.—Mr. Rudolf **Martin** read a paper on some remains of the ostrich, *Struthio karatheodoris*, found in the Upper Miocene deposits of Samos. The author stated that the existence of an ostrich in Samos was of interest, because a comparison of the fauna of Samos and that of the Siwalik Hills showed that the latter was younger, and consequently *S. karatheodoris* was of a greater geological age than *S. asiaticus*. The hypothesis, therefore,

that the family of ostriches had been developed in Southern Eurasia and emigrated at a later period to Africa and Southern Europe could not be sustained. The discovery of *S. karatheodoris* in Samos showed rather that the specialisation took place in Africa, and that the existence of such forms in India and Southern Europe was due to a secondary immigration from Africa. Most probably, however, there was the same relationship between the whole fauna of Samos and that of the Siwalik Hills—*i.e.* the latter was a transformed and later generation of the former.—Mr. F. E. **Beddard**, F.R.S., read a paper upon some species of Oligochæta from Africa.

Linnean Society, March 5.—Prof. S. H. Vines, F.R.S., president, in the chair.—Rev. T. R. R. Stebbing, F.R.S., exhibited a collection of spiders and wasps from Singapore, made by Mr. C. J. **Saunders**. (1) Spiders found in eleven clay cells built between the boards of a thin book standing upright on a book-shelf; the space ¼ inch broad by ½ inch high, and 4½ to 5 inches long. Mr. Saunders reckoned that each cell contained ten or eleven spiders and a single grub. He found a small fly in one cell, and others later in a different set of cells. He remarks that the Chinese must have noticed the spider-trapping habit, since they say of certain bees that they "adopt" spiders and bring them up as young bees. (2) Contents of another set of cells, built in a corner of the verandah, in two vertical rows, about thirteen cells in all. The spiders were all of one kind, fifty-six in number, with three half-eaten and two skins. (3) Contents of a set of cells, the topmost of which was closed while Mr. Saunders was examining other sets. The day before had been wet, but even the topmost cell, which was not yet dry, contained a grub. The exhibitor also remarked that in the family Crabronidæ or Sphegidæ, *Ammophila hirsuta*, a British species of sand-wasp, is said to provision its nest with spiders. The same habit has long been known in *Pelopoeus spirifex* (Linn.), belonging to the same family. Also in the family Pompilidæ, species of Pompilus are known to attack large spiders and make them a provision for their young ones. Latreille, in 1802, quotes a letter from Cossigny to Réaumur, describing the behaviour of *Pelopoeus spirifex* to spiders in the Isle de France. Latreille named the genus Pelopœus, the mud-worker, or potter.—On some points in the visceral anatomy of the Characinidæ, with an inquiry into the relations of the Ductus pneumaticus in the Physostomi generally, by Mr. W. S. **Rowntree**. The author summarised Sagemehl's observations on the skull of the Characinidæ, and then described his own investigations into the visceral anatomy of these fishes, derived from the examination of fifty-three species belonging to thirty-three genera, the chief interest of the paper centring in the author's observations on the position of the Ductus pneumaticus in relation to the alimentary canal, which observations had extended to other families of the Physostomi.—On the anatomy of the pig-footed bandicoot, *Chaeropus castonotis*, by Mr. F. G. **Parsons**.—Further notes on the lemurs, with especial reference to the brain, by Dr. G. Elliot **Smith**. This paper records observations supplementary to those recently published in the *Transactions* of the Linnean Society, and deals with two internal casts of imperfect crania of Nesopithecus recently acquired by the British Museum, two brains of young specimens of *Propithecus diadema*, and an adult brain of *Lemur macao*. The brain of Nesopithecus (Globilemur) is shown to present a curious mixture of pithecoid and prosimian féatures, and the author regards this genus as a specialised one, forming a connecting link between the lemurs and apes.

Entomological Society, March 4.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Colonel C. T. **Bingham** sent for exhibition specimens of Diptera and two Aculeates from Sikhim, showing in the banding of the wings and other characteristics a singularly beautiful case of mimicry. The Rev. F. D. Morice drew attention to the way in which the fly imitated with its tibia the tarsus of the bee.—Mr. A. J. **Chitty** exhibited specimens of the rare *Atomaria rhenana*, taken by him out of some food rubbish found near Lancing, probably the same locality where the beetle was discovered formerly by Dr. Sharp. He also exhibited a Ptinus, found in a granary in Holborn in 1893, apparently new to Britain and probably introduced.—Mr. W. J. **Kaye** exhibited species of Lepidoptera from British Guiana, forming a Müllerian association in which all but one were day-flying moths, the exception being an Erycinid butterfly, *Esthemopsis secina*. The particular interest of the exhibit consisted in the association being one of moths, a butterfly being the exception, and not one of butterflies with perhaps a single moth, which latter is so frequently the case in South America. The butterfly most closely resembled *Agyrta micilia*, one of the most abundant of the Syntomid group.—Mr. C. O. **Waterhouse** read notes on the nests of bees of the genus Trigona; Mr. G. A. Rothney communicated a paper on the Aculeate Hymenoptera of Barrackpore, Bengal, and descriptions of eighteen new species of Larridæ and Apidæ, from Barrackpore, by Peter **Cameron**; Colonel Charles **Swinhoe** communicated a paper on the Aganiidæ in the British Museum, with descriptions of some new species.

MANCHESTER.

Literary and Philosophical Society, February 17.—Mr. Charles Bailey, president, in the chair.—Mr. T. **Thorp** showed a copy of a Japanese magic mirror he had cast. He had had it ground and polished with a partial vacuum behind it, with the result that the reflection showed the design on the back of the mirror very distinctly. Mr. Thorp believed this to be the first mirror to be made in that way, and he afterwards presented the mirror to the Society. Mr. Thorp also exhibited a small apparatus for attaching to a gun to facilitate sighting.—Mr. W. E. **Hoyle** showed on the lantern screen a number of microscopic sections illustrating the structure of the luminous organs of a cuttle-fish which he had described to the Society during the previous session. Mr. Hoyle also read a paper entitled "Notes on the Type Specimen of *Loligo eblanae*, Ball," in which was demonstrated the identity of a squid from Dublin Bay, described by the late Dr. Robert Ball, with one recorded by M. Girard from the coast of Portugal and also found in the Mediterranean.

PARIS.

Academy of Sciences, March 9.—M. Albert Gaudry in the chair.—The general theory of translucency, by M. J. **Boussinesq**. A generalisation of the theory of gradual extinction of plane waves with pendular motions, given in a preceding note.—The preparation and properties of the hydrides of rubidium and cæsium, by M. Henri **Moissan**. The hydrides of these metals were obtained by heating the metal in hydrogen at about 300° C., the general method adopted being that described in a previous note on the preparation of the hydrides of potassium and sodium. In both cases crystalline compounds possessing the composition RbH and CsH were obtained. These are energetic reducing agents decomposing water, hydrogen sulphide and hydrochloric acid at the ordinary temperature. With sulphur dioxide at low temperatures, and under reduced pressure, hydrosulphites are obtained; carbon dioxide is added on directly with the formation of formates, and amides are produced by the reaction with ammonia.—On the non-conductivity of the metallic hydrides, by M. Henri **Moissan**. An attempt to measure the electric conductivity of the hydrides of sodium, potassium, cæsium and rubidium showed that all these substances act as insulators. These experiments lead to the conclusion that hydrogen is not comparable to the metals, since the metallic hydrides have neither the properties nor the appearance of metallic alloys.—On the motion of vitreous media, affected by viscosity and very slightly deformed, by M. P. **Duhem**.—M. Th. Schlœsing, jun., was elected a member of the section of rural economy in the place of the late M. Dehérain.—The comet 1902 *b*, by M. A. **Senonque**. The results of photographic observations at the Observatory of Meudon. The comparison of the photographs taken on October 6 and 7 shows large variations in the size of the tail of the comet.—On a transformation of a particular class of triple orthogonal systems, by M. C. **Guichard**.—On the deformation of surfaces, by M. W. de **Tannenberg**.—On the hypohermitian, by M. Léon **Autonne**.—The rigidity of liquids, by M. G. de **Metz**. From the equation given by Maxwell connecting the viscosity coefficient, the modulus of rigidity, and the time of relaxation of the elastic force, and from some measurements of the rate of relaxation of accidental double refraction in

copal varnish, the author has been able to determine the modulus of rigidity in this liquid, 0·12 absolute unit at 22°·2 C. It is interesting to note that this figure is of the same order of magnitude as the value found by M. Schwedoff for the modulus of rigidity of a half per cent. solution of gelatine, by an entirely different method.—New magnetic systems for the study of very feeble fields, by MM. V. **Cremieu** and H. **Pender.** The disadvantages attending the use of astatic systems for the exploration of very weak magnetic fields are fully discussed, and a new arrangement is proposed consisting of a horizontal arm suspended at its centre by a long wire, and carrying at one end a vertical magnet and at the other a non-magnetic counterpoise. It is claimed for this arrangement that it is extremely sensitive, easily regulated, and capable of being rendered perfectly astatic.—On electric convection, by M. **Vasilesco-Karpen.** Experiments are described by the author which appear to prove beyond question the reality of the existence of the Rowland effect.—A method of stereoscopic radioscopy, by M. Th. **Guilloz.** It is shown that the use of two sources of the X-rays is unnecessary for stereoscopic radioscopy, and that the same effects can be practically realised by the displacement of a single tube.—On a thermostat with electrical heating and regulation, by MM. C. **Marie** and R. **Marquis.** The expansion of acetone or other suitable liquid actuates a relay, by which the heating current is governed. The bath can be kept at any desired temperature within two or three hundredths of a degree.—On cuprous sulphate, by M. A. **Joannis.** The author has succeeded in isolating and analysing the compound of cuprous sulphate and carbon monoxide the existence of which was indicated in a previous note. Its composition is $Cu_2SO_4,2CO,H_2O$; the carbon monoxide is given off in a vacuum, the residual cuprous sulphate decomposing into copper and cupric sulphate, although there are indications that the cuprous sulphate can exist undecomposed in the presence of ammonia.—On some derivatives of oxynaphthoic acid, by M. F. **Bodroux.** —On the nervous system of the Nautilus, by M. Ch. **Gravier.**—On a new mode of constitution of the chain in a new Salpa from the Persian Gulf, by MM. Jules **Bonnier** and Charles **Pérez.** A new subgenus is proposed, Stephanosalpa, and the new species collected at Kumzar is described under the name of *Stephanosalpa polyzona*.—On the influence of the subject on the graft, by M. Leclerc **du Sablon.** The results of a series of experiments on the grafting of different varieties of pears.—On the development of *Cicer arietinum* after section of the embryo, by M. P. **Ledoux.**—On the new genus Protascus, by M. P. A. **Dangeard.**—The formation of antherozoids in *Marchantia polymorpha*, by M. S. **Ikeno.**—On the existence of several successive orogenic movements in the Northern Urals, by MM. L. **Duparc,** L. **Mrazec** and F. **Pearce.**—On the oxydases of cuttle fishes, by M. C. **Gessard.** A study of the ink-producing gland of the cuttle fish shows that, as is the case in plants, the tyrosinase is always accompanied by a laccase.—On the presence of an erepsin in some Basidiomycetes, by MM. C. **Delezenne** and H. **Mouton.**—On the dust deposits of February 22, 1903, by M. F. A. **Forel.**

DIARY OF SOCIETIES.

THURSDAY, MARCH 19.

ROYAL SOCIETY, at 4.30.—On the Formation of Barrier Reefs and of the Different Types of Atolls: Prof. A. Agassiz, For. Mem. R.S. —On Central American Earthquakes particularly the Earthquake of 1838: Admiral Sir John Dalrymple Hay, Bart, F.R.S.—The Emanations of Radium: Sir William Crookes, F.R.S.

LINNEAN SOCIETY, at 8.—On *Poa laxa* and *Poa stricia*, of our British Floras: G. Claridge Druce.—The Botany of the Ceylon Patanas. Part II. Anatomy of the Leaves: John Parkin and H. H. W. Pearson.

FRIDAY, MARCH 20

ROYAL INSTITUTION, at 9.—The Paths of Volition: Prof. E. A. Schäfer, F.R.S.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—The Prevention of Diphtheria Outbreaks in Hospitals for Children: Dr. Louis Parkes.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—A Premium System applied to Engineering Workshops: James Rowan.

SATURDAY, MARCH 21.

ROYAL INSTITUTION, at 3.—Light: Its Origin and Nature: Lord Rayleigh.

MONDAY, MARCH 23.

SOCIETY OF ARTS, at 8.—Hertzian Wave Telegraphy in Theory and Practice: Prof. J. A. Fleming, F.R.S.

TUESDAY, MARCH 24.

ROYAL INSTITUTION, at 5.—Great Problems in Astronomy: Sir Robert Ball, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Protection Works of the Kaiser-i-Hind Bridge over the River Sutlej, near Ferozepur: A. Morse.

MINERALOGICAL SOCIETY, at 8.—On the Diathermancy of Antimonite: Dr. A. Hutchinson.—A Peculiar Form of Magnetite in Bunter Sandstone: J. B. Scrivenor.—(1) A Large Crystal of a Sulpharsenite of Lead from the Binnenthal; (2) A Twin of Copper Pyrites: Prof. Lewis.—A New Sulpharsenite of Lead from the Binnenthal: R. H. Solly.

WEDNESDAY, MARCH 25.

SOCIETY OF ARTS, at 8.—Oil Light by Incandescence: Arthur Kitson.

GEOLOGICAL SOCIETY, at 8.—(1) On a New Species of Solenopsis from the Pendleside Series of Hodder Place, Stonyhurst; (2) Note on Some Dictyonema-like Organisms from the Pendleside Series of Pendle Hill and Poolvash: Dr. Wheelton Hind.—The Geology of the Tintagel and Davidstow District (Northern Cornwall): John Parkinson.

THURSDAY, MARCH 26.

ROYAL SOCIETY, at 4.30.—*Probable Papers*:—Some Physical Properties of Nickel Carbonyl.—Prof. J. Dewar, F.R.S., and H. O. Jones.—The Electrical Conductivity imparted to a Vacuum by Hot Conductors: O. W. Richardson.—An Attempt to Estimate the Relative Amounts of Krypton and of Xenon in Atmospheric Air: Sir William Ramsay, K.C.B., F.R.S. —On a New Series of Lines in the Spectrum of Magnesium: A. Fowler. —An Inquiry into the Variation of Angles Observed in Crystals, especially of Potassium-Alum and Ammonium-Alum: Prof. H. A. Miers, F.R.S.—On the Dependence of the Refractive Index of Gases on Temperature: G. W. Walker.—On the Evolution of the Proboscidea: Dr. C. W. Andrews.

FRIDAY, MARCH 27.

ROYAL INSTITUTION, at 9.—The Pearl Fisheries of Ceylon: Prof. W. A. Herdman, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Advantages of Motor Driven Printing Machines: J. G. Y. D. Morgan.

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