THURSDAY, JANUARY 21, 1904.

AN EVOLUTIONARY STUDY OF EUROPEAN POLITY.

The Development of European Polity. By Henry Sidgwick. Pp. xxvi+454. (London: Macmillan and Co., Ltd.; New York: the Macmillan Company, 1903.) Price 10*s.* net.

HENRY SIDGWICK'S exposition of the theory of politics was published in two editions in his lifetime, as is well known to all English students of the subject. These posthumous lectures are the historical complement, "an evolutionary study of the development of polity within the historic period in Europe," as Mrs. Sidgwick says in her preface. The author conceived, as the final part of the work, a comparative study of living modern constitutions, founded so far as possible on personal observation. He did not live, unhappily, to carry out any substantial portion of that design. Everyone who knew Sidgwick or was acquainted with his work would expect his account of any period or aspect of European history to be sound and careful, notwithstanding that he was not a professed historian. Everyone who knows anything of the difference between finished and not quite finished work is aware of the difficulties that commonly attend the posthumous publication of an author's materials, even if he has not had the experience of being charged with such a production himself. General observations of this kind prepare the way, in many cases, for an appreciation more or less apologetic in tone.

On this occasion there is no question of apologies. We are not surprised that Mrs. Sidgwick's intimate knowledge and sympathy have given us a book in which not only there is no jarring contrast between the author's and the editor's hand, but the difference is barely discernible. We do confess to a little surprise at the comprehensive grasp of the matter, and the almost invariable sureness of judgment, disclosed in these lectures. Historical students who have no taste for philosophy (a mistaken frame of mind in our opinion, but common) may well be tempted to regret that Henry Sidgwick was not a historian altogether. We do not know of any book in English that covers the same ground as this; among those which intersect its lines it would be possible to find more wealth of learning and greater brilliance of style, but very hard to find so safe and impartial a guide.

As the topics dealt with range from the patriarchal family to modern cabinet government, and the treatment—even without the author's last hand—is by no means diffuse, it would be idle to attempt a summary. We may note, however, that the book is provided, as every book of its kind should be, with an excellent analytical table of contents as well as an index. In the earlier part there is a refreshing freedom from mere antiquarianism. Such a quietly humorous note as this on the Homeric banquets:—"Political dinners are very primitive institutions," is more effective than many solemn paragraphs to make the learner understand that even archaic history is concerned with real human nature.

The short chapter on the patriarchal theory partly follows and partly criticises Maine, and leads to the conclusion that

"there is no reason to regard the father's power, in the patriarchal family, as the original type of political power; but doubtless the firm establishment of the patriarchal type of family contributed importantly to the stability and strength of tribal headship."

Indeed, Maine's own perfectly just view that the units of archaic society are not individuals but families requires us to ask, in the first instance, not how kingship, but how the primacy of one family or clan in the tribe is accounted for. Sidgwick's task was somewhat lightened here by the clear consciousness that he was trying to account only for European and not (for example) Mongol or Polynesian institutions. If Maine himself had more plainly disclaimed any intention of dogmatising on anthropology at large, some not very profitable controversy might have been spared.

A word of special criticism on Maine occurs in a later chapter:—

"I cannot agree with Maine that codes [in early Greek and Roman history] generally included no new law."

This, no doubt, is sound in itself, but we cannot find that Maine really committed himself to any such statement, though he dwells mainly on the consolidating function of ancient codes. Farther on we have a more substantial amendment. Sidgwick declines to conceive the Roman *jus gentium* as formed by a process of deliberate selection from the customs of different Italian (or Mediterranean) communities.

"It is clear," he says, "that the development of the kind of law afterwards known as *jus gentium* was entirely due to practical needs; and we may connect it with the development of Roman trade."

It is right to point out that Maine himself, in his later work, did suggest a connection with market law. The present writer is disposed to go farther, and to regard the incipient *jus gentium* as having been, in fact, the custom of merchants. Without some general customs trade could not have gone on at all, and if they existed it was an obvious course for the Roman jurisdiction to adopt them. Sidgwick rightly notes in the same chapter the theoretical divergence between *jus naturae* and *jus gentium* on the point of slavery.

The mediæval section is remarkably good, although Henry Sidgwick's particular tastes and studies did not lie that way. Mediævalists, as well as ordinary historical students, will find profitable matter in the treatment of Italian and German autonomy with regard to the general political development of Europe. The contrast between Continental feudalism, leading first to wild particularism and then to a reaction towards absolute monarchy, and the stronger central government which saved England from despotism, by an apparently despotic but really popular system, is not in itself new, but is thoroughly well brought out.

England, nevertheless, had a narrow escape; we have been slow to realise how narrow it was. Mr. Maitland was the first, we believe, in his Rede lecture two years ago, to claim boldly for the common law and its traditions their due share in effectual resistance at the critical time. This point, though lightly touched on by Sidgwick, did not escape him; see his well weighed remarks on the unity of the common law and of Parliament (p. 312). The beginning of modern political history and constitutional doctrine is placed at the peace of Westphalia, and we do not think a better date could be found. We have some doubt on a matter of detail in the next stage. Blackstone is the normal representative of the doctrine accepted in the reign of George III. Sidgwick acquiesces in the current view of Montesquieu's influence on him, but we think that Blackstone's own practical consideration of Locke may have counted for more than is commonly supposed, and Montesquieu, whose work was still very recent when Blackstone wrote, for less. Although Blackstone was not, on the whole, an original thinker, there is no reason to assume that he never did any thinking for himself.

The reader is finally conducted with a sure hand through the modern development of constitutional and cabinet government to the prospect of federalism as the most important factor in the coming generation.

FREDERICK POLLOCK.

A CONTRIBUTION TO CALIFORNIAN GEOLOGY.

The Palaeontology and Stratigraphy of the Marine Pliocene and Pleistocene of San Pedro, California. By Ralph Arnold. Pp. 420; 37 plates. (California: Stanford University, 1903.)

THIS, the latest of the well-known "Contributions to Biology from the Hopkins Seaside Laboratory of the Leland Stanford Junior University" (reprinted from the *Memoirs* of the California Academy of Sciences, vol. iii.), forms a dissertation presented to the faculty in geology of the university for the degree of doctor of philosophy, and is by far the bulkiest of the thirty-one "Contributions" as yet published.

It may not, perhaps, contain matter apparently offering such brilliant results as some of its predecessors, but it yields to none of them in being a most sound and important contribution to the knowledge of a scarcely touched subject. Nor is it the outcome of some spasmodic effort of the moment, for Mr. Arnold began the work in the winter of 1886, and has paid several visits each year since to the fossil-bearing beds of San Pedro.

In the field work and in collecting the author had the assistance of his father and the further cooperation of numerous friends, principally of Dr. J. P. Smith, Dr. J. C. Branner, and, in the systematic work, of Mr. Wayland Vaughan and Dr. Dall.

The deposits investigated rest on raised and contorted Miocene shales, while a similar unconformity is evident between the Pliocenes and Pleistocenes themselves. All are successively overlain by alluvial soil with Kitchen-middens. In thickness these beds exceed any of the same age in this country, and attain in the Pleistocene to more than 1300 feet, and in the Pliocene to about 5000 feet.

In the first portion of the work the information concerning the various subdivisions is summarised, and lists of the several fossil contents are given. The faunal relations of the beds are of great interest. The fauna of the Pliocene strata is similar to that now living only a short distance off-shore from San Pedro, but probably in colder water than is found in-shore; it also contains 18.5 per cent. of species only found living further north, hence the climate was probably colder on the coast of California at the time of deposition than it is at the present day.

In the succeeding Pleistocene deposits the lower series reveal by their fossil-contents a change in climatic conditions towards tropical, while in the upper series semi-tropical conditions appear to have prevailed.

Great similarity is shown to exist between the later Tertiary and Pleistocene marine invertebrate fauna of Japan and that of the western coast of the United States, though the living faunas are not as closely related.

The second portion, or the "description of species," forms the bulk of the work, and occupies 276 pages, of which all but 12 deal with the Mollusca. The excessive preponderance of molluscan remains, indeed, is one of the most remarkable features connected with these beds. The diagnoses of the few new Anthozoa are by Mr. Wayland Vaughan, whilst to Dr. Dall the author acknowledges indebtedness in the identification of some of the Mollusca and for superintending the text relating to the Pyramidellidæ, which was prepared by Mr. Paul Bartsch.

In his classifications the author has wisely followed well-known text-books or memoirs, and though this course necessarily results in the nomenclature being in some places not quite of the latest description, it enables the work to be more readily followed than if some fresh arrangement had been adopted. One rectification we are glad to note in Mr. Bartsch's portion—Fleming's name, *Odostomia*, resumes its pride of place.

A useful bibliography forms the third part of the volume, albeit unduly extended to include works that might have been, rather than that were, actually referred to, and even to embrace all the papers of one writer because he was considerate enough to supply them, although a considerable number have no bearing whatever on the question. That the G. B. Sowerbys should have become mixed is not surprising, but "Sowerby, James, and De Carls, James" should have been avoided.

The thirty-seven plates, twenty-one of which relate to the fossils, are of that high quality which we have come naturally to expect in works of this class produced in the United States, and he who could find aught to cavil at in them must indeed be hard to please.

B. B. W.

PHYSIOLOGY AND ALCOHOL.

Elementary Physiology and Hygiene. By Prof. Buel P. Colton, M.A. Heath's Modern Science Series. Pp. viii+317. (London: D. C. Heath and Co.) Price 2*s.* 6*d.*

THIS book has obviously been written to supply the wants of the American schoolchild, and consequently

"the subject of *alcohol* has been treated very thoroughly and in full compliance with the laws of the various States."

"Throughout the book the effects of alcohol and other narcotics have been discussed in close connection with the accounts of the functions of the body."

"A number of authoritative quotations have been made, so that the pupil may know that the statements made are supported by the most eminent authorities of the world on these subjects."

The above quotations from the author's preface show that it has been a pleasure to him to comply in his book with the law enjoining that all text-books of physiology used in American State schools must contain a description of the effects of alcohol upon the body.

So thoroughly has this instruction been carried out that it appears on reading the book as if in many cases the very brief descriptions of the physiology of the different tissues had been written chiefly as introductions in order to make clear the dire effects of alcohol, which are subsequently described in each case.

There is a denunciation of alcohol in every chapter, and its ill effects upon every tissue in the body, from the bones to the brain, through the whole gamut of the muscles, blood, circulation, respiration, digestion and excretion, are specially described in words usually chosen from well-known authors; and then, as if feeling that this alone were not sufficient, the author adds a chapter, written in great part by himself, dealing entirely with alcohol and its disastrous effects upon the body.

Truly this book must be appalling reading to the American schoolchild whose parents may be in the habit of making even moderate use of alcoholic drinks, until time has eventually brought the convincing comfort that the parents do not suffer so badly as might have been expected from the descriptions of the text-book.

It is a pity that the picture is so overdrawn, both for the sake of the effect upon the mind of the child and the valuable reformation of the parent which might have been effected through the child.

It is most desirable that every adult in every country should know the evil results upon the system of over-indulgence in such a powerful drug as alcohol, but it is highly questionable whether any good result can follow the drawing of such lurid pictures as are found here for the perusal of boys and girls at school.

The style of the book is not beautified by the use of the English instead of the Latin plural, so producing such monstrosities as *pleuras, ganglions, ciliums, villuses,* and *papillas.* The author states that this has been done to avoid puzzling the student who has not "had Latin," appearing to forget that such words have become part of the language, and that it is a drastic procedure to coin many new and uncouth words to save his readers the labour of acquiring a knowledge of the Latin plural forms. This knowledge they ought already to possess at school before they have reached the stage of studying physiology and hygiene, unless school work is becoming very inverted and chaotic.

In addition to inventing new plurals, the author in his preface admits the manufacture of new words, again on the plea of simplicity, and further examples of this practice are to be found in the text, such as *aur-vent* and *vent-art* valves on p. 52.

The book contains a smattering of popular physiology and a very small amount of elementary hygiene, but it appears to the reviewer to be a volume which ought specially to attract temperance lecturers in search of "material" for their discourses.

BENJAMIN MOORE.

A BOOK OF ENGLISH SPORTS.

English Sport. Edited by A. E. T. Watson. Pp. ix+361; illustrated. (London: Macmillan and Co., Ltd., 1903.) Price 12*s.* 6*d.* net.

IN this handsome volume, illustrated by a large number of exquisite coloured plates (many of which are photographs), the editor has managed to compress into a comparatively small size an interesting and accurate account of all the chief English sports. All the articles, each of which is written by a recognised authority on his special subject, have previously appeared in the *Badminton Magazine,* but since the series was compiled with a view to subsequent republication in book form, there is not that lack of connection and completeness—to say nothing of overlapping—which is sometimes noticeable in collections of this nature. To particularise the names of the different contributors would be unnecessary on the present occasion, but a glance at the table of contents will be sufficient to convince the reader that the editor has been especially fortunate in obtaining the cooperation of such a number of names well known in the sporting world.

To review in detail a work of this nature comes more within the province of journals devoted specially to field and other sports, and we shall therefore, while commending the volume to the best attention of those whom it more immediately concerns, content ourselves with a few brief references to points more or less intimately connected with natural history.

All lovers of British animals cannot fail to find much matter of interest in the article by Viscount Ebrington on hunting the wild red deer in Devon and Somerset, of which his lordship, in his capacity as master of the hunt, probably knows more than any man living. Those who read this article must be convinced what an excellent lesson in "nature teaching" is afforded by the cultivation of the power of minute observation essential on the part of all those concerned in discovering the whereabouts of the quarry. In the article on harriers ancient and modern by the late Earl of

Suffolk and Berkshire, reference is made to the now almost forgotten fact that no later than the first half of the last century many of these hounds—and we presume fox-hounds also—were whole-coloured, instead of being of the tripartite "hound-colour" with which we are now familiar. Reddish was the prevalent tint, with a tinge of brownish-grey along the back, so that the hound was very similar in colour to the hare of which it was in pursuit. This, of course, has an important bearing on the ancestral stock from which our modern hounds are derived, and tends to confirm the view of Bell as to the derivation of these animals from a bloodhound stock.

As the editor admits in his preface, some objection might legitimately be raised to the inclusion in the volume of an article by Lord Delamere on lion-shooting in East Africa, and of another by Lord Walsingham on Spanish ibex hunting, since if these are admitted it is somewhat difficult to see why big game shooting in general was not included. Taking, however, the facts as they are, we find some very interesting points in Lord Delamere's narrative—notably the statement that wart-hogs, when chased by lions to the deserted aard-vark holes, in which they often take up their abode, invariably enter backwards, so as to present their formidable tusks to an assailant. In the course of his account of a hunting trip to the haunts of the Spanish ibex, or wild goat, Lord Walsingham records many interesting points in connection with the fauna and flora of the districts traversed.

With this we take leave of an attractive volume which ought to occupy a handy position in the library of every British sportsman R. L.

OUR BOOK SHELF.

Theoretical Mechanics. An Elementary Text-book. Second edition. By L. M. Hoskins. Pp. xi+456. (Published by the author, Stanford University, Cal., 1903.) Price 3 dollars.

We have here a very clear and lucid exposition of the fundamental principles of mechanics, presented always with incisive logic, in a simple manner, and enforced and illustrated at frequent intervals by well selected examples.

The book is divided into three parts, of which the first deals with statics, and includes a chapter on gravitation and the attraction of spherical shells. The second part is concerned with the dynamics of a particle, and part iii. treats of the motions of systems of material particles and of rigid bodies.

The subject is treated mainly by analytical methods, an elementary knowledge of the calculus being assumed. But the vector nature of the subject is always kept prominently to the fore, and the vector significance of the various terms in the dynamical equations is brought well home to the student by ample illustrations and descriptions. The book opens with a special chapter on vectors, and vector equations are freely employed throughout, verging sometimes on the use of vector products, as, for instance, when establishing the relations which exist amongst the various quantities in the case of the transformation of axes in the instructive chapter on relative motion which concludes the volume, and which has been added since the first edition.

Attention is mainly confined to motion of translation in space, and to the general case of plane motion, general motion in three dimensions being only casually alluded to. This seems to us a wise arrangement, as, in the space available, it allows the treatment to be very full and complete.

The C.G.S., the poundal-pound, and the "engineers'" systems of units are all clearly explained. The author, however, seems to be under some misapprehension as to the unit of force in the engineers' system. He says this varies with the locality on account of the variation of gravitation, but that the system could be made dynamical by specifying the locality. In this country, at any rate, such specification is made, and the engineers' system is thus as strictly absolute as the C.G.S. or the poundal-pound systems.

Considering the importance of harmonic motion in its many applications, as in electricity, in problems on balancing, in harmonic analysis, &c., many readers would have welcomed a special chapter devoted to the subject, including some reference to rotating vectors.

In a treatise like the present, it would seem highly desirable that a short account of the experimental verification of fundamental laws should be given, and the student be directed to carry out the experiments personally in the laboratory. But there is little room for adverse criticism in this most excellent text-book, which is one of the best on the subject that has recently appeared, and cannot fail to give satisfaction wherever used.

Atlas des Erdmagnetismus für die Epochen 1600, 1700, 1780, 1842 *and* 1915. By Dr. H. Fritsche, Director emeritus des K.R. Observatoriums in Peking. (Riga: Müllerschen Buchdruckerei, 1903.)

This work consists of a series of charts of equal lines of magnetic declination, inclination, and horizontal force for the five epochs 1600, 1700, 1780, 1842 and 1915, calculated by the author with the assistance of the Gaussian theory.

In his introduction he discredits the accuracy of the charts of the epochs hitherto published by Hansteen, van Bemmelen, Sabine and others as being the results of observation only, many of such observations being defective, and the lines drawn without the help of any theoretical groundwork. There is a mistake here as regards Sabine's charts of the Arctic and Antarctic regions, as the Gaussian lines calculated for 1840 were largely used in their construction. Nevertheless, the author has spared no pains in his endeavour to replace what he condemns by something better, hence the present charts.

Considering the existing knowledge of terrestrial magnetism as regards the secular change of the magnetic elements, and our limited knowledge from observation of the conditions in the southern parts of the earth, the author appears to be somewhat premature in providing charts of inclination and force for the epochs 1600 and 1700, especially when so little was known of either element before the early years of the last century.

From the lengthened period during which the declination has been observed, the means exist for comparing the theoretical results of these calculated charts with good normal observations. Thus at Cape Town we find for the epochs 1842 and 1915 a difference in declination of $-1^{\circ}\cdot5$ and $+2^{\circ}$ respectively, and at other well-known places similar differences.

Again, these charts indicate that the north magnetic pole moved in a south-easterly direction nearly 700 miles in the 315 years since 1600, some 93 miles of these being traversed between 1842 and 1915, whereas observations during the latter period indicate that the pole moved in a north-westerly direction. The south

magnetic pole is declared to have moved about 800 miles in a north-westerly direction between 1600 and 1780, then about 400 miles in a south-easterly direction between 1780 and 1915.

The remarkable results thus given in these charts can hardly be accepted until observation has done its work and provided a better basis of calculation than that at the disposal of their author.

The Wonderful Works of God. Pages from the Book of Nature. By J. Polkinghorn. Pp. iv+156; illustrated. (London: Society for Promoting Christian Knowledge, 1903.) Price 2*s*.

THE purport of the book, it is said, is to awaken an interest in the marvels of creation, and perhaps this might have been done without the introduction of quite so many "pious reflections." Be this as it may, the author might at least have taken care that all his statements were up to date, and at the same time have avoided the introduction of misleading illustrations. As an example of the former failing, we may refer to the statements (p. 29) that sponges are included in the Cœlenterata, and (p. 94) that a few birds probably hibernate (*vide* A. Newton, "Dictionary of Birds," p. 928). As regards the second point, we may direct attention to the figure on p. 29, in which the shell borne by a soldier-crab presents no resemblance to that of any mollusc with which we are acquainted. Although exception may be taken to the mode of treatment, the purport of the book is deserving of all commendation.

Riviera Nature Notes. Second edition. Pp. xv+402. (London: Bernard Quaritch, 1903.)

THIS volume will be a welcome addition to the library of everyone who is interested in the old-fashioned hobby of field natural history or its modern substitute of "nature-study." The first edition, which was published in 1898, was a delightful book, but it left much to be desired in the matter of paper, printing, illustrations, correction of misprints, and similar matters of general detail. In all these respects the present volume is quite a different book from its predecessor, and though a few misprints still survive, it is evident that no pains have been spared in producing a well printed book, the illustrations in which are quite works of art. The anonymous author states that he is a schoolmaster by profession, and that the book was written as a recreation, and with no intent to produce a scientific treatise. But those who have visited the shores of the Mediterranean will know that the fauna, the flora, and the folklore of this region possess an individuality of which no adequate impression can be conveyed by exact scientific descriptions, but of which a much better idea can be obtained from the descriptions and illustrations given by one who is evidently familiar with every nook and corner of the district. We cordially agree with the last words of the preface:—"But I may, perhaps, venture to plead that there are many recreations even less profitable than writing notes upon the Natural History of the Riviera."

The Square Circled. By P. O. P. Pp. 44. (Edinburgh: E. and S. Livingstone, 1903.)

MANY writers have given approximate geometrical constructions for straight lines equal in length to arcs of circles, and some of these are so simple that it seems a pity they are so rarely seen in text-books. This remark in no way applies to the constructions given in the present book. Most of the figures are very involved and complicated, containing between thirty and forty lines. If the methods really did lead to an exact and not merely an approximate construction for squaring the circle, the use of ruler and compasses would introduce errors far greater than those which would arise from taking even such a rough value for π as $3\frac{1}{7}$. It is a pity that the author before writing this book did not consult a mathematical friend. Had he done so he would have been told that his "V-shaped curve" is a portion of a cycloid, and he would not have issued the book in its present form.

The Garden Diary and Calendar of Nature. With Gardening Directions by Rose Kingsley and Preface by G. A. B. Dewar. Pp. x+Diary. (London: George Allen, 1904.)

A FEW nature and other notes, together with directions as to the month's work in the garden, precede the diary for each month. Every day throughout the year is provided with an appropriate poetical quotation and a space in which to record personal observations of nature in the garden and elsewhere. Altogether a pleasing compilation.

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.*]

Oxford Science.

To the report of a lecture recently delivered in Oxford (NATURE, vol. lxix. p. 207) Prof. Perry appends a footnote in which he states that if he were to endow a professorship in some definite branch of science at Oxford, the authorities would appoint a man who never had done, and who never could be expected to do, any research work, and whose highest ambition would be to act zealously as the bursar of his college! As some of the readers of this report might regard this statement as being literally true, it is as well it should be contradicted. Of the fourteen full science professors at Oxford, only one is, or ever has been, a college bursar. In fact, nearly all the professors are eminent men, who by their research work have contributed in no small measure to the advancement of science. All are fellows of the Royal Society, and nearly all have served on its council.

Prof. Perry's statement that Oxford turns out very little research work of any kind is likewise unsupported by facts. As can be seen from the "Reports of University Institutions" (published by the Clarendon Press), the amount of research work done in Oxford is increasing every year. To take but a few instances, we find that, in 1902, workers in the department of physiology published eighteen original memoirs, those in the department of astronomy eleven, and those in the department of comparative anatomy ten memoirs, whilst from the Hope department of zoology two bulky volumes of collected researches have been published within the last few months. In fact, I challenge Prof. Perry to name a single professor, lecturer or demonstrator, in the departments of physiology, comparative anatomy, zoology, geology, botany, physics (electricity), astronomy or mineralogy, who is not engaged upon research at the present time, and who has not published original work during the last year or two. Again, many of the colleges are subsidising research by electing research fellows rather than fellows by examination. Of such fellows—all elected within the last few years—it will suffice to mention the names of Messrs. Arthur Evans and D. G. Hogarth, whose exploration work in Crete is known to all, and Messrs. Grenfell and Hunt, equally well known for their work in Egypt.

The statement that Oxford hates science does not seem to be borne out by the fact that, of the total yearly revenue of the university (as apart from the colleges), more than 10,000*l*., or a seventh part of the whole, is devoted to the upkeep of the science departments and the payment of science readers and lecturers. Many of the colleges are no less liberal in their support of science and research. To

take a single instance, Magdalen College spends more than 5000*l.* a year upon science professorships, fellowships and scholarships, or a seventh part of its net revenue, and of the last twelve fellowships it has awarded, six have been for research. Also it keeps up a very efficient private laboratory, as, indeed, do five other colleges in the university.

Oxford, January 9. H. M. VERNON.

I THINK that others may interpret the footnote as Mr. Vernon does, and it is therefore my intention to express myself more clearly when the address is republished. Surely all Oxford science men know what I meant to say, and if so, they must know how difficult it is to say it without making two or three particular references. It is evident from other parts of my address that I certainly did not mean that most of the Oxford science professors neglect research. On the contrary, I know that the majority of them perform their duties well, including duties as to research, and they do this in an antipathetic atmosphere such as science professors elsewhere know nothing of. If I had the inclination to punish a scientific man and the power, I would appoint him to an Oxford science professorship.

Some of the most distinguished workers were listening to my address, and I know that they were not much annoyed when I expressed my opinion that, relatively to the position and wealth of Oxford, there is very little being done. We know the names of the Oxford men who are doing good research work in Oxford and elsewhere, and surely Mr. Vernon will not say that they form one-tenth of one per cent. of the number of living men who have been educated at Oxford. But I am not concerned with the easy standard which he is satisfied to apply. I was expressing what is a very general opinion, and one that is certainly my own. Also in saying that Oxford fears and hates natural science I was expressing a very general opinion. It is ridiculed by Mr. Vernon, but he does not disprove it when he tells how Oxford trifles with science by the establishment of what are called science scholarships and fellowships and starved little laboratories.

Public opinion has been burked for many years by this grotesque fooling. Add to this that the majority of the dons throw ridicule upon natural science studies and create an atmosphere in which it is nearly as difficult for a man to do scientific work as it is for a mouse to live in an atmosphere of carbonic acid. An earnest student of natural science swims in a sea of troubles, and the university authorities in their love for him ornament him with a millstone of compulsory Greek as neck ornament. Surely this is something worse than trifling; it is torture. The torture is not so exquisite as what is applied to natural science in schools which are under Oxford influence, but it serves its purpose. JOHN PERRY.

An Undescribed Rudimentary Gill-plume in the Crayfish.

I SHOULD be glad if you would allow me to place on record the discovery, by Miss Margery Moseley (daughter of my old friend, the late Prof. H. N. Moseley, of Oxford), in specimens of the common cray-fish (*Astacus fluviatilis*), of a pair of minute gill-plumes (right and left), belonging apparently to the somite of the first pair of maxillipedes. Miss Moseley discovered these new minute gill-plumes, independently, in the course of dissection of a series of "types" in the department of comparative anatomy at Oxford. Finding no description of them in the text-books, and that they were not recognised or admitted by the authorities, she sent her notes and drawings on the subject to me. The discovery has been confirmed at my request by Dr. Calman, who is engaged in work on the Crustacea at the Natural History Museum, and he expresses his astonishment (in a letter to me) that so important and (when once noted) so obvious an organ can have been overlooked by the many students who have carefully examined the cray-fish since Huxley made it one of his "types," and published his researches on the gills of the astacoid Crustacea.

The discovery is interesting, not only as a fact in the morphology of Crustacea, but as being a novelty in a subject treated with special attention by so skilled an observer as Huxley, and minutely examined by thousands of students and teachers during the last twenty years. Miss Moseley is preparing a description and drawings of the new gill-plumes for immediate publication.

January 15. E. RAY LANKESTER.

A Theory of the Cause of Atmospheric Electricity.

THE idea that the sun sends out a large amount of Becquerel rays has found considerable support in the scientific world, and has been used to explain a number of difficulties connected with cosmical physics, for example, the source of the sun's energy and comets' tails. There is still another old standing difficulty which it appears to be able to solve, viz. the permanent maintenance of the electrical field in the lower regions of the earth's atmosphere. If we take for granted that the sun continually emits Becquerel rays consisting of positive and negative electrons, one would expect the following to be the consequence. Some of the electrons which reach the earth's atmosphere will be absorbed—probably mainly by the water vapour and dust in the lower atmosphere—but according to Rutherford's experiments more positive than negative; thus we may expect a greater number of negative electrons to reach the surface, a corresponding number of positive electrons being held back by the air. We at once see a cause for the positive charge of the air and the corresponding negative charge on the surface. If there were no "dissipation" the result would be a continual charging up of the atmosphere or an ever increasing potential gradient above the earth's surface; but there is dissipation, and it counterbalances the tendency of the electrical field to increase. If we had a constant dissipation the result would be a maximum potential gradient in the daytime and a minimum in the night, for we must assume that more electrons reach the atmosphere in the day than in the night. But we know from Elster and Geitel's measurements that the dissipation reaches a maximum at midday; this will tend to reduce the maximum of potential gradient which would otherwise be reached about that time. This consideration agrees entirely with the fact, for Exner has described the daily variation of the potential gradient as "a simple daily period, distorted by a midday depression." With the fairly constant daily period of the entrance of electrons into the atmosphere, the main determining factor of the potential gradient will be the dissipation; thus we find a maximum potential gradient in the winter with a corresponding minimum dissipation. The relation between potential gradient and dissipation has been thoroughly investigated by Elster and Geitel, and they have found experimentally that "that which tends to reduce the dissipation tends to increase the potential gradient," which is just what one would expect from the theory. This theory appears to me to be able to account for a great many more of the problems of atmospheric electricity, but the above will show the general idea. GEORGE SIMPSON.

Projection of Imitation Spinthariscope Appearance.

WITH reference to Sir Oliver Lodge's letter in NATURE of last week (p. 247), might I venture to say that I exhibited to a large audience the nature of the effect seen in a spinthariscope in a lecture which I gave on radio-activity at the Cavendish Laboratory last term? My plan is somewhat similar to that suggested by one of Sir Oliver Lodge's sons, and consists of two black discs rotating in opposite directions in a mechanical slide. The discs have a large number of transparent spots, so that whenever two of these coincide a flash is produced on the screen. The resultant effect is the same as that seen in the spinthariscope. The coincidences can be arranged so as to be most numerous near the centre. J. B. B.

The Diminishing Size of the New Bishop's Ring around the Sun.

IN addition to the notes recently given in NATURE by Prof. Forel, Mr. Rotch and Mr. Backhouse concerning the new Bishop's Ring, I should like to direct attention to the steadily diminishing size of this ring.

Mr. Backhouse says in vol. lxvii. (p. 174) that the middle of this reddish ring in the summer of 1902 was 70° from the sun, but on December 21 it was only 40° from the sun.

The first measurements made by me were on January 9, 1903, when I found the faint reddish ring extending from between 25° and 30° to about 40° from the sun, the mean distance being about 33°. On January 20 several measurements made with an altazimuth instrument gave the mean distance of the middle of the red ring as 30° (see *Science*, N.S., vol. xvii. p. 150, January 23, 1903). On February 24, measured by an altazimuth instrument, the reddish glow extended from 26° to 31° from the sun, the mean being about 29°. On May 13 the average distance of the middle of the ring was by measurement roughly about 30°. On June 26 it was found to be about 26° from the sun. All these measurements were made at Blue Hill between 10 a.m. and 2 p.m., and the distance was measured from the sun vertically upward to the ring.

On September 1 Mr. Rotch, when on the summit of Mont Blanc, measured the distance of the ring from the sun, and found it to be between 20° and 25°, which would give a mean distance of about 23° (NATURE, vol. lxviii. p. 623).

On October 14 I again measured it at Blue Hill with a sextant, and found it extended out to 26°, which would give a mean distance of about 23°. A recent measurement by me on December 28 with an altazimuth instrument showed that it extended from about 16° to 24° from the sun, giving a mean distance of 20°.

Putting these measurements together, the following results are obtained :—

1902		1903						
Aug.	Dec.	Jan.	Feb.	May	June	Sept.	Oct.	Dec.
70° ...	40°	32° ...	29° ...	30° ...	26° ...	23° ...	23° ...	20°

These results show a very rapid decrease in size at first, followed by a diminishing rate of decrease.

When I began my measurements I had not seen the letter of Mr. Backhouse, and did not see it until about a month ago. I anticipated that the ring would grow larger with time, reasoning that if the ring was a diffraction phenomenon, due to volcanic dust, the larger particles of dust would fall first to earth, leaving the smaller particles, and theoretically this ought to increase the size of the ring. I have been surprised to see the ring grow smaller. Perhaps it is because the whole of the particles causing it are getting nearer to the ground. Inside the very faint reddish ring described above, is a whitish glare which is visible to everyone, but I find that many people are unable to distinguish the reddish ring, which is very faint, and only distinguishable by anyone on the clearest days, and is most distinct when the sun itself is hidden by a cloud.

HENRY HELM CLAYTON.

Hyde Park, Mass., December 30, 1903.

Subjective Images.

WILL you kindly allow me to submit the following case for the consideration of your readers? I was reading a book one day in the open air, and the full light of a strong sun was shining on the printed page. After reading for about half an hour, I went over to a fountain, a few yards distant, in the shade of some trees. On a white marble slab attached to the fountain, there was an inscription, which I knew to be in jet black letters. To my surprise, the letters now appeared to my eye a rich emerald green. So brilliant and persistent was this green that I thought, for a time, that the colour had been really changed. After a few minutes, however, the green hue slowly faded away, and the letters appeared black as before.

The explanation that occurs to me for the moment is that the impression made on the retina by the different colours present in white light, lasts longer for some colours than for others, and that it lasts longest for the green. Thus the retina having been exposed for a considerable time to an intense white light, retained the impression of green after the impressions made by the other colours had faded away, and accordingly those portions of the retina on which the image of the black letters fell would still produce the sensation of green, while that sensation would be practically effaced for the remainder of the retina by the strong white light of the marble slab. It would be interesting, I think, if any of your readers could give evidence of a similar experience, or offer any better explanation of the phenomenon.

GERALD MOLLOY.

86 Stephen's Green, Dublin.

National Science Scholarships.

As a former student of the Royal College of Science and School of Mines, London, S.W., I was much struck by the hard working, studious demeanour of the national scholars I came into contact with at this excellent institution, and it seems to me that they are deserving of a better fate than being compelled to exist in London and to find many college necessaries out of 25*s.* per week, which I understand is only paid them during term time (p. 237). I am proud to be able to number several of these fine fellows among my intimate friends, whose mental calibre makes their companionship an acquisition; the miserable pittance doled out would seem hardly likely to attract such material, and seems to me only calculated, in many cases, to crush the element it professes to foster, and to turn out drudges for the general use and convenience of others possessing healthier digestions and a more extended knowledge of the world in general.

In this age of educational raving, when, apparently, it is assumed that the expenditure of large sums of money on the erection of colossal buildings is the surest way of building colossal minds, it makes one hesitate and wonder what education of any kind means.

Surely the object of scholarships should be two-fold, or more than two-fold, to make *men*, as well as *men of science*, and to educate in accuracy and truthfulness, and manliness also, and not to make mental and physical wrecks by ignoring earthly needs, yet the latter must result in many cases from such false economy. Either the scholarships should be made sound in every way or they should be abolished; the country would at any rate gain by a reasonable number of healthy minded citizens, which no nation can afford to despise in the race of life as it goes on to-day.

I think your suggestion of suitable halls and corporate life a good one; it is a need of the Royal College of Science, it is in fact, a need of all large colleges and universities drawing students from the various quarters of the Empire. The system of halls for a college should, in my opinion, be in miniature representative of the colleges of Cambridge and Oxford, a system which has probably assisted in maintaining the pre-eminence of these universities more than one is at first sight prepared to admit. Each unit belonging to the mother institution striving to obtain good men and fostering them by every encouragement to work for the hall they represent, let each hall have its cherished list of names of prizemen, and thus convert what, in a simple college not possessing such units, becomes a system of pace-making into a healthy, manly, and sportsmanlike competition, in which the honour of the hall is at stake equally with that of the individual, where each will do his best work and be free from that tendency on the part of many high minded individuals to condemn themselves for entering into direct competition with less healthy, less capable men who nevertheless possess qualifications which make them respected by all to whom they are known, for the honour of the hall is a thing apart from self. Such a system would, I believe, tend to advance greatly the beloved institution which many others and myself regard as Alma Mater.

Bedford, January 14. W. H. PRETTY.

The Transvaal Technical Institute.

IN view of various unauthorised statements which have appeared from time to time in the public Press, the council of the Transvaal Technical Institute will be obliged if you will give publicity to the following particulars regarding the arrangements which have been made to meet the needs of this community and of South Africa generally in respect of technical education.

The classes for mining students which for seven years past have been held at Kimberley are being transferred to Johannesburg, and it is expected that some forty students will be in residence here at the beginning of next academic year (February).

To provide lecture rooms and laboratories for these students, the council of the Institute has taken over from Government the lease of the Boys' High School in Kerk Street, while a row of houses in Highfield Terrace will be furnished for boarding accommodation.

The council, aided by a committee at home, is making the necessary appointments to the teaching staff. Already

Prof. Hele Shaw, of Liverpool, has been appointed senior professor, and he will be in charge of the department of mechanical and electrical engineering, with Prof. Orr, late of Kimberley, as assistant professor. The chair of mining engineering and the assistantship in that department have not yet been filled, but arrangements will soon be completed for the due carrying on of this department.

The courses at present provided by the Transvaal Technical Institute are those of the third and fourth years of the Cape mining curriculum arranged by the University of the Cape of Good Hope, but the council has under consideration the development of the Institute, so as not only to give a complete four years' mining course, but also to provide courses in other departments of engineering and technical education generally, and to provide post-graduate courses for mining engineers.

Evening classes in subjects bearing on certain trades and industries are already being carried on in Pretoria and in Johannesburg, and the council is preparing a scheme of technical instruction for mines employees and others which involves the early opening of evening and day classes along the line of Reef, and eventually in other parts of the Transvaal.

The council of the Institute has also under consideration the wider proposals recommended by the Commission on Technical Education, and it is intended that no undue delay shall intervene in the carrying out of these.

JOHN ROBINSON (Secretary).

Transvaal Technical Institute, Secretary's Office, Johannesburg, December 23, 1903.

The Quadrantid Meteor Shower of 1904.

THE evenings of January 2 and 3 were clear here, but the moon being full and near perigee, rendered invisible in the north-eastern sky all stars less bright than second magnitude. A brief watch before midnight on January 2 indicated a total absence of meteors, and it was not thought advisable to prolong observations on this night, as it had been previously determined by the writer that it was on the following night that the Quadrantid maximum would occur.

The calculated time of this maximum was January 3, 18h. G.M.T. On the same night there was an earlier, and what had been supposed would be a much weaker, maximum at 13h. Observations were therefore commenced here shortly after midnight, and it very soon became apparent that, notwithstanding the strong moonlight, shooting stars were unusually numerous. Between 12h. 5m. and 13h. (Dublin time) there were observed 17 meteors, of which 8 were as bright, or brighter, than first magnitude stars. They made their appearance at very considerable distances from the Quadrantid radiant, and, owing to the very limited number of fixed stars visible in that quarter of the sky, it was impossible to record the meteor-paths with accuracy, but several of the latter indicated a divergence from the region of Boötes, there being at the same time another probable centre of emanation near the tail stars of Ursa Major.

The advent of clouds from the south-east rendered observations impracticable or fruitless between 13h. and 14h. 15m., but during the first quarter of an hour succeeding this interruption 4 more meteors were seen, of which 2 were of first and the rest of second stellar magnitude. The early maximum of the night was now evidently declining, as in the next half hour but 3 shooting stars were visible, the two brightest of these being only of second magnitude. The two hours' interval between 15h. and 17h. was remarkable for its meteoric paucity, only 1 bright meteor equal to second magnitude having been observed during this period at 15h. 30m., though the sky was very clear; and the watch would very probably have been abandoned after 15h. but for the maximum expected some hours later. This anticipation of a recrudescence of the phenomenon was fully realised, for between 17h. and 17h. 30m. 10 meteors were observed (half of them of first magnitude), although two-thirds of the eastern sky had by this time become covered with light clouds. The meteors radiated in all directions from a region very evidently situated in the north of Boötes. In the next ten minutes 2 more Quadrantids were observed, although the clouded area had by this time increased to five-sixths. Observations were discontinued at 17h. 40m. The meteors had a fairly rapid motion, and were slightly red in colour. Their paths ranged from 10° to 20° in length. The excessive moonlight must have detracted considerably from the splendour of the present display, but, even as it was, the meteoric rate during the shower's activity was much higher on the night of January 3 than on the corresponding night in 1903.

Dublin, January 13. JOHN R. HENRY.

M. Blondlot's *n*-Ray Experiments.

IT would be interesting to know whether anyone has succeeded in confirming the above, as described in your columns and elsewhere.

Personally, I have repeated most of M. Blondlot's experiments, but I have not been able to discern the slightest trace of any of the remarkable phenomena that he describes. This is also the case with Mr. J. C. M. Stanton and Mr. R. C. Pierce, who have assisted me in the investigations.

In order to get away from personal physiological idiosyncrasies we have also applied delicate photographic methods of observation, but without result, and as a general conclusion I am inclined to think that M. Blondlot's observations must be due, not to physical, but to physiological processes, and further, that these are not operative in the case of all persons.

Perhaps others may have tried the experiments and may have met with greater success.

A. A. CAMPBELL SWINTON.

66 Victoria Street, London, S.W., January 19.

Phosphorescence of Photographic Plates.

SOME time ago when developing an X-ray photograph I observed the effect noticed by your correspondent in your last issue. Very little of the silver salt had been affected, and the plate, after development, when put into alum solution lit up as described. I have often watched for the same effect since with ordinary negatives; sometimes there is phosphorescence, sometimes not. Apparently a fairly long development with the pyro soda is necessary. Not only the plate itself, but the used developer will give the phosphorescence with alum solution. Dilute sulphuric acid may be used instead of the alum. Quinine sulphate or hydrochloride does not light up when the used developer is added, but will do so if a few drops of sulphuric acid are subsequently introduced. Printing out paper may sometimes be successfully used instead of the plate, or the experiment may be still more easily made by mixing potassium bromide and silver nitrate solutions in dim gaslight, decanting, and shaking up the resulting silver bromide with pyro soda. A red liquid results which gives the lighting up effect when poured into alum solution or dilute sulphuric acid.

H. J. EDWARDS.

Heaton, Newcastle-on-Tyne, January 16.

BIRD-LIFE IN WALES.[1]

ALTHOUGH the writings of Messrs. Murray Mathew, Cambridge Phillips and others have made us more familiar with the avifauna of southern Wales than we are with that of some other parts of that country, Mr. Walpole-Bond's description of the bird-life of a part of the district is not any the less welcome and instructive. For he enters very fully into the nesting habits and comparative abundance or scarcity of the birds in a way that is only possible to a good climber, indifferent to weather, who is able to devote every day wholly to the pursuit of his favourite study. The wild Wales of this book seems to lie, in the main, in part of the county of Brecon, although Pembrokeshire and other districts are touched upon. Incidentally, Bucks, Kent, and Hampshire are mentioned.

[1] "Bird Life in Wild Wales." By J. A. Walpole-Bond. Illustrated with photographs by Oliver G. Pike. Pp. xv+283. (London: T. Fisher Unwin, 1903.) Price 7*s.* 6*d.*

Wild Wales is still, happily, a stronghold of the buzzard and the raven, both of which are still fairly common there (the author seems to have had the luck to see no less than three buzzards' nests with eggs in one day), and enjoy a certain amount of protection or at least toleration, while the sight of a fork-tailed kite even may still gladden the eye of the bird lover, and we read of six seen in the air together! The management of the attempt to protect the kite in Wales, in support of which some members of the British Ornithologists' Union (which should not be called the "British Ornithological Society") have subscribed liberally, was in 1903 placed in the author's hands. Accordingly, a valuable chapter gives us an account of a nesting haunt of the kite in that year. But the birds seem to have had bad luck, despite the watchful care of the author. In the nest he found the kite addled one egg and cracked the other accidentally. A visit to Tenby in the breeding season

FIG. 1.—Merlin's Eggs in Crow's Old Nest. (From "Bird Life in Wild Wales.")

supplies material for an account of the ordinary seafowl to be found breeding just then. The little wader which remained unidentified was probably an immature turnstone, for many non-breeding individuals of this species pass the summer on the coast of Wales. The explanation of the light coloured shag seen on May 27 is, perhaps, that these birds do not attain adult dress in their first year, and this was immature.

Other chapters deal with the birds to be seen "in the hills" and along the river, with well-known feathered outlaws and some of the rarer birds of Wales. But the buzzard and the raven are the favourites of the author (who, indeed, devotes a whole chapter to the latter), and his personal observations on the breeding habits of these two species would alone make this pleasant book a valuable addition to the literature of the subject. The fact of the peregrine breeding in Breconshire is here recorded for the first time, and the author was lucky enough to find a merlin's nest, the second only recorded in that district. Additional interest attaches to this nest from the fact that the birds had taken possession of an old crow's nest in a tree, a most unusual thing in this country, where the merlin usually deposits its eggs on the ground or on a ledge of rock. About half the volume is occupied by an account of the author's bird-nesting and general ornithological observations on the birds of his own neighbourhood (in the form of a diary) from March to July, 1902. From these interesting pages we can gain a very good idea of the avifauna of the district, in which, by the way, the very local woodlark is to be found breeding.

The author includes a chapter of rough notes on climbing, collecting, &c., with an appeal to landowners to preserve our rarer birds. May we venture to supplement this with a hope that he will set no more traps for marten-cats? For the marten is every bit as interesting a member of our native fauna as the buzzard or the peregrine, and it is getting *very, very* rare. The author, when writing about egg collecting, states that the dealer is the worst offender in this respect, "for he stops at nothing, and will take as many clutches of a good thing as he can find." This, we fear, is quite as true of some collectors, and we must protest against the inference that the collector in general is one bit less to blame than the dealer. The collector stands in the place of "receiver," and whether or not it is true that the thief would not exist without the receiver, it is certainly true that the dealer would not exist without the collector.

As to the unsafety of "generalising" in observations all will agree. It is, perhaps, unsafe to generalise on such a subject as whether or no the curlew "seldom, if ever," lays less than four eggs. For in the case of ground-building birds, especially, the question whether a crow has visited the nest always comes in; but we have twice found three incubated eggs in a curlew's nest. If the missel thrush has usually ceased to sing in South Wales by April 15, its habit is very different in some other parts of Wales, where it may be heard well on into May. In Oxfordshire we have heard it in June. It may be pointed out with reference to the distribution of the garden warbler (p 211) that it is common in Merionethshire, and not uncommon in parts of Carnarvonshire.

These charming pages are all the more refreshing reading because the author is evidently more accustomed to scaling crags and climbing "stiff" trees than to the making of books. All the same, a little more method in the arrangement would have husbanded space by avoiding repetition. For instance, the events of some March days detailed in the third chapter are repeated, with slight verbal variations, in the fifth, and in another place we notice that a note descriptive of bird-life recurs. The author thinks waterhen a better name than moorhen, "as one would no more expect to find one on a moor than a grouse in the river." But it may be pointed out that "moor" is an old English name for a wet meadow, and a "moorish" place is a wet place, so that moorhen was an appropriate English name for the bird long before English people had so much as heard of grouse moors.

The work is profusely illustrated with photographs of nests and bird haunts by Mr. O. G. Pike, the excellence of whose work is too well known to need further comment here. But we may direct attention especially to the clearness of the details of the sparrow-hawk's nest, the wool in the lining of the raven's nest, and the beautiful roundness of the pheasant's eggs. We do not remember to have seen a photograph of a woodlark's nest previously. O. V. APLIN.

EARTH-MOVEMENTS IN THE BAY OF NAPLES.[1]

IN spite of the prolonged discussions on the question of changes in the relative level of land and sea in connection with the Temple of Serapis [2] at Pozzuoli, yet much remained unknown with respect to the movements of the Italian coast which it was surmised must have taken place since Roman times. An exclusive study of the columns of this building is insufficient to indicate the Roman sea-level relative to the land, for although the lowest portion of the columns, now below sea-level, was obviously above it, we cannot determine to what extent. Neither can we conjecture the size of the area affected by the movements; indeed, by the undue prominence which has been almost universally accorded to the Serapis phenomena in geological treatises, many authorities, among whom was Prof. Suess, were led to the conclusion that the phenomena were strictly local and almost confined to the Bays of Baia and Pozzuoli, in short, to the country immediately surrounding Monte Nuovo.

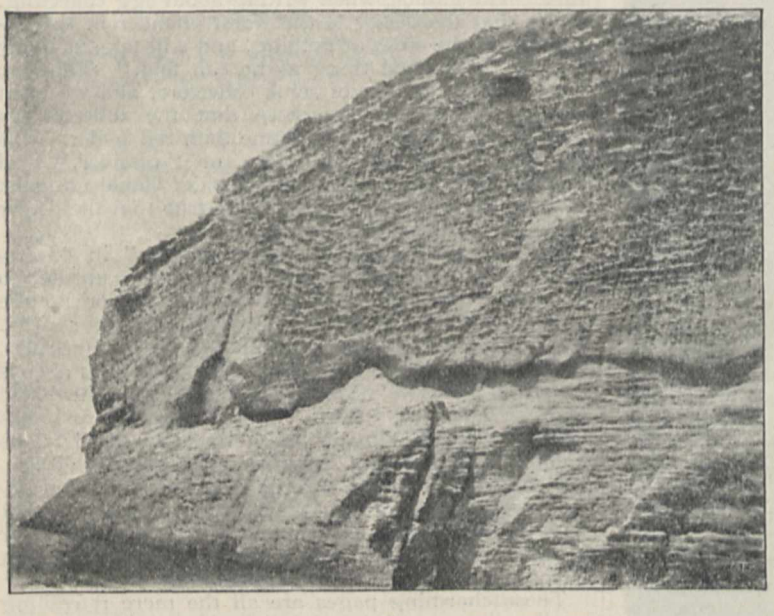


FIG. 1.—The Upper Groove of Erosion on Tufa Cliffs of Nisida.

Note the difference of the texture of the surface below the upper erosion line, which has been preserved by submergence, and that above, which has been weathered.

It was with the object of collecting facts for the elucidation of these points, that we undertook the work of surveying and describing the little-known remains of Roman constructions which are so numerous around the Bay of Naples. Some of them are still standing on the present water-line, while some are awash and some deep beneath the surface: and from localities furthest from Monte Nuovo, we obtained evidence of earth-movements not less great than from localities nearer the mountain; thereby confirming our conjecture, as to the movement of the land spreading over a more considerable area than had been supposed at first.

At many points on the coast (Fig. 1), and especially in the limestone cliffs of Capri, the observer may note a clearly marked line of grooves and holes at a height varying from 23 feet to 12 feet above the present sea-level. This line, which presents the same appearance as one which traverses the rock face along the present water-line, is undoubtedly due to the same cause, namely, the eroding action of the surface of the sea. The upper marks of erosion correspond in height with the highest Lithodomus borings in the columns of the Temple of Serapis, thus showing that the entire Bay of Naples took part in the movement of the subsidence and subsequent elevation of the temple, and, as evidence of the same sort is to be found forty miles north at Gæta, and probably on the promontory of Mt. Circello as well, if atmospheric weathering has not obliterated the traces of marine erosion, the same alteration of land-level must have affected a large extent of the Mediterranean sea-board.

The changes of level have been deemed by some to be due to periodic changes in the level of the ocean. We are unable to accept this view, for we should expect the oscillations of the water-level to be of a regular and tide-like nature, as Niccolini, the eminent exponent of the theory, must himself have imagined, for the curve illustrative of his theory of marine phases is essentially a tidal curve, but the marks of erosion indicate spasmodic movements, changes of level during relatively short periods alternating with prolonged periods of rest. Another point against the theory of the change of sea-level is that the line of erosion, though continuous, varies in height; for instance, at the east end of Capri it is 10 feet higher than at the west, and smaller variations have been noted elsewhere. These facts are more reasonably accounted for by a theory of change of land-level, rendering inequalities in the oscillatory movement natural, than by a theory involving changes in the level of the sea.

Interesting as it is to search for the traces of her handiwork that nature leaves in her own domain of rocks and cliffs, yet we confess to an interest not less keen in seeking out those she has left on the handiwork of man, on the remains of the Roman buildings by the sea. Massive piles of masonry and concrete, once part of some noble building, have been roughened by the never ceasing onslaught of the waves to the semblance of the brown rocks upon which they stand; and it is only possible to distinguish between the natural and the artificial on calm days, when they can be seen through the clear water.

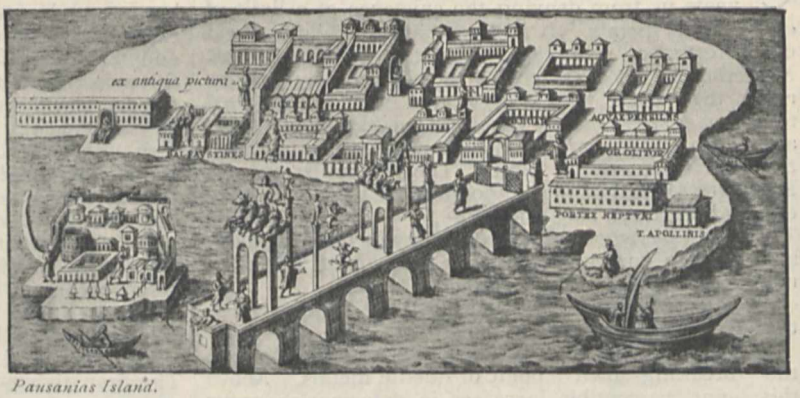
It is the accumulated evidence furnished by these water-worn ruins that gives so strong a confirmation of our theory that, notwithstanding the oscillatory land-movement indicated by the upper erosion line before mentioned, the present land-level is far below the Roman land-level—how far we cannot exactly say, but we believe that the approximate figure of 17 feet will not be found to be very wide of the mark.

[1] The author's papers here summarised are:—"On the Possibility of Obtaining more Reliable Measurements of the Changes of the Land-level of the Phlegræan Fields (*Scottish Geographical Magazine*, October, 1900). "Earth-movements in the Bay of Naples" (*Geographical Journal*, August and September, 1903). "The Submerged Greek and Roman Foreshore near Naples" (*Archæologia*, vol. lviii. pp. 1–62, figs. 1–29, plates xlv.–li., 1903). A few copies of the two last papers, reprinted with corrections, have been issued under the title "Contributions to the Study of Earth Movements."

[2] *Macellum*, or market-place, would be a more correct name for the building than "Temple of Serapis."

The evidence is of the most diverse description; masses of concrete or of Roman brickwork may be seen under water, so disposed that they show the ground-plans of the buildings they once supported; stairways with steps several feet below water are cut in the rock of caves, the walls of which still show traces of a stucco covering even where they are submerged; a drain which runs several feet below the surface, in a sea-side palace of Tiberius; artificial tunnels or *cuniculi* entirely submerged; these are but few among many other facts which have been a puzzle to antiquarians, and can be accounted for by the theory that the Roman land-level was about 17 feet higher than the present.

By the same theory we can explain why the malarious Lago d'Agnano was not mentioned by Roman writers, for it would not have been in existence with the land at the higher level; the present unhealthiness of the low-lying plain of Pæstum, once the site of a flourishing Greek colony, is also explained; then the Pool of Baiæ, mentioned by classical writers, and an island off Dicæarchia, described by Pausanias (Fig. 2), that have apparently vanished, we find by this theory to have been carried down by the land as it sank so that they are now covered by the sea; and finally the Roman fresco representing the famous breakwater of Puteoli Harbour (Fig. 2), which shows us the arches that join the piers or *pilae*, with the springing of the arches well above the water, is of the breakwater as the Romans saw it; nowadays the springing of the arches is submerged (Fig. 3).



Pausanias Island.

FIG. 2.—The Breakwater of Puteoli, after a Roman Picture.

FIG. 3.—The Breakwater of Puteoli, after an eighteenth century drawing.

These researches have thrown a new light on a point of controversy among scholars, namely, the question as to the exact site of the ancient Greek colony of Palæpolis, the mother-town of Neapolis, the present Naples. This ancient town was supposed by some authorities to have stood where Naples now is, by others to have been further inland towards Aversa. Following up our hypothesis that the shore was higher by nearly 17 feet than it is now, there would be a stretch of land extending nearly half a mile out to sea at the base of the cliffs of the promontory of Posilipo; it is here, where the ruins now under water attest to the existence of numerous buildings grouped round the Gaiola rocks, that we would place Palæpolis. Close by under the lee of this extended foreshore we discovered the defensive works of an ancient harbour, and we found many traces of an ancient coast road, also submerged, which ran along the foot of the cliffs and by tunnels through some of the little headlands on the eastern side of Posilipo (Fig. 4). This road gave an easy means of communication with the neighbouring colonies, and the many proofs we have found of its existence, as well as the geographical situation of the southern extremity of Posilipo, which was pre-eminently adapted to the conditions of Greek colony life, have emboldened us to believe that here, beneath the foundations of the later Roman edifices, the site of the vanished town is to be sought.

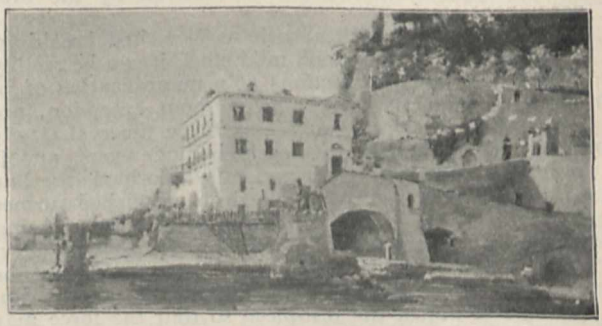


FIG. 4.—Ancient tunnel through Headland of the Villa Luisa, Posilipo. (After an oil painting by Mrs. Holcombe Ingleby.)

R. T. GÜNTHER.

THE ELASTIC LIMIT OF METALS.

COMMON SENSE, as Lebasteur has remarked, prevents us from denying the existence of a limit of elasticity in metals. It is true that the smallest load on a test-piece will cause a slight permanent set. Nevertheless, such structures as iron railway bridges retain their shape, and if a piece of metal is subjected to a small stress many times in succession, recovery after each application becomes almost perfect. What, then, is the elastic limit? The Commission des Méthodes d'Essai of 1894 announced that it is necessary to recognise three such limits :—

(1) The theoretical limit of elasticity or the maximum stress which does not produce a permanent strain (of more than a certain small amount).

(2) The proportional limit of elasticity, within which the strain is proportional to the stress.

(3) The apparent limit of elasticity, corresponding to the "breaking-down" point of ductile metals. Above this point, perceptible increases in deformation occur without a perceptible change of load.

With regard to these limits, M. Frémont points out, in a carefully reasoned article contributed to the September number of the *Bulletin* de la Société d'Encouragement pour l'Industrie nationale, that no one can say what is the exact difference between the first two, and that there are theoretical grounds for supposing that they ought to coincide. Moreover, the proportionality of deformation has been called in question, slight irregularities having been detected when the measurements were made with the greatest care.

These matters, however, do not greatly interest the practical man. It is not usual for the elastic limit of a consignment of steel to be tested, although it is frequently mentioned in specifications. As a general rule the breaking load only is measured, and it is assumed that the elastic limit is a definite constant fraction of this. In view, however, of the tendency of engineers to avail themselves more fully of the elastic limit, it is becoming more important to determine that limit exactly. In fact, if the elastic limit were known with a greater degree of exactness, it might be possible to practise economy by using a smaller margin of safety than is necessary at present.

Holding these views, M. Frémont set himself the task of discovering whether there is a real limit of elasticity, and if the anomalies mentioned above could be explained. Calling to mind the dictum of seventy or eighty years ago that a metal had passed its elastic limit if it had undergone a change of texture under stress, he proceeded to examine how far the microscopic structure of metals was altered by the first permanent strain.

In the class of bodies with well-marked breaking-down points, such as good mild steel, it can be readily observed in polished sections at a magnification of 50 diameters that all the grains, without exception, are clearly deformed at what seems to be the real elastic limit. These bodies are nearly homogeneous, and if part of a test-piece is permanently deformed, the line of demarcation is clearly defined on a polished surface by the deformed part becoming dull, the change being visible even without magnification. In general, however, the first deformations are local, owing to the unequal distribution of stresses. It is almost impossible to adjust the test-piece so that the force may act in a straight line in the direction of its axis, and so the test-piece is generally deformed obliquely. Local action is strikingly illustrated by the fracture of some cast-iron or other hard non-ductile test-pieces at a place in the head where the section is greater than elsewhere.

Various devices have been invented to overcome this defect, but in none of them is any account taken of the effect of stress-hardening. The effect is well known, and may be readily demonstrated by a simple experiment. Mark a prismatic test-piece with a punch, and then file off the mark and polish the metal. If the prism is then compressed between two end-pieces the mark will reappear as soon as the elastic limit has been sufficiently passed. The stress-hardened parts resist more than, and do not lose their polish so easily as, the unaltered portions of the test-piece. The principle is the same as in the magic mirrors of the East, and the effects are observable in actual tests. Traces of striæ, file-marks, the marks made by the jaws of the vice in which the test-piece was held while it was being prepared, all reappear in the course of testing. Similarly, if the force in testing is not applied equally, the part which bears the greatest stress will be deformed first, and *ipso facto* hardened and strengthened. The first giving-way of the metal causes the pressure to be more evenly distributed, but the irregularity of pressure is succeeded by irregularity of resistance, which continues to the end of the test.

In some experiments on homogeneous boiler-steel M. Frémont found that a permanent set could be obtained in compression tests under loads varying from 8.55 to 15.70 kilograms per square millimetre, but judging from the dulling of the polished section, the deformation was always local, and the elastic limit was not passed, except in isolated patches of the metal.

After painstaking but vain efforts to adjust the force accurately, he fell back on the use of test-pieces of gradually increasing section. Then the first irregular deformations occurred in the weakest section; there was a local sinking and adjustment, and the discontinuous dulled lines tended to lie flat at right angles to the force. As the force increased the lines approached each other, and coalesced to form a continuous sheet the area of which could be measured and compared with the stress.

In Fig. 1 the effects of compression are shown on the four polished faces of a test-piece having the shape of a truncated pyramid. The first effects are quite discontinuous, the dark lines near the upper part of the top row of photographs showing the areas which have received a permanent set. In the second row the effect of a maximum pressure of 1015 kilograms is shown. In the third row, under a pressure of 1155 kilograms the discontinuous lines have coalesced, and the deformation has been made to advance as a continuous sheet, the area of which amounted to 46.8 square millimetres, so that the real elastic limit was found to be 24.60 kilograms per square millimetre. The last two rows of photographs show the effects of pressures of 1295 kilograms and 1435 kilograms respectively, corresponding to elastic limits of 24.80 and 24.65 kilograms per square millimetre. The same metal was used as that which underwent local deformation in an ordinary trial under a pressure of 8.55 kilograms per square millimetre of the whole section.

Similar results were obtained by M. Frémont in tension tests. The first deformations were apparent under a force of 8.5 kilograms, although the real limit of elasticity was certainly above 21.5 kilograms. Tests on thin flat test-pieces of increasing section gave results shown in Fig. 2, where the strained parts, at first discontinuous, subsequently form a continuous sheet.

The conditions are different in determining the elastic limit of the class of bodies which show no definite breaking-down point. The members of this class, which includes hard steels and metals of small elongation, are less homogeneous, and consist of networks of substances of different elastic limits. In the

first permanent deformations some grains only are deformed slightly, and as the stress augments more grains are deformed, and the deformation of the others increases. No definite dulling of the polished metal visible to the naked eye takes place, and the effects must be studied by means of the microscope. The polishing must also be done with the greatest care. The line of demarcation between the permanently strained and unstrained parts is even then always confused, and its exact position a little doubtful, but otherwise there is no difference between the testing of the two classes. In all cases the surface to be examined must be polished, for a scale of oxide has an elastic limit different from that of the metal underneath, and its indications are untrustworthy.

Similar results are obtainable in tests of flexion, torsion, &c.

By his experiments M. Frémont has proved that the

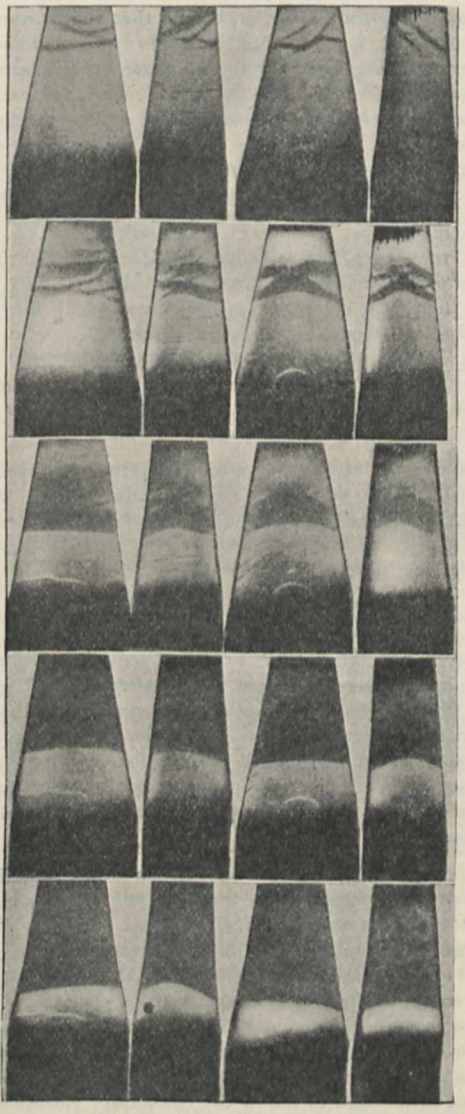


FIG. 1.—The dark areas at the upper parts of the test pieces show where the metal has given way under compression.

theoretical elastic limit is the mean charge per unit of section on which the real elastic limit is locally attained at a point of the piece tried. It is not the elastic limit of the metal, but of the particular piece of metal under the special conditions employed. Its value depends on care in adjustment, &c.

The proportional elastic limit is still more fortuitous. Owing to compensating errors the line showing the relation between stress and strain may continue to be fairly straight even above the theoretical limit.

The apparent limit is the mean charge per unit of section when the real elastic limit is reached in all regions where it had not previously been reached. It is nearer the real limit but is not identical with it, because the charge is unequally distributed between the parts that have been previously hardened and those that are not yet hardened.

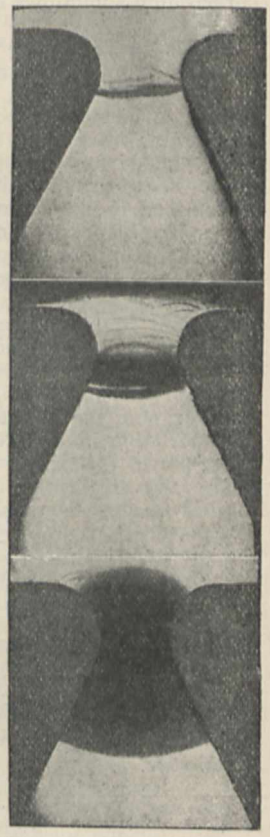


FIG. 2.—The dark areas on the test pieces correspond to the portions of the metal which have given under tensile stresses.

When the appearance of the lines of Lüders, which are now seen to be portions of metal which have given way, does not precede the continuous sheet, the theoretical limit and the apparent limit will coincide with the real limit. Generally, however, the lines come first and then the various limits will not coincide.

The nature of the metal has also an effect, for in annealed steel the two limits are nearer than in hardened and tempered steel.

To sum up, M. Frémont claims with much force that there is only one elastic limit of a metal, the "real elastic limit," as determined by the method he indicates. The real limit alone has the characters of a physical constant. The other so-called limits depend on the appearance of discontinuous deformations, the presence of which is almost inevitable in practice, although their cause is purely accidental.

T. K. R.

PREHISTORIC STUDIES IN AUSTRIA.

THE concluding part of the first volume of reports of the Prehistoric Committee of the Vienna Academy of Sciences has recently been published.[1] In former parts accounts have been given by Dr. Szombathy of excavations in the well-known cemetery at Hallstatt, of tumuli at Gemeinlebarn and Langenlebarn, and of the cemetery at Idria. Dr. Franz Heger has also treated of work carried on at Hallstatt in 1877 and 1878, as well as of various researches in Hungary and Lower Austria, while Dr. Moriz Hoernes and others have communicated valuable reports.

The part now issued contains two reports. The first, by Julius Teutsch, relates to some late Neolithic settlements with painted pottery in the valley of the Alt or Aluta, in the neighbourhood of Kronstadt, in Transylvania. A remarkable feature in one of the de-

[1] "Mittheilungen der Prähistorischen Commission der Kais. Akademie der Wissenschaften." 1 Band. (Vienna: Carl Gerold's Sohn, 1903.)

posits is the presence of stamps made of burnt clay with spiral devices upon them, which it is suggested may have served for producing coloured patterns on the human skin after the manner of tattooing. A few fragments of pottery are also decorated with spirals formed of white slip on a polished red ground, but bordered by lines painted in black. A favourite decoration consists of broad lines either straight or curved, and sometimes circular, distinguished by black edgings.

Spoons or ladles are fairly abundant, some having straight handles adorned with chevron and other patterns painted upon them. Human and animal figures in burnt clay occur, though rarely. Remains of beaver, bear, wolf, fox, lynx, wild cat, chamois, stag, and ox (possibly *primigenius*) have been found, and of domesticated animals, those of dog and pig.

Relics of a somewhat later age are also described, but the principal feature of the report is the pottery, which it will be of great interest to compare with that of a more southern area.

Dr. Moriz Hoernes, whose recent volume on "Diluvial Man in Central Europe" is well known, is author of the concluding paper in this volume. It relates to Neolithic dwelling-places near Troppau, in Austrian Silesia, and is illustrated by six admirable photographic plates and numerous cuts in the text. A remarkable stone hatchet has been found which was made out of the half of a perforated axe that had split along the perforation. Another hatchet shows the mark of the saw by means of which it was blocked out. The pottery is not remarkable, though there are among the specimens figured some stands for vessels not unlike those found by the MM. Siret in Spain. The objects found are, indeed, of a more common character than those from Transylvania. It is, however, of great importance that in a volume of reports such as that now summarised, all details of the discoveries on each spot should be carefully recorded, and the Prehistoric Commission of Austria may well look back with much satisfaction on the volume embodying the results of its labours. J. E.

NOTES.

The Secretary for Scotland received on Tuesday a deputation of Scottish scientific societies, who urged that the Royal Institution in Edinburgh should be exclusively devoted to scientific purposes (see p. 105).

We regret to see the announcement, in the *Daily Chronicle*, that Mr. J. S. Budgett, Trinity College, Cambridge, died at Cambridge on Tuesday of malarial fever. Mr. Budgett was Balfour student in biology, and only returned from the Niger recently.

The Clarke memorial medal of the Royal Society of New South Wales has been awarded to Mr. A. W. Howitt, of Melbourne.

The Food Test Commission, appointed by the United States Government, has reported that the use of salicylic acid in food is seriously injurious to health.

Prof. Vincent Rodella, of Rome, is reported to have met his death accidentally by inhaling the fumes of hydrocyanic acid in the course of some experimental work. He was only thirty years of age.

Messrs. Burroughs, Wellcome and Co. are making arrangements for a historical exhibition of rare and curious objects relating to medicine, chemistry, pharmacy, and the allied sciences, to be held in London in the course of a few months. The exhibition will be strictly professional and scientific in character, and is intended to illustrate the development of the art and science of healing. Cooperation is invited, and it is hoped that many objects of interest will be lent for exhibit. Mr. H. S. Wellcome, Snow Hill Buildings, E.C., will be glad to give particulars of the undertaking.

By the terms of Mr. Herbert Spencer's will, the trustees, on the completion of certain specified provisions in connection with his books, are directed to sell the whole of the copyrights and other property. The trustees are also directed to "give the sum realised in equal parts to the Geological Society, the Geographical Society, the Linnean Society, the Anthropological Institute, the Zoological Society, the Entomological Society, the Astronomical Society, the Mathematical Society, the Physical Society, the Chemical Society, the Royal Institution, and the British Association, or such of them as shall then be in existence, and shall accept the gift upon the condition in each case that the sum received shall, within five years from the date of payment, be spent by the governing body for the purchase or enlargement of premises, or for books or apparatus, or collections, or for furniture or repairs, or for equipment, or for travellers and donations of instruments of research, but in no way or degree for purposes of endowment."

An interesting paper on the electrical reconstruction of the South London tramways was read by Mr. A. Millar before the Institution of Civil Engineers on January 12. The paper describes in great detail the conduit system which has been employed. The lines which have been electrified are those known as the Tooting lines; the route length is just more than 8 miles, and the total length of single track 16¾ miles. The same system has been adopted for the Greenwich lines of the London County Council.

The council of the Institution of Civil Engineers has nominated the president, Sir William White, K.C.B., F.R.S., to fill the place of the late Sir Frederick Bramwell, Bart., as one of the representatives of that Institution on the Engineering Standards Committee.

We have received a copy of a pamphlet on the use of electricity in mines in Europe, by M. Émile Guarini, which has been translated into French from the *Engineering Magazine*. The pamphlet is well illustrated, and gives in detail descriptions of the principal applications that have been made of electricity to mining work. These are already numerous, but there is still much room for their further extension. We can recommend this pamphlet to those interested in the subject, whether as mining or as electrical engineers.

The completion of the Great Northern and City Railway marks another step in the progress of the provision of proper transport facilities in London. The new "tube" does not differ much from its predecessors in the general features of its construction and electrical equipment. It is, however, the largest of all in diameter, being large enough to accommodate, if necessary, the existing rolling stock of the Great Northern Railway. Special precautions have been taken in the construction of the tunnel to guard against the risk of fire and to lessen the chances of vibration. The railway will be open to general traffic in a few weeks. It has taken just four years to complete; an extension of the line from Moorgate Street to Lothbury is now in progress.

Dr. H. R. Mill has sent us a copy of a very handy pocket register which has been prepared by him for the personal use of rainfall observers. It contains full instructions for

placing the rain-gauge, forms for recording the daily readings of one or several instruments, monthly summaries, and the extreme daily falls in each month. It also contains some useful memoranda connected with the subject, and, for convenience of comparison with other stations, the average monthly falls of several types, from the driest to the wettest localities. Space is also provided for recording the general conditions of weather, wind direction, &c. Suggestions for improvement are solicited; we do not think he has left much room for improvement, but we suggest that the Beaufort weather notation or the international weather symbols might be a useful addition to the work.

We have received from the Meteorological Office a list of the meteorological observations received there from colonial stations in various parts of the world. During the year 1902 manuscript returns were received from sixty-two stations, more than half of which are situated in Africa. The amount of the information received varies considerably; at some stations complete registers have been kept, while at others only the daily rainfall has been observed. The list also contains a statement of the printed observations received either direct from the colonies and protectorates or which are included in books in the possession of the Office. It may not be generally known, although the fact is published in the annual reports issued by the Meteorological Council and in circulars issued from time to time, that this valuable information, both manuscript and printed, is available for reference free of charge by permission of the secretary.

In his interesting and stimulating address on "A Scheme for Exploration in Asia Minor," recently given before the Society for the Promotion of Hellenic Studies, Prof. W. M. Ramsay suggested the formation of a summer school of exploration in Asia Minor. The scheme, briefly, was the conducting of parties of young men by an experienced leader to various regions of Asia Minor; a suitable town would be selected for the headquarters of a party, from which excursions could be made. All those who have done field work far removed from home find that there are elements of uncertainty in their notes which a very short inspection of the original ground, or a few minutes' conversation with a native, would dispel, but which have to remain doubtful owing to the difficulty or impossibility of returning to the place. Prof. Ramsay wisely proposes that the students should write up all their notes at the centre, and thus verification would be easy. There are many other branches of science which admit of similar developments. Field work is often undertaken in the long vacation, but it is frequently desultory; what we now require is the combined action of several universities for well planned field work in geology, geography, botany, zoology, and anthropology, including archæology and ethnology. Such practical work should be considered as part of the academic curriculum, and it is certain that these would become still more living subjects in our universities if the undergraduates felt that they were making original investigations in the field, while the students themselves would greatly benefit by this new departure.

In the *Entomologist* for January the Hon. N. C. Rothschild describes four new species of fleas taken on Egyptian rodents. Others are described by the same writer in a recent issue of *Novitates Zoologicae*, one of which is named in honour of Mr. O. Thomas.

In the report of the Bristol Museum and Library for 1903, the committee directs attention to a fine series of heads of large mammals from Somaliland, collected and presented by Major H. G. C. Swayne, R.E., the discoverer of *Bubalis swaynei*. A photograph of the group is included in the report.

The *Journal of Conchology* for January contains three papers on the small fresh-water gastropods of the genus Paludestrina. In the first Messrs. Jackson and Taylor have notes on the habits of a species named from British specimens in 1891; in the second Mr. Tomlin records for the first time the continental *P. anatina* in Britain; while in the third Mr. Dean describes the relation of fishes to *P. jenkinsi*.

The regeneration of lost parts in various invertebrates forms the main topic in vol. lxxv., part iii., of the *Zeitschrift für wissenschaftliche Zoologie*, Mr. P. Imanow contributing an article on this subject in connection with a species of worm, while Dr. E. Schultz contributes two instalments of the account of his investigations on reparation of injury in general. In a fourth article Dr. O. Römer discusses the histological structure of the shell of certain bivalves, more especially the pearl-oyster. The skin-nerves of Ammocœtes form the subject of an essay by Dr. G. Marenghi.

According to the *Daily Telegraph*, whalebone has been recently sold in America for 2900*l*. per ton, while it is also asserted that 3000*l*. per ton has been paid for two and a quarter tons at Dundee, although there seems to be some degree of doubt attaching to the latter statement. Soon after the middle of last century, the price of this commodity was as low as 150*l*. per ton, but, according to the late Frank Buckland, it suddenly leapt up to 620*l*. with the introduction of the "crinoline" into ladies' costume, and it has apparently been on the rise ever since.

In the January issue of the *Popular Science Monthly* Dr. F. A. Bather, of the British Museum, returns once more to his favourite subject—the functions of museums. After mentioning the chief functions of these institutions, the author gives some much needed advice to the curators of local museums as to the necessity of firmness in refusing unsuitable specimens—if they do not wish the establishments under their charge to degenerate into mere curiosity shops. Small local museums are also warned that investigation is not their province—they are for education and the general public needs alone. Further, in larger establishments the investigation, the instruction, and the exhibition series must be kept apart. In the author's opinion, where museums have, as a rule, gone wrong is in exhibiting too much to the public. The same journal also contains an admirably illustrated article by Prof. T. A. Jaggar, of Harvard University, who was present at the time of the eruption of Mont Pelée on July 9, 1902.

We have been favoured by Captain Barrett-Hamilton with copies of two papers recently contributed by him to scientific journals. In the one (*Proceedings* Royal Irish Academy, xxiv., part iv.) he describes a new bank-vole (*Evotomys scomerensis*) from Skomer Island, off the coast of Pembroke, which differs from *E. glareolus* of the mainland by its superior size, its colour, and the structure of the skull. In the second (*Ann. Mag. Nat. Hist.*, series 7, xi., p. 390) he records the result of his own observations on the flight of the true flying-fishes (Exocœtus), which differs to some extent from those of other recent observers. Captain Hamilton, who is in this respect in full accord with the late Prof. Möbius, is of opinion that, at any rate in the genus named, the "wings" are never moved as organs of

true flight. "They may vibrate or quiver under the action of air-currents or the shifting a little of their inclination by the fish; but the whole motive power is supplied by the powerful tail. The wings are a parachute to augment the action of this propeller. Their motions are in no way comparable to those of the wings of a bird."

THE January number of the *Journal of State Medicine* commences a new series, and the *Journal* has been enlarged and much improved in appearance and in printing. It includes articles and papers by Prof. Hueppe on tuberculosis, Mr. Lloyd on the milk supply of large towns, Dr. Coles on acid-fast bacteria, Prof. Smith and Dr. Sommerville on the standardisation of disinfectants, and Prof. Hewlett on ankylostomiasis, with a translation of Prof. Behring's article on tuberculosis, together with chemical and legal notes, reviews, &c.

IN the current number of *Climate* the work that has been done by the London and Liverpool Schools of Tropical Medicine is reviewed, and Sir Patrick Manson's address on the former is given *in extenso*. An extract from a despatch from Sir William MacGregor, the Governor of Lagos, suggests the introduction into the elementary schools in the tropics of the subjects of hygiene and sanitation. Sir William MacGregor has already taken the bold step of including sanitation with reading, writing, and arithmetic as compulsory subjects in the schools of the Lagos colony receiving Government grants. A description of the Livingstone College and some technical papers complete the list of articles appearing in this useful periodical.

IN a communication to the Paris Académie nationale de Médecine (December 8, 1903) Dr. J. A. Rivière gives an account of the results achieved by him in the treatment of inoperable malignant growths by physicotherapeutic means, *i.e.* by a combination of X-rays, static electric discharges, and discharges of high frequency, together with the administration of calomel and quinine internally to promote elimination. The effect of the treatment is to cause a diminution in the size of the growths, disappearance of enlarged glands and of œdema, abolition of pain, and healing of ulcers, together with an improvement in the general condition of the patients.

IN a report on the second outbreak of plague at Sydney in 1902 just published, Dr. Ashburton Thompson describes in detail the management of the epidemic, and discusses the mode of spread of the disease. Both in this and in the previous epidemics the disease seems to have been undoubtedly rat-borne, and it is of interest that an outbreak occurred among the animals in the Zoological Gardens. The mode of spread of the disease from infected rats to man has been a much debated question, Simond, Tidswell and others maintaining that the fleas serve as the intermediaries, while others, notably Galli-Valerio, deny this on the ground that the rat fleas do not bite man. Further observations have been made on this point by Dr. Frank Tidswell, microbiologist to the Sydney Board of Health. The species of flea infesting the rat (at Sydney) in order of frequency are:—*Pulex pallidus, Pulex fasciatus, Typhlopsylla musculi,* and *Pulex serraticeps*. Of 101 fleas obtained from man, 85 were *Pulex irritans* and 16 were *Pulex serraticeps*; from a wallaby, dogs and cats, numerous specimens of *Pulex serraticeps* were obtained; thus there is one species common to man, the rat, and other animals. The objection, therefore, that the "rat flea" does not bite man falls to the ground as regards one species, and Dr. Tidswell further states that he has repeatedly observed both *P. pallidus* and *P. fasciatus* bite man. Reviewing the evidence, therefore, Dr. Thompson is of opinion that Simond's hypothesis of "flea borne plague" best explains the phenomena of the epidemic of the disease as seen at Sydney.

THE report of the Botanical Exchange Club of the British Isles for 1902 is edited by Mr. Arthur Bennett. Mr. C. Bailey gives a list of some interesting plants which he found on the sandhills at St. Anne's, Lancashire, and figures *Ambrosia artemisiaefolia* and *Vicia villosa*. Mr. G. C. Druce has been able to reinstate another of Don's doubted records by finding the grass *Deyeuxia neglecta* in Caithness.

IN the *Proceedings* of the Boston Society of Natural History Mr. C. A. King describes certain stages in the life-history of Araiospora, a genus allied to the common plant parasite Pythium. The chief points of interest are the formation of a fertilisation tube, not by the antheridium, but by the oogonium, and the specialisation of a central mass of protoplasm in the oogonium in which the male and female nuclei meet. The author places the genus in the Peronosporeæ.

WE have received a copy of an address by Dr. Rudolf Blochmann on "Die drahtlose Telegraphie in ihrer Verwendung für nautische Zwecke" (Leipzig and Berlin: Teubner, 1903), given at the thirty-fourth annual meeting of the German Nautical Society at Berlin in February, 1903. It consists of a very general description of the methods used in wireless telegraphy and of the author's views as to the future in store for wireless methods. Stress is laid on the utility of such methods in the case of fogs at sea.

A TRANSLATION into French of Prof. T. Jeffery Parker's "Lessons in Elementary Biology," by Dr. A. Marie, has been published by M. C. Naud, of Paris.

THE third and concluding volume of Mr. C. Raymond Beazley's "Dawn of Modern Geography" will, it is hoped, be ready for publication early next year. It will be issued by the Oxford University Press, to which Mr. Murray has transferred the volumes already published. Dr. M. Aurel Stein has undertaken, with the official sanction of the Secretary of State for India, a complete account of the results of his researches in Chinese Turkestan. The book will be published by the Oxford University Press, probably in the spring of 1905.

THE "Year-book of New South Wales," compiled by the editor of the "Year-book of Australia" by authority of the Government of New South Wales for circulation by the Agent-General in London, contains much information of value about the colony. In addition to particulars concerning administrative, commercial, and other matters, the volume provides an interesting account of the geographical characteristics of the country, its water supplies, and its mineral products. In fact, the publication contains all the data necessary to enable a prospective emigrant to form a good idea of New South Wales.

THE current number of the *Quarterly Review* contains two articles on subjects of scientific interest. The first is on the metric system of weights and measures, and in it the writer examines exhaustively the arguments for the compulsory adoption of the metric system. He comes to the conclusion "that the stock arguments of the advocates of the metric system, based on the extent to which it prevails abroad and the disadvantage to British trade of our adherence to a different system, have very little justification

when we consider our whole trade, import and export, with our colonies and with foreign countries." The "analysis of the conditions of our foreign trade," the article states, "leads us back to the ground that the advocates of the change would do well never to have quitted, viz. the comparative merits of the metric and imperial systems. . . . As regards all such important points as logical arrangement and symmetry, ease and swiftness of calculation, simple and direct connection among the fundamental units of length, weight, and volume, there can be no possible room for doubt as to the vast superiority of the metric system." The other article is by Mr. W. C. D. Whetham, and is entitled "Matter and Electricity." It gives a good and complete account of the scientific work of the last seven years, or so far as radiation and radio-activity are concerned. The researches of Becquerel, J. J. Thomson, Rutherford, the Curies, Crookes, Dewar, Ramsay, Soddy, and others are passed in review, and a clear idea is given of what, in the opinion of the best authorities, is the probable physical significance of the results obtained.

THE December number of the *Agricultural Students' Gazette* (Cirencester) contains a lecture given at the college by the new honorary professor of forestry, Dr. W. Schlich, which is of special interest in view of the attention which forestry and education in forestry are receiving at present. By an appeal to figures, the professor showed that the demand for timber in this country increases steadily, and that our foreign supplies rest on an unsafe basis. The British forester has therefore a double incentive to mend his ways, for not only is there the prospect of an advance in prices, but he may, if he will, replace by home-grown timber part of the present imports. In discussing the question, "Will it pay?" Dr. Schlich had to confess that British forests supplied him with no satisfactory data, for none has been sufficiently long under scientific direction, but he was able to show what had been done by Saxony under conditions which are not very different from ours. The forests of that State, which occupy close on half a million acres, have been systematically worked by the Government for more than a century, and since 1817 records have been kept. In 1817 the produce was 61 cubic feet, in 1893 92 cubic feet of timber per acre; while the net return eighty years ago was 4*s*., and in 1900 was 22*s*. 6*d*. per acre. After discussing the cost of production, the lecturer said he estimated that a purchaser who was content to accept 2½ per cent. for his money might pay for land for oak growing 9*l*. 10*s*., for spruce 15*l*., for ash 24*l*., and for larch 34*l*. per acre. As oak requires a much better soil than spruce or larch, it is evident that the profits from growing timber will vary widely with the species grown. The above figures, however, do not take account of diseases, and these sometimes seriously affect profits. Larch, the most valuable of our trees, readily falls a prey to *Peziza Willkommii*, and so destructive has this parasite become of late years that Dr. Schlich fears it may make profitable larch cultivation impossible.

IT appears from the work of the expedition under Colonel Spindler, which has lately explored the Gulf of Kara-bughaz, that this interesting appendix of the Caspian Sea has a great commercial value, its bottom being covered with immense layers of nearly pure Epsom salt (mirabilite). This large gulf, which covers 7080 square miles, and has only a depth of from 34 to 36 feet, is now separated from the Caspian Sea by two narrow sand peninsulas which are nearly joined at their ends, leaving only an 86 fathoms wide channel, through which the water of the Caspian continually rushes into the gulf, to be evaporated there, leaving its salts to be deposited at the bottom. From 18 to 33 cubic kilometres of water enter in this way the gulf every year, and under the rapid evaporation which goes on there (3·2 feet per year) the salinity of the water in the gulf attains as much as 16·3 per cent. Consequently, the bottom of the Kara-bughaz consists now to a great extent of gypsum or of Epsom salt, and it is calculated by the chemist of the expedition, A. Lebedintseff, that the deposits of pure Epsom salt must cover an area of about 1300 square miles, and have a thickness of 7 feet or more. Owing to the small depth of the gulf, this salt can easily be extracted by means of excavating machines.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*) from India, presented by Mrs. Hughes; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Mr. H. Brack; a Ring-necked Parrakeet (*Palaeornis torquatus*) from India, presented by Mrs. Watts; three Yellow Baboons (*Papio cynocephalus*) from Africa, three Impeyan Pheasants (*Lophophorus impeyanus*) from the Himalayas, two Rufous Tinamous (*Rhynchotus rufescens*) from Brazil, two Tuatera Lizards (*Sphenodon punctatus*) from New Zealand, deposited.

OUR ASTRONOMICAL COLUMN.

INTENSITY OF ATMOSPHERIC LINES IN THE SOLAR SPECTRUM.—The results of an interesting research on the intensities of the atmospheric lines in the solar spectrum are published in No. 8, vol. xlviii., of the Harvard College Observatory *Annals*. The widths of various lines in the D, α and B regions were measured on the solar spectrum charts prepared by Higgs under various recorded atmospheric conditions and solar altitudes. The results thus obtained, after suitable reduction to standard conditions, were analysed, and in cases where a difference exceeding a fixed minimum was found to exist between the width of a line at "high" sun and its width at "low" sun, this line was attributed to absorption in our atmosphere. The lines thus determined as "atmospheric" were compared with those similarly designated by Rowland, and in a few cases in each region the decision of that observer, as to whether a line was truly solar or atmospheric, has been reversed.

Measurements of the widths of six atmospheric lines between λλ 5867·8 and 5905·5 were made on sixteen charts, and the results arranged in a table in which the charts were placed in order of the sun's altitude at the time each chart was drawn. According to the general result the lines should show an increase of width proportionate to the lengths of the paths of the rays through our atmosphere, this increase of width being probably due to the moisture present in the atmosphere. Some abnormal widths were, however, noted, and were found to agree, in effect, with Higgs's remarks as to the state of the atmosphere at the times the respective charts were made. From these results it is concluded that this method is probably the most accurate one known for determining the total amount of moisture, in the line of sight, in the earth's atmosphere.

OBSERVATIONS OF JUPITER.—Some interesting results of observations of Jupiter during 1903 are published by Mr. Denning in No. 340 of the *Observatory*. Between May 26 and November 19 the planet was observed on eighty-four nights, 1200 transits of various markings being observed. It is proposed to continue the observations until the end of the present month, and then to publish the complete results. A few of the more important points in the observed phenomena may, however, be mentioned now.

During the six months completed at the end of November the rotation perod of the Great Red Spot became somewhat lengthened, the mean value being 9h. 55m. 41·7s., as compared with 9h. 55m. 39·0s. in 1902. The large south tropical spot, visible since the spring of 1901, is still easily seen, and has a rotation period of 9h. 55m. 19s. This spot

covers 48° of Jovian longitude, and its centre will be in conjunction with the centre of the Great Red Spot in June, 1904. Differences of period have been exhibited by three of the most conspicuous spots situated on the red, narrow belt north of the N. equatorial belt, their respective periods being (1) 9h. 55m. 35·8s., (2) 9h. 55m. 31·5s., and (3) 9h. 55m. 26·6s. Greater differences of rate have been shown in the N. temperate and N.N. temperate spots, one group of six showing a period of 9h. 55m. 57s., whilst the observed period of another similar group of six was 9h. 55m. 40s.

MERIDIAN CIRCLE OBSERVATIONS OF EROS AND NOVA PERSEI.—The results of the Harvard meridian circle observations of Eros and the comparison stars are published in No. 6, vol. xlviii., of the Harvard College Observatory *Annals*. The comparison stars are those given in *Circulaire* No. 4 of the Conférence Astrophotographique Internationale, and were observed over bright wires in a dark field. Tables showing the elements of the reduction of the observed places are given, and are followed by a table showing the position of Eros on six evenings in November and one in December, 1900.

No. 7 of the same volume of the Harvard College Observatory *Annals* contains the results of the meridian circle observations of Nova Persei and comparison stars. The observations and reductions were similar in character to those made for Eros—except that Nova Persei was observed in a red field over dark wires—and have been made by the same observer, Mr. John A. Dunne. The final table gives the magnitude, the apparent and mean places, and the 1900·0 positions of the Nova, as determined on fourteen dates between February 24, 1901, and January 24, 1902. The observations have all been reduced to Auwers's system of star-places.

PERIODICAL COMETS DUE THIS YEAR.—Mr. W. T. Lynn, in a letter to the *Observatory* (No. 340), gives a short account of the following periodical comets which are due to return to perihelion during this year. Winnecke's comet should become visible in the early part of the year, as it performed its previous perihelion passage on March 20, 1898, and has a period of about 5·8 years. Tempel's comet (1873), having a period of about 5·28 years, was observed on its return in 1894 and again in 1899, and in the latter year it passed through perihelion on July 28. It should therefore return towards the end of the present year.

The now familiar object discovered by Méchain in 1786 and known as Encke's comet has been observed at every return since 1818–19, and should be visible again during the latter end of this year. The period is about 3·3 years, and the last perihelion passage took place on September 15, 1901.

RECENT CONFERENCES OF SCIENCE TEACHERS.

YEAR by year the conferences arranged by the Technical Education Board of the London County Council have increased in importance. This January no less than 850 teachers attended the meetings—which occupied three whole days, January 7, 8 and 9—at the South-western Polytechnic. Moreover, a valuable and suggestive exhibition of matters dealing with its special subject, arranged by the Geographical Association, was opened two days before the conferences began, and the collection remained on view until they ended.

Mr. A. J. Shepheard, chairman of the Technical Education Board of the London County Council, presided over the first meeting on January 7, and gave a very cordial welcome to all present. His opening address dealt with the conclusions which he, as a member of the Mosely Commission, had drawn from his recent visit to the United States of America. By way of introduction Mr. Shepheard very briefly indicated the steps that led up to the inquiries which Mr. Mosely had boldly instituted. The fact that American engineers had succeeded in mining operations when Englishmen had failed raised the question as to whether the success was due to American education. The commission, upon which Mr. Shepheard served, resulted, and it was intended to determine whether there were any points in American education which are superior to our own.

Mr. Shepheard found that in America there was a more largely diffused spirit of education and a greater belief in its necessity and value than here in England. The American people were taught to cherish the idea that they had a right to the best education possible, and at the expense of the State; while the State recognised clearly its duty in this respect, and regarded such work as the best investment that it could make.

Here there is an undoubted lesson to England, and Mr. Shepheard strongly urged all who believe in education, not to let the matter rest until every citizen feels that this nation will never be what it ought, until everyone is educated to the fullest extent to which he or she is capable. America, Mr. Shepheard went on to say, was fortunately free from "the religious difficulty," and in this country in future, sectarian questions must be strictly kept in the background. Education in America is free up to the age of eighteen years, and the universities are more open than here. The manner of teaching is more practical, and without losing our reputation for culture we might consider this point more. The value placed upon nature-study in the United States was considered by Mr. Shepheard, who dwelt upon observational work, painting from nature, weather notes, and the consideration of all natural objects of interest. Finally, Mr. Shepheard discussed manual training, the trade high schools, and the career of a student in such institutions as the Boston Technical School and the universities.

Mr. H. J. Mackinder, reader in geography to the University of Oxford, contributed the first paper, entitled "The Development of Geographical Teaching out of Nature-Study." He digressed for a moment to point out that there was no great antithesis between culture and practical education. We are creatures of history, and we have chosen different methods of cultivating imagination from those adopted by the Americans. Geography, he said, was calculated to expand the imagination, and should start with the home. He quoted the paragraph on the scope of nature-study from the judges' report of the exhibition held in 1902, and proceeded to show that geography, as now understood, followed many of the same paths. Mr. Mackinder sketched out some excellent methods of teaching geography, beginning with the construction of a rough plan, and discussed the use of globes and maps without lettering before dealing with such as are commonly used, and which, as he says, tend to dwarf the imagination. He had something also to say about the far-reaching commercial importance of geography, and all right thinking people will support his plea that the idea be at once stamped out which implies that the British possessions can be studied apart from the world as a whole.

At the afternoon meeting Sir John Cockburn in a telling manner summarised from the chair the various matters at issue. Mr. Kendall, of the Yorkshire College, Leeds, described some ingenious methods of filling in the steps of models (made up of thicknesses of cardboard cut according to contour lines) with dry material, which is set by having water sprayed upon it.

Mr. J. Lomas, when treating of excursions, gave a description of a ramble along the banks of a tiny stream in Cheshire. He showed with the help of some specially prepared lantern slides, the questions which it, in common with larger rivers, asks and—yielding to the careful observations of the nature student—likewise answers. Why is here a waterfall? Why is there a patch of sand? The fact that the stream is small is a great help in determining what has altered and is altering its course, and in making experiments to determine the direction of various currents. Mr. Lomas concludes that the object of teaching should be to see that the pupil receives correct impressions, and the only way, he says, to secure this is by observation.

Dr. A. J. Herbertson showed by means of a lantern a number of Ordnance maps illustrating typical regions, and considered the points that go to make a good map. He alluded also to the issue of Ordnance Survey maps to schools for teaching purposes (owing to recommendations of the Geographical Association) at a cost of 25*s*. per hundred for outlines and 35*s*. for the same number when hill-shading is added.

Mr. T. Alford Smith gave an account of the use of simple

globes in his class, and showed how a lantern may be used with them to explain the production of night and day. The meetings on Friday, January 8, and on the morning of January 9 were devoted to questions connected with the teaching of languages and art. At the concluding meeting Mr. W. Hibbert described some new forms of apparatus; the most important of these was a magnetic balance devised by him, which has a very long magnetometer needle, and permits the direct estimation of magnetic forces in dynes. Afterwards Prof. Perry, who took the chair, briefly summarised his ideas on the practical teaching of mathematics, and a discussion took place which was introduced by Mr. R. W. Bayliss, of St. Dunstan's College, Catford, who read the paper on practical work in the teaching of geometry. Among the speakers were Mr. Eggar, of Eton, Mr. Garstang, of Bedales, Mr. Harrison, and Mr. Jackson. The general opinion was in favour of making the teaching of geometry practical, but the importance of not forgetting the mental side of the question was emphasised by some speakers.

The geographical exhibition will be shown in other parts of the country, and should prove of very great use to teachers. Individual exhibits which call for attention are the half-inch to a mile reduced survey map of England and Wales without black printing, exhibited by the London School of Economics and issued by Messrs. J. Bartholomew and Co.; the model of the Alps, exhibited by Prof. Dinges; the tinted Siegfried map of Switzerland (one in fifty thousand), brought by Dr. Herbertson to illustrate his remarks, and the excellent maps, geological and topographical, prepared by the Japanese Survey. The number of exhibits officially sent by various Government departments shows the interest taken in the matter. Of the numerous other matters we can only allude to Mr. Freshfield's photographs illustrating types of scenery and to Captain Wilson-Barker's pictures of clouds.

Prof. Tilden, president of the Association of Public School Science Masters, took the chair at the annual meeting held on January 16 at Westminster School, by kind permission of Dr. Gow. The chairman alluded to the influence exerted during the last year upon educational authorities by the Association, and prophesied that its voice would be heard with still greater effect in the future. He pointed out that an attempt was being made to stifle chemistry in the examinations for medicine, and that the exigencies of time prevented engineering students from obtaining the physical knowledge that they ought to have. The solution of the difficulty Prof. Tilden thought would be found in the preparation at school of boys intended for such professions and in their being required to show evidence of the fact before entering upon their special studies.

After the election of Sir Michael Foster as president for the year 1905, and the filling up of vacancies upon the executive committee, the meeting proceeded to discuss the possibility of coordinating the teaching of mathematics and science in public schools. The subject was brought forward by Mr. R. E. Thwaites (Malvern), who pointed out that it would be of the greatest help to public school science if a thorough sympathy and understanding were established between mathematical and science masters. As means to this end it was suggested that practical mensuration should be extended and taught by mathematical men—if possible—in the physics laboratory. Secondly, practical mathematics should be taught to all boys who take theoretical mechanics at present, and this should also be undertaken by the mathematical staff. The fact that mathematical men are regarding the practical bearings of their subject with increased favour was adduced as evidence of the possibility of such hopes being realised. Moreover, the Army Committee has decided that candidates must take a course of practical measurements as part of their mathematics. This can only be carried out properly in the physics laboratory. In view of mathematical men taking laboratory classes a course of practical physics ought to be made obligatory on candidates for honours degrees in mathematics.

Mr. C. S. Jackson (Woolwich), speaking at the beginning of the discussion that followed, said that the reforms should not be put off, as he did not think mathematical men needed a special training, as shown by the introduction of models into their teaching of solid geometry.

Mr. W. D. Eggar (Eton) supported Mr. Thwaites's contentions, and suggested that mathematical masters who went into the laboratory would find no difficulty in keeping a page or two ahead of their boys, while they would learn much of great value to themselves. He condemned the study of electricity and optics, without reference to laboratory work, for university examinations, and, turning to another aspect of public school work, thought that classical masters might help in the pursuit of nature-study.

Mr. W. C. Fletcher (Board of Education) pointed out that the reforms hoped for by his audience he had seen carried out, for in the school at Liverpool of which he was recently head the mathematical masters took their share in the physics teaching, which gave them a fresh interest in their work. He thought that at first the teaching of physics and of mathematics should be in the hands of the same man.

Other speakers on the subject were:—Mr. W. E. Cross (Felsted), Mr. A. W. Siddons (Harrow), Mr. W. A. Shenstone, F.R.S. (Clifton), and Mr. H. Clissold (Clifton).

Mr. M. D. Hill (Eton) started a discussion upon the examination for the Oxford and Cambridge higher certificate. He considered only the position of biology, the teaching of which in public schools would not be encouraged by the examination question, in which its position was unsatisfactory from the point of view of both teacher and pupil. For instance, only one of the six branches could be offered by the candidates, and since practical work is not required, knowledge gained from books rather than from nature would result, and successful papers be written by a candidate who had never seen the objects which he described. He claimed, further, that biology should be placed on an equal footing with other sciences in which public school boys are examined.

Mr. W. A. Shenstone, F.R.S., spoke of the disadvantages of having no practical work in the physics of the same examination. He thought also that the chemistry syllabus was overloaded, and that no line ought to be drawn between organic and inorganic chemistry. Finally, he proposed a resolution to the effect that the opinion of the members of the Association should be taken upon the syllabus, and that the committee, if necessary, should approach the examining board in connection with it. After some discussion the motion was unanimously passed.

The last paper, on "Nature-Study," was read by Mr. O. H. Latter (Charterhouse); he characterised the scope of nature-study as being very wide, and mentioned a host of sciences which, strictly speaking, took cognisance of the material made use of. In fact, he said that nature-study included nearly all visible phenomena. Its object, he continued, is to train the eye to see appreciatively, to awaken interest and to foster certain valuable habits. The matter must be determined by the season of the year and the situation of the school, and an orderly sequence of lessons is not essential. Mr. Latter pointed out how useful the knowledge obtained may be made when English composition is being undertaken. The boy in ordinary cases is gravelled for lack of matter, but when he has observed for himself he is able to put down what he has learned in a way that is interesting and shows individuality. Though he made no attack upon physics and chemistry, which had their own and necessary uses in education, Mr. Latter said that in many respects nature-study is superior to them, especially for young children, and the training which it affords is different in kind. The habits acquired are of value in all walks of life, but they would be especially so in a military service, and Mr. Latter much regretted that what he terms "field subjects" were entirely absent from army examinations. Nature-study, in Mr. Latter's opinion, has come to stay, and will, before long, take a regular place in the early stages of our education. One of the greatest faults of our school system is that the desire for knowledge on the part of the child—who is by nature both inquisitive and observant—is killed outright in most cases by the time that the age of seventeen is reached. It was suggested that nature-study might profitably be employed in the two or three lowest forms of our public schools, but as it is of specially great importance in preparatory schools, Mr. Latter thought that the Association should approach the preparatory school masters with a view to obtaining some uniformity of action on their part. The matter is particularly urgent, as a combined examination for entrance

to a number of public schools is likely to be devised in the future. In conclusion, Mr. Latter was of opinion that nature-study might with advantage be extended to advanced biological work of the school and university laboratories.

A discussion followed, in which the chairman, Mr. Hill, Mr. Shenstone, Mr. Talbot and others took part. Prof. Armstrong said that the phrase "nature-study" was simply a "war cry" at present, and was being used by one party for something which was scientific neither in its intentions nor methods. Later on in the discussion the facts were mentioned that nature-study has a general educational significance, and is recognised in England as expressing the methods of science, but as being otherwise of an informal character.

In reply, Mr. Latter said that all he wanted was that the boys should have their eyes opened, and a resolution was passed that a subcommittee should be appointed to communicate with the preparatory schools in order to determine the form of science teaching best suited to their needs.

WILFRED MARK WEBB.

THE ORIGIN OF THE AUSTRALIAN MARSUPIALS.

THE relationships of marsupials in general to other mammals, the route by which their Australasian representatives reached their present habitat, and the date of their arrival, are problems which have of late years attracted a large amount of attention on the part of naturalists, and are still far from being definitely solved. A bold and vigorous attempt to determine these questions has lately been made by a promising young Canadian zoologist, Dr. B. A. Bensley, of Toronto University, who a few years ago paid a visit to England for the purpose of studying the unrivalled amount of material in the British Museum. The final results of his investigations have just been published in the *Transactions* of the Linnean Society of London. Needless to say, this elaborate memoir is bristling with technicalities, and much of its contents is of far too abstruse a nature to be even touched upon in a journal like our own. Nevertheless, there are certain parts of more general interest which admit of notice.

One of the difficulties which beset the study of the group has arisen from the discovery, by an Australian naturalist, that the bandicoots, unlike other marsupials, possess vestiges of a placenta, by means of which the maternal blood is brought into direct connection with that of the fœtus, and the question is whether this implies a much nearer relationship between marsupials and ordinary placental mammals than has been generally supposed to exist. Dr. Bensley answers the question in the negative, believing the bandicoot placenta to have had an independent origin. He may, of course, be right in this surmise, but it must always be remembered, as in analogous cases, that this is a summary, if convenient, way of getting rid of difficulties. Even, however, on this view, the author is of opinion that the relationship between marsupials and placentals is much more intimate than was believed to be the case by the older naturalists.

As the result of the investigations of several modern naturalists, the belief is gradually gaining ground that all the modern marsupials, with the possible exception of the Tasmanian wolf, or thylacine, are derived from a primitive arboreal type, of which the South American opossums (not the animals so miscalled in Australia) are now the only representatives. This arboreal ancestry is chiefly displayed in the structure of the foot, and even the essentially terrestrial kangaroos can be easily traced, through the phalangers (the miscalled opossums of Australia), into connection with an arboreal type. Somewhat curiously, it may be mentioned in passing, certain members of the former group—to wit, the tree-kangaroos—show a kind of reversion to the arboreal life of their ancestors. There are, however (as, indeed, would be manifestly impossible), no signs of reversion to the original grasping type of foot, tree-kangaroos hopping on the larger branches in the characteristic manner.

The opossums, then, are the most primitive of living marsupials, and since they date from the earlier portion (Eocene) of the Tertiary period, they are likewise the earliest animals which can be definitely included in that group, for there is great doubt whether any of the small mammals of the Secondary epoch (those, for instance, of the Stonesfield slate and Purbeck beds) are really marsupials, or at all events marsupials as we now know them.

The arboreal "radiation" (to use a term now extensively employed by American zoologists) of marsupials differentiates them from the extinct creodonts, or primitive Carnivora, of the early Tertiary epoch, which appear to have been essentially terrestrial types. Nevertheless, by means of certain Middle Tertiary South American forms (the so-called sparassodonts), these same creodonts appear to have been very closely connected with the thylacine, and thus with other marsupials, and this presumed relationship seems to have considerably puzzled Dr. Bensley. For, while including that animal in the Dasyuridæ, he suggests that it may be an altogether foreign member of the Australian fauna, and that its origin may have to be sought elsewhere—presumably in South America. He adds that no signs of arboreal ancestry are to be detected in the thylacine's foot. If this means anything, it seems to imply that the animal in question is not related at all to the typical arboreal marsupials, but that its kinship (unless the resemblances are due to "parallelism in development") is with the South American sparassodonts, and thus with the creodonts. But if so, it surely seems to follow that the creature is not, phylogenetically, a marsupial at all. The whole question seems a hopeless puzzle, and if the author cannot explain it, most surely we will not make the attempt.

To turn to less debatable ground, great interest attaches to the author's remarks concerning the huge extinct marsupial from Australia described by Owen as a carnivore, under the name of Thylacoleo. Arguing from the resemblance of its dentition to that of the phalangers, later writers, however, came to the conclusion that the creature was herbivorous. This view is discredited by Dr. Bensley, who, following Dr. Broom, reverts to the opinion that it was a flesh-eater, which, as Owen suggested, may have preyed on the contemporary giant kangaroos or even the still more gigantic diprotodons. Nevertheless, it is believed that Thylacoleo was descended from herbivorous marsupials allied to the phalangers, and, this being so, it is not easy to see why the author assigns it to a family group by itself. This, however, is but a detail.

The marsupials of Australasia, it is pointed out, must have come either from the north-west by way of the Malay Archipelago and Papua, or from the south through an Antarctic connection. Certain objections raised by Prof. Baldwin Spencer against a Malayo-Papuan route are discounted, but the author does not commit himself to any definite opinion as to the probable line of immigration.

As to the date of the immigration, the author, after mentioning that one authority makes it Jurassic, a second Cretaceous, and a third Eocene, inclines to the opinion that it did not take place until the Miocene or middle division of Tertiary time. Although we incline to the view that it was probably Tertiary, so late an epoch as the Miocene seems to allow a very short period for the evolution of the numerous modern forms and their immediate ancestors.

Later on, it is argued that opossums may be the descendants of Jurassic ancestors, or they may themselves be the original marsupials. Assuming the latter to be the case, it may be asked, was the arboreal marsupial radiation only Tertiary, and are creodonts (inclusive of the South American sparassodonts) and the thylacine developments of an earlier common terrestrial stock related to the still earlier mammal-like reptiles?

Summing up the evidence as to the diffusion of modern marsupials, the author is of opinion that during the Oligocene period there was a radiation of opossums throughout a large portion of the northern hemisphere, and that some of these animals gained an entry into South America, where they may have given rise to the extinct Microbiotheriidæ of Patagonia. Then came the immigration into Australasia, during Miocene or Middle Tertiary time. About the same period occurred the great development of South American marsupials, such as the extinct Abderitidæ and the forerunners (Epanorthidæ) of the modern

Cœnolestes. The sparassodonts (Prothylacinidæ) are also included in this radiation, although how these terrestrial types (which, as already stated, the author thinks were probably allied to the thylacine) were developed from arboreal forms is left unexplained. Finally, in the Pliocene occurred the irruption into South America of the modern opossums of that country.

It may be added that the author classifies modern marsupials by the foot-structure rather than by the dentition, thus making the two main groups Didactyla and Syndactyla, in place of Polyprotodontia and Diprotodontia.

R. L.

CONTRIBUTIONS TO THE SCIENCE OF MEDICINE.[1]

THE handsome volume under notice contains a number of important papers of considerable interest to the physiologist, pathologist, and physician. It commences with a description, and an account of the opening, of the Johnston Laboratories for Biochemistry, Tropical, and Experimental Medicine, the munificent gift of Mr. William Johnston—hence the addition in the title of these reports. This has a melancholy interest also, since one of those who replied to the toasts on that occasion was the late Prof. Nocard.

The first paper is by Prof. Moore on the synthesis of fats accompanying intestinal absorption, in which it is shown that absorbed fat is re-synthesised to neutral fat in the intestinal mucous membrane. Neurology is represented by papers on the physiology of the cerebral cortex in anthropoid apes, by Dr. A. S. Grünbaum and Prof. Sherrington (reprinted from the *Proceedings* of the Royal Society, London), and on the electric conductivity of mammalian nerve, by Dr. Woodworth. Prof. Sherrington records a number of experiments carried out for the special chloroform committee of the British Medical Association on the dosage of the mammalian heart by chloroform; these have already been referred to in the columns of NATURE. Dr. Hume publishes a method for the isolation of the typhoid bacillus, based upon the greater motility of this organism compared with that of the colon bacillus, with which it is generally associated, so that the former will reach the surface of a column of viscid medium sooner than the latter when the two are introduced at the bottom. Mr. Roaf contributes a note on the influences of flour and allied substances upon the typhoid bacillus, from which it would seem that emulsions of flour are inhibitory to the growth of this microbe. Dr. J. W. Stephens describes a modification of the Van Ermengem method for flagella staining.

The study of cancer is represented by two important papers, one by Dr. Prowse on the relation of vesicular mole to chorion carcinoma, the other by Mr. Keith Monsarrat on an organism associated with mammary carcinoma. In the last-named it is claimed that by the use of a special culture medium, round encapsuled organisms have been cultivated, the cultures in certain instances producing nodules of growth when inoculated into guinea-pigs.

The vitality of the Liverpool School of Tropical Medicine is evidenced by several contributions. Prof. Ronald Ross describes his "thick film" process for the detection of malaria and other parasites in blood. Dr. Christy and Dr. Stephens contribute papers on "tick fever" and on "blackwater fever" respectively, and Drs. Stephens and Christophers give a summary of researches on native malaria and blackwater fever, and suggestions for the prevention of these dread scourges.

Finally, the volume concludes with the report of the malaria expedition to the Gambia in 1902, by Mr. Dutton, to which an appendix is contributed by Mr. Theobald on the mosquitoes collected in that expedition, with a description of some new species. Every paper contains the results of original work or observations of value, and the general "get up" of the volume is all that could be desired, the illustrations being numerous and excellent.

R. T. HEWLETT.

[1] "The Thompson-Yates and Johnston Laboratories Reports." Vol. v. (New Series.) Part I. (London: Longmans, Green and Co., 1903.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It is proposed to "affiliate" the University of King's College, Nova Scotia. Graduates in arts of that university will be admitted to the privileges of affiliated students, namely, exemption from the previous examination and permission to proceed to the B.A. degree after six terms' residence in Cambridge.

An annual prize in civil engineering, of the value of about 15*l*., has been founded by Mrs. Wimbolt, in memory of her late husband, Mr. J. S. Wimbolt, M.A., of Trinity College. The prize is open to Bachelors of Arts, and will be given for the best exercise or dissertation embodying the results of independent research in some subject related to the profession of a civil engineer.

THE Finance Committee of the Liverpool Corporation has decided to recommend the city council to grant to the Liverpool University 10,000*l*. during the year 1904, such sum to be paid out of the city rate.

AT the Northampton Institute, Clerkenwell, on Friday, February 26, Lord Kelvin will present the certificates and prizes on the occasion of the annual prize distribution and conversazione of members and students.

A CONFERENCE on nature-study, arranged by the School Nature Study Union, will be held on Saturday, January 30, at the Passmore Edwards' Settlement, Tavistock Place, W.C. The chair will be taken by Mr. Cyril Jackson, Chief Inspector, Board of Education, and two short papers will be read by representatives of elementary and secondary schools.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 10, 1903.—"On the Resemblances Exhibited between the Cells of Malignant Growths in Man and those of Normal Reproductive Tissues." By J. Bretland **Farmer**, J. E. S. **Moore**, and C. E. **Walker**.

The object of the communication is to direct attention to certain important cytological transformations exhibited during the development of malignant growths in man. The changes described appear to be diagnostic of malignant as opposed to benign growths, inasmuch as they seem to be absent from the latter class of tumours. Briefly, the authors have identified, within the proliferating edges of advancing growths, cells that exhibit a type of karyokinesis presenting an extraordinary similarity to, if not identity with, the heterotype mitosis that forms so constant a character during the production of sexual cells. This mitosis, or nuclear division, is remarkably different in character from the other divisions in the body-cells, and is recognised with ease and certainty. The nuclear chromosomes pass through a totally different series of changes as compared with those exhibited by the chromosomes of ordinary nuclei. Not only in shape is this difference manifested, but also in the reduction of their number to one-half; and in all the subsequent cell generations that follow from a cell that has once passed through the heterotype mitosis the reduced number of chromosomes is retained in normal cases that lead to the direct formation of the sexual cells themselves. In any cells, otherwise of similar (heterotype) origin, that are not about to form actual sexual cells, variations and abnormalities may supervene.

All the principal varieties that are commonly met with during the evolution of the sexual cells have been identified in malignant growths of carcinomatous and sarcomatous types. The authors consider themselves justified in relating the malignancy of the growth with these facts, and they regard the malignant tissue in question as having originated in cells that have lost their somatic character, and have directly assumed the nature of reproductive tissues.

They propose the term *gametogenic* to signify tissues that are potentially or actually about to give rise to sexual cells (gametes), whilst they call the cells that have passed through the metamorphoses indicated above, but which do not finally form functional gametes, *gametoid*. This expression is thus intended to embody their conclusion that the

so-called "cancer cells" are not, indeed, functional gametes, but essentially of a similar character.

They point out that the origin of gametogenic cells from somatic tissue is a common feature in plants, but its occurrence is obscured in animals because it involves a pathological condition. They further point out that parasitic habit of the neoplasm finds its analogue in the normally parasitic character of the gametogenic tissue of plants.

Linnean Society, December 17, 1903.—Prof. S. H. Vines, F.R.S., president, in the chair.—The Rev. T. R. R. **Stebbing,** F.R.S., exhibited:—(1) A house-spider (Tegenaria sp.) with its cylindrical dwelling in the coiled feather of an Indian fan. The fan which the spider adapted to its purposes had been hanging up in a drawing-room at Jerusalem. The spider, forwarded by Miss FitzJohn to Miss Grace Stebbing, reached England alive. (2) A solid gnaur or excrescence upon the root of *Cupressus macrocarpa*, sent for exhibition by Mr. F. G. Smart, of Tunbridge Wells; it was eleven inches in circumference.—On the Docoglossa; an evolutionary study: H. J. **Fleure.** The Docoglossa are a division of gastropod molluscs for which the stout teeth on the lingual ribbon have suggested a name literally meaning "beam-tongued." The common limpet is a sufficiently familiar representative of this group. Mr. Fleure's essay aims at showing that the group, within the limits which he defines, is a natural one. To arrive at the structure of the common ancestor, he uses "the facts of comparative anatomy and the few known details of palæontology and embryology for the reconstruction of docoglossan history." Admitting the preliminary character of this evolutionary study, based on the examination of comparatively few types, he appeals to zoologists for further material on which he may extend his researches.—A brief account of new researches in cancer: Prof. J. Bretland **Farmer,** F.R.S. The author referred to current theories of cancerous growth, and then proceeded to state his own discovery that the cytological changes in malignant growth resemble those exhibited by sporogenous or gametogenous tissues in plants and animals, in the occurrence of the form of nuclear division known as heterotype, as distinguished from the more usual homotype division.

Royal Astronomical Society, January 8.—Prof. H. H. Turner, president, in the chair.—Mr. **Conrady** read a paper on the chromatic correction of object glasses.—Mr. Wm. **Ellis** read a paper on auroras and magnetic disturbances.—Mr. Maunder read a paper by Mrs. **Maunder** on a suggested connection between sun-spot activity and the secular change in magnetic declination.—Mr. **Maunder** also read a paper by himself (communicated by the Astronomer Royal) on the "great" magnetic storms from 1875 to 1903, and their association with sun-spots, as recorded at the Royal Observatory, Greenwich. The data given in the paper showed a remarkable number of coincidences between the appearance of large spot groups and the occurrence of the greater disturbances in terrestrial magnetism.—Prof. **Turner** gave an account of the observations of variable stars made under the direction of the late Sir C. Peek at Rousdon Observatory, Lyme Regis. Prof. Turner had undertaken to edit and discuss the observations, which would be shortly published in the *Memoirs* of the Society.—Mr. Tyson **Crawford** showed a new finder eyepiece and a sketching board arrangement for the telescope.—Mr. **Wesley** read a note on Mr. Ritchey's photographs of the nebula in Andromeda. The transparency which Mr. Ritchey had sent to the Society had been taken from a negative in which the dense central portion had been reduced with a weak reducing solution, so as to show on the same photograph the details both in the dense central and the faint outlying parts of the nebula. Mr. Wesley had carefully compared this transparency with some *untouched* negatives which Mr. Ritchey had since sent, and concluded that the local reduction had produced no false detail or spurious effects.—Mr. Hinks showed photographs of the Orion nebula by Mr. W. E. **Wilson,** in which the detail in the central portion had been brought out by differential printing, instead of reduction of the negative.

EDINBURGH.

Royal Society, December 7, 1903.—Dr. Robert Munro, vice-president, in the chair.—The Keith prize for 1899–1901 was presented to Dr. Hugh Marshall for his discovery of the persulphates and for his communications on the properties and reactions of these salts, published in the *Proceedings* of the Society. The Makdougall-Brisbane prize for 1900–1902 was presented to Dr. Arthur T. Mastermen for his paper entitled "The Early Development of *Cribella Oculata* (Forbes), with Remarks on Echinoderm Development," printed in vol. xl. of the *Transactions* of the Society.—In a paper on the bull trout of the Tay and of the Tweed, Mr. W. L. **Calderwood** discussed the identification of this important migratory species, and gave reasons for the view that the Tay bull trout was a true salmon, which has undergone modification of probably a temporary nature, while the Tweed fish was a trout regarded as the proper representative of *S. eriox,* now classed as a variety of *S. trutta.*—Mr. J. G. **Goodchild** read a paper entitled "Field Evidence Relating to the Modes of Occurrence of Intrusive Rocks," in which he gave a detailed description of a number of cases in which intrusive rocks had clearly replaced their own volume of the rocks they invade. Hughes in 1868, and Clough in 1880, had indicated cases of this kind, and had considered that the country rock so replaced had been dissolved, and that the composition of the product had been equalised by circulation. Mr. Goodchild supported this view, and gave an outline of what appeared to be the *modus operandi.* The chief factors concerned were:—(1) the heat generated by dynamic causes, connected chiefly with terrestrial disturbance; (2) the presence of saline constituents existing in solution in sea-water or in the inland lakes of arid regions, which found their way to the foci of volcanoes and there underwent concentration by prolonged boiling; and (3) the influence of pressure arising partly from the generation of steam and partly from the dynamic causes to which the volcanic heat was mainly due. He concluded with some remarks upon the differentiation of the magma originating in this way, and the possible effects which might arise from a potash magma invading an older set of rocks which had consolidated from an earlier soda magma.

December 21, 1903.—Prof. Flint, vice-president, in the chair.—Prof. **Schäfer** read a paper on the relative efficiency of certain methods of performing artificial respiration in man. After describing the apparatus he had devised for the accurate measurement of the air inspired and expired per minute, he proceeded to compare the various methods associated with the names of Sylvester, Howard, and Marshall Hall, and showed by actual numbers that these all fell short of the natural breathing, the least efficient being Sylvester's, in which the chest is expanded and contracted by motion of the arms. This method, which was still in common use for resuscitation from drowning, was absolutely condemned. The Howard method was moderately efficient, and was most in favour among medical men. The Marshall Hall method was somewhat less efficient than the Howard, and had the further objection of being more complicated. More efficient than any of these, and remarkably easy to perform, was the "Schäfer" method, in which the subject was placed in the prone position and an intermittent pressure applied on the lower ribs by the mere weight of the operator's body, which was swung backwards and forwards some thirteen times a minute. By this method 6760 cubic centimetres per minute were forced through the lungs as against 5850 cubic centimetres which passed in natural breathing.—Dr. C. E. **Fawsitt** gave an account of certain physicochemical investigations in the amide group. From determinations of the change of conductivity produced by the addition of an amide to acid, alkali, and neutral salts, he concluded that the amides have no acid character, but only basic properties. Accordingly, the amide group is better represented by the formula $\begin{matrix} O \\ \| \\ -C-NH \end{matrix}$ than by the formula $\begin{matrix} -C=NH \\ | \\ O-H \end{matrix}$. The change of conductivity produced by the addition of an amide to a neutral salt is a viscosity effect. The viscosity of solution of acetamide and carbamide follows very closely the formula $\gamma_a = A^a$, where γ is the viscosity with concentration a, and A is a constant.—In connection with Sir John Murray's bathymetrical survey of the Scottish fresh-water lochs, Mr. James **Murray** gave a preliminary note on the biology of

Loch Ness. The organisms found were grouped under the three headings, pelagic, littoral, and abyssal. All the pelagic forms and most of the abyssal forms extended into the littoral region, but the littoral forms (which were by far the most numerous) were rarely found in the open waters. A comparison of the organisms found in spring and in autumn showed that there was little seasonal variation, the chief difference being the greater number of Rotifers in autumn and the presence of certain species of Cladocera in the later season. A remarkable vertical migration of Leptodora was established, the animal coming to the surface in great numbers immediately after sunset, and retiring to a depth of 100 feet or more during the day. The study of the animals obtained from the deep muds had led to many interesting results. The Rotifers in the abyssal region differed from specimens got nearer shore, but not enough to lead to their classification as distinct species. One main difference was in the size of the eyes.

DUBLIN.

Royal Dublin Society, December 15, 1903.—Prof. W. F. Barrett, F.R.S., in the chair.—Prof. T. **Johnson** read a paper on willow canker. The author gave an illustrated account of an osier canker due to *Physalospora gregaria*, Sacc., a hyalosporous sphæriaceous Pyrenomycete, which is recorded in "Sylloge Fungorum," on Prunus, Salix, Alnus, Rosa, &c., in Italy, France, Siberia, and South America. The ascosporous stage is associated in the cankers with two others—pycnidia with triseptate conidia, and pycnidia with bisporous intercalary conidia on branching hyphæ. Economically the fungus does great harm, killing many of the osier sets outright, and in other cases spoiling the rods for basket-work. The author has traced the fungus from the sets first planted with the rods cut from year to year, and has also found the disease to be present in the osier holt in England from which the original sets were supplied. Experiments in infection and in prevention were also described.—Dr. Henry H. **Dixon** and Dr. J. T. **Wigham** presented a paper on the action of the radiations from radium bromide on some organisms.

PARIS.

Academy of Sciences, January 11.—M. Mascart in the chair.—The action of the X-rays upon animal tissues: R **Lépine** and M. **Boulud.** The X-rays favour the formation of amylase in the pancreas. In the liver and in the blood, their first action is to increase glycolysis, but this effect is diminished, or even arrested, by their prolonged action.—M. Lacroix was elected a member in the section of mineralogy in the place of the late M. Munier-Chalmas.—On the asymptotic study of meromorphic functions: M. Émile **Borel.**—On the homographic resolution of spherical triangles: M. **d'Ocagne.**—On the properties of notched test-pieces: Aug. **Pourcel.**—On a self-recording apparatus allowing of the measurement through a solid wall, carrying pressures relatively high, of small differences of pressure: M. A. **Mesnager.**—On a method for the comparison of thicknesses: M. **Mesnager.** In the method of MM. Pérot and Fabry a thin layer of air between two half-silvered glass plates making a small angle with each other is utilised. The delicacy of the measurements is increased two hundred times by replacing the air film by a thin plate of quartz. The quartz plate, placed between two parallel Nicols, gives the same fringes as the half-silvered plates, but 218 times larger. This arrangement also possesses the advantage of absorbing much less light than the compensator with half-silvered plates, and also avoids the confusion resulting from multiple reflections.—On the production of the *n*-rays by sound vibrations: J. Macé **de Lépinay.** The fact that the compression or extension of a body gives rise to the *n*-rays led to the conclusion that sound vibrations would produce the same effects, and this conclusion has been experimentally confirmed.—On the applications of the chronostiliscope: E. **Varenne** and L. **Godefroy.**—Colour reactions of vanadic acid and ethenol: Camille **Matignon.** The colour reaction obtained with vanadic acid and some specimens of ordinary ether has been traced to the presence of ethenol, vinyl alcohol.—The use of bismuth as a separating agent for the rare earths: G. **Urbain** and H. **Lacombe.** On adding to uncrystallisable mother liquors of the rare earths their own weight of the double nitrate of magnesium and bismuth, the latter carries down the gadolinium in crystallising, the operation being repeated until the soluble earths no longer give the spectrum of gadolinium. This method of extraction works equally well in the elimination of gadolinium from crude yttrium earths.—A new method of estimating the halogens in organic compounds. The case of chlorine and bromine: A. **Baubigny** and G. **Chavanne.** The compound is oxidised by heating with a mixture of sulphuric and chromic acids, the halogen being caught in an alkaline sulphite solution. Analytical results are given showing the accuracy of the method.—The titration of manganese: Léon **Déhourdeaux.** The oxide is dissolved in a solution of sulphuric and oxalic acids, the active oxygen being measured by the amount of oxalic acid destroyed, and from the amount of sulphuric acid used up the quantity of hydrochloric acid required by the oxide in the commercial preparation of chlorine can be calculated.—On a new general method for the synthesis of aldehydes: MM. **Béhal** and **Sommelet.** Aldehydes of the types $R_2.CH.CH{=}O$ and $RR'.CHCH:O$ are obtained by heating α-glycols of the type $RR'.C(OH).CH_2.OX$ with oxalic acid. The glycols are readily obtained by Grignard's reaction from the ketones $R.CO.CH_2.OC_2H_5$. The properties of a series of aldehydes prepared by this method are given, in which R includes alkyls from methyl to isoamyl, and also allyl and phenyl. The method appears to be quite general.—The synthesis of aromatic aldehydes: F. **Bodroux.** Phenylmagnesium-bromide reacts with ethyl orthoformate and gives benzaldehyde, with a yield of 90 per cent. The para-tolyl magnesium bromide reacts in a similar manner.—The stimulating influence of an albumenoid material on the oxidation caused by manganese salts: A. **Trillat.** The oxidising effect is increased by the addition of an albumenoid, but the effect produced is not proportional to the amount of the latter, there being a proportion producing a maximum result.—On the formation of tetrads and maturative divisions in the testicle of the lobster: Alphonse **Labbé.**—On the nidamental gland of the oviduct in elasmobranchs: I. **Borcea.**—The emission of *n*-rays by plants: Édouard **Meyer.** *N*-rays are emitted by plants, this emission being a function of the nutritive activity or evolution of the plant.—The morphological characters of the Acrocecidia: C. **Houard.**—Chronology of the cave near Mentone: Marcellin **Boule.** A further examination of these well-known caves has been undertaken at the instigation of the Prince of Monaco, and has resulted in the discovery of four human skeletons, many fossil remains of animals, and a large number of worked objects in stone and bone. The present paper contains the results of the stratigraphical study of these caves. Layers have been found corresponding to the Upper and Lower Quaternary, and a layer beneath these which appears to be pre-Quaternary.—On the earthquakes in the Andes: de Montessus **de Ballore.**—On the general bathymetric chart of the ocean: J. **Thoulet** and Ch. **Sauerwein.**—An experimental demonstration of the general action of the interstitial gland of the testicle on the economy: P. **Bouin** and P. **Ancel.** Contrary to the opinion of Brown-Séquard, the seminal fluid is without action on the organism, the interstitial gland alone possessing the functions generally recognised as belonging to the whole testicle.—Cooperation, hierarchisation, and integration of the sensations in the Artizoa: Georges **Bohn.**—Radiotherapy as a means of diagnosis and therapeutics in certain fibromas: Foveau **de Courmelle.**

NEW SOUTH WALES.

Royal Society, October 7, 1903.—Mr. F. B. Guthrie, president, in the chair.—The geology of the Mittagong district: T. Griffith **Taylor** and D. **Mawson.** The authors show in this paper that the eruptive rocks of the Mittagong district are all of post-Triassic age.—Notes on some native dialects of Victoria: R. H. **Mathews.**

November 4, 1903.—Mr. F. B. Guthrie, president, in the chair.—On some further observations on the life-history of *Filaria immitis*, Leidy: T. L. **Bancroft.** In this paper Dr. Bancroft (who has at various times during the past fifteen years worked at filarial diseases of the human subject, the dog, and birds) has detailed the results of final work on this subject. He has succeeded, through the agency of mosquitoes, in transmitting *Filaria immitis* from

an infected to several healthy dogs, and has also observed the manner in which the young Filaria leaves the mosquito's proboscis.

Linnean Society, November 25, 1903.—Mr. Henry Deane, vice-president, in the chair.—Sur quelques Similitudes des Langues et des Coutumes des Indigènes de Funafuti (Ellice Group) et des Indigènes des Iles de la Société, de l'Archipel des Tuamotu, &c., by MM. **Donat** and **Seurat.** The resemblances specially considered have reference to the names of divinities, temples, the cocoanut, *Morinda citrifolia* and the root of Cordyline; the bark girdle ornamented with feathers, and the eye-shade; the hooks and baits used in fishing, and the capture of turtles; edible Mollusca; and juvenile games.—The variability of Eucalyptus under cultivation, by Mr. J. H. **Maiden.** The author has been at considerable pains to obtain specimens of the Eucalypts described as new species from cultivated forms. Through the kindness of the professors of the Museum d'Histoire Naturelle at Paris, he has obtained a large number of Naudin's types, and has expressed his views as to the identity of these with spontaneous Australian forms.—Notes from the Botanic Gardens, Sydney, No. 9, by Messrs. J. H. **Maiden** and E. **Betche.** This paper continues the series of descriptions of new Australian plants, new records for New South Wales, and critical notes of special interest to Australian botanists.—On the botany of the "clears" and "basalt masses," County of Hunter, N.S.W., by Mr. A. C. **Barwick.**—Description of a new genus and species of Coleoptera (Fam. Hispidæ) from New Britain, by Mr. David **Sharp,** F.R.S. The generic name Brontispa, n.gen. Chrysomelidarum (Hispides, group Cryptonychides), is proposed for this insect, which has of late done much damage in cocoanut plantations.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 21.

ROYAL SOCIETY, at 4.30.—On the Acoustic Shadow of a Sphere, with an Appendix by Prof. A. Lodge giving the Values of Legendre's Functions from P_0 to P_{20} at Intervals of 5 Degrees: Lord Rayleigh, O.M., F.R.S.—The Third Elliptic Integral: Prof. A. G. Greenhill, F.R.S.—On the Structure of the Palæozoic Seed *Lagenostoma Lomaxi*, with a Statement of the Evidence upon which it is referred to Lyginodendron: Prof. F. W. Oliver and Dr. D. H. Scott, F.R.S.—The Significance of the Zoological Distribution, the Nature of the Mitoses, and the Transmissibility of Cancer: Dr. E. F. Bashford and J. A. Murray.—In view of the special meeting immediately following, these papers will be taken as read by printed abstract.

ROYAL INSTITUTION, at 5.—The Flora of the Ocean: G. R. M. Murray, F.R.S.

LINNEAN SOCIETY, at 8.—An Account of a Plankton Expedition to the Bay of Biscay in H.M.S. *Research* in 1900: Dr. H. G. Fowler.—The Crustacea obtained by Dr. G. H. Fowler in the Biscayan Plankton: Rev. T. R. R. Stebbing, F.R.S.

FRIDAY, JANUARY 22.

ROYAL INSTITUTION, at 9.—Spectroscopic Studies of Astrophysical Problems at Stonyhurst College Observatory: Rev. Walter Sidgreaves, S.J.

PHYSICAL SOCIETY, at 5.—The Photographic Action of Radium Rays: S. Skinner.—Astigmatic Aberration: W. Bennett.—Some New Cases of Interference and Diffraction: Prof. R. W. Wood.—Exhibition of Instruments by Messrs. Crompton and Co.

SATURDAY, JANUARY 23.

ROYAL INSTITUTION, at 3.—British Folk Song: J. A. Fuller-Maitland.

MATHEMATICAL ASSOCIATION, at 2.—Annual Meeting.—Models of Regular and Semi-regular Solids, including the four "polyèdres étoilés" of Poinsot, exhibited by Mr. E. M. Langley.—An Account of a Recent Discussion on the Possibility of Fusion of the Teaching of Mathematics and Science: C. S. Jackson.—A Geometrical Note: J. C. Palmer.—Advanced School Courses of Mathematics: C. A. Rumsey.

MONDAY, JANUARY 25.

SOCIETY OF ARTS, at 8.—Oils and Fats—their Uses and Applications: Dr. J. Lewkowitsch (Cantor Lectures I.).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Geographical Pivot of History: H. J. Mackinder.

INSTITUTE OF ACTUARIES, at 5.—A Comparison of the Various Methods of Grouping Whole-Life Assurances for Valuation: D. C. Fraser.

TUESDAY, JANUARY 26.

ROYAL INSTITUTION, at 5.—The Development of Animals: Prof. L. C. Miall, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Sanding-up of Tidal Harbours: A. E. Carey.

WEDNESDAY, JANUARY 27.

SOCIETY OF ARTS, at 8.—Ice-Breakers and their Services: Arthur Gulston.

THURSDAY, JANUARY 28.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Observations on the Sex of Mice—Preliminary Paper: Dr. S. Monckton Copeman, F.R.S., and F. G. Parsons.—Observations upon the A quirement of Secondary Sexual Characters indicating the Formation of an Internal Secretion by the Testicle: S. G. Shattock and C. G. Seligmann.—On the Part played by Benzene in Poisoning by Coal Gas: Dr. R. Staehelin.—The Morphology of the Retrocalcarine Region of the Cortex Cerebri: Prof. G. Elliot Smith.

ROYAL INSTITUTION, at 5.—The Flora of the Ocean: G. R. M. Murray, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Edison Accumulator for Automobiles: W. Hibbert. (Adjourned discussion.) To be opened by Dr. J. A. Fleming, F.R.S.—On the Magnetic Dispersion in Induction Motors, and its Influence on the Design of these Machines: Dr. H. Behn-Eschenburg. (Adjourned discussion.)

FRIDAY, JANUARY 29.

ROYAL INSTITUTION, at 9.—The Marshes of the Nile Delta: D. G. Hogarth.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Metallurgy as Applied in Engineering: Archibald B. Head.

SATURDAY, JANUARY 30.

ROYAL INSTITUTION, at 3.—British Folk Song: J. A. Fuller-Maitland.

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