THURSDAY, DECEMBER 22, 1904.

A ZOOLOGICAL TRIBUTE.

Mark Anniversary Volume. To Edward Laurens Mark, Hersey Professor of Anatomy and Director of the Zoological Laboratory at Harvard University, in Celebration of Twenty-five Years of Successful Work for the Advancement of Zoology, from his former Students, 1877–1902. Pp. xix+513; 36 plates and portrait. (New York: Holt and Co., 1903.)

THIS stately volume is a tribute to a notable personality in the history of American zoology. It has been inspired by the affection and loyalty of about one hundred and fifty of his former students, twenty-six of whom contribute the memoirs which fill its 500 quarto pages. To their esteemed master, these students—now themselves in many cases well known teachers and investigators—express their gratitude for his rigorous discipline in methods of work, for his critical skill, and for his stimulating sympathy. They recall with pride the service that was done to science by the publication of Mark's work on the maturation, fecundation, and segmentation of the egg of Limax—"a work that introduced into America the then new cytological methods in the application of which this country has since reached an elevated position. It likewise introduced into zoology a proper fulness and accuracy of citation and a convenient and uniform method of referring from text to bibliography. It marked a step forward, also, in thoroughness and detail, and in the full recognition that, even in zoology, as in physics and chemistry, method is hardly less important than matter."

The tribute of twenty-five memoirs is one to make a teacher proud, especially as they exhibit many of the features which have distinguished his own work.

Seitaro Goto leads off with a description of a new Craspedote medusa—*Olindioides formosa*, n.g. et sp., from Misaki, like Haeckel's Olindias in some ways, yet strikingly different, *e.g.* in having six radial canals instead of four. Along with Gonionema and Halicalyx, Olindiopsis and Olindias represent the subfamily Olindiadæ, which must rest meanwhile under the Eucopidæ among the Leptomedusæ. H. S. Pratt describes four new Distomes—a new genus (Ostiolum) from the frog, related to Hæmatotœchus of Looss, and three new species of Renifer (=Styphlodera) from the mouth and air passages of common North American snakes. W. A. Locy takes us into a different domain in elaborating his discovery (1899) of a "new nerve" in Selachians, which arises on the dorsal summit of the fore-brain, before and apart from all other olfactory radices, and runs to the olfactory epithelium. A similar nerve has been recorded in Protopterus by Pinkus, and in Amia by Allis; elsewhere it has remained undetected. Jacob Reighard takes us into the open air in his fascinating and most instructively careful study of the breeding habits of *Amia calva*. The sexes differ obviously in colour, but spawning is usually at night; there are about three times as many males as females on the spawning ground; the male builds the nest, guards and defends it; he excites the female by biting and rubbing; he may induce two females at different times to spawn in the same nest; he leads the young black larvæ forth, re-unites the school when it loses scent, and guards them until they begin to assume orange and green hues; he is a model of paternal care.

Charles A. Kofoid describes an interesting Opalinid, *Protophrya ovicola*, the least specialised member of the family, which he found in the brood-sac of *Littorina rudis*. An interesting item is the presence of a micronucleus, which has only been observed in one other Opalinid, *Anoplophrya branchiarum*. It is obvious that the question of the micronucleus in Opalinids should be looked into, and that this new genus should be searched for in other localities. The next memoir brings us back to "new-fangled" methods, for C. B. Davenport compares a lot of Pectens from Tampa, Florida (*Pecten gibbus*, var. *dislocatus*), with another lot from San Diego, California (*Pecten ventricosus*). These are closely analogous species, and if environmental facts are similar, the variability should be the same. But in all the proportions measured, the San Diego Pectens show themselves from 50 per cent. to 100 per cent. more variable than those of Tampa. The San Diego forms represent a plastic race in a varied present environment. It seems to us that the concepts of variability and modifiability must be analysed out before such statistics as those offered in this memoir can be of much value in ætiological discussion. Observed differences have to be recorded, but it is only when demonstrable modificational differences are subtracted from the observed differences that we can draw secure conclusions as to variability in the strict sense. Gertrude Crotty Davenport discusses the longitudinal division and fragmentation of the sea-anemone *Sagartia luciae*, and shows that numerous intermediate forms may occur while the individuals are always tending by means of regeneration in the direction of twelve stripes and forty-eight mesenteries. Again, we must emphasise the desirability of distinguishing between modificational and variational divergences from the norm of the species.

Frank W. Bancroft describes an interesting seasonal modification of the compound Ascidian *Botrylloides gascoi*; the colony died down and the zooids degenerated, but with the assistance of a "yellow lobe" containing no zooids recuperation was effected. Carl H. Eigenmann discusses another mode of degeneration in telling the whole history of the eyes of the blind Amblyopsid fishes. The foundations of the eye in the embryos, which develop in the gill-cavity of the adult, are normally laid, but the stages beyond the foundations are cœnogenetic or direct; in fact, there is a developmental degeneration corresponding to the degeneration of the eye in the adult. Somewhat surprising is H. P. Johnston's account of three fresh-water Nereids—*Nereis limnicola*, n.sp., *Lycastis hawaiiensis*, n.sp., and *Lycastroides alticola*, n.g. et sp.—from indubitably fresh-water habitats. The author discusses the conditions which will admit of marine forms becoming denizens of fresh water, and gives a useful synopsis of recorded cases of fresh-water Polychæta. Then follows an interesting study in ethology, H. R. Linville's account of the tube-formation in *Amphitrite ornata* and *Diopatra cuprea*, the particular

point of which is the minute adaptations of structure to function, an illustration of a kind of research which is always welcome and valuable.

W. E. Ritter discusses the structure and affinities of a new type of Ascidian from the Californian coast, which he calls Herdmania after a well known ascidiologist. The colony is composed of crowded but entirely free zooids arising by budding from short, much branched, closely interwoven stolons. The zooid is long and narrow, with three regions—thoracic, digestive, and cardiogenital. It is quite unique in having two epicardiac tubes, separate throughout their length; the oviduct serves as a uterus in which the embryos go through their development to nearly the period of metamorphosis; there is a peculiar grouping of the numerous branchial tentacles. It seems to be a divergent offshoot from the Polyclinid branch. R. M. Strong brings us back to a familiar subject and an old problem; he analyses the iridescence or metallic coloration of the dorsal surfaces of the distal portions of the feathers from the sides of the neck of grey domestic pigeons. The coloration is not due to diffraction, and Gadow's refraction-prism hypothesis will not work. The colours are probably thin-plate interference colours or Newton's rings, effects which are produced where spherical pigment granules come in contact with the outer transparent layer. C. R. Eastman takes us back to Palæozoic sharks, showing that the much-debated Edestus fossils are genuine teeth, and represent a stage in an interesting evolution series from Campodus to Helicoprion. We can hardly do more than refer to H. V. Neal's careful study of the development of the ventral spinal nerves in Selachians, but we may note that while the neuraxones of these nerves develop like those of Amniota as processes of neuroblast cells, there is a migration of medullary cells in early stages of development, which, though they take no part in the formation of the neuraxones or ganglia of the ventral nerves, participate in the formation of the nerve-sheaths, which have usually been regarded as of mesenchymatous origin.

H. S. Jennings elaborates his interesting thesis that the asymmetry of most flagellate and ciliate Infusorians, as also of the Rattulid Rotifera, is correlated with the habit of swimming in spirals. The spiral course is the simplest device for permitting an unequally balanced organism to progress in a given direction through the free water, and the method of reaction to most stimuli is closely correlated with the unsymmetrical or spiral type of structure. Rolfe Yorke contributes a study of the nerve cells of the cockroach and of the substance within these that seems to correspond to the chromophilous material in the nerve cells of higher animals. R. M. Yerkes shows by elaborate experiments that *Daphnia pulex* is strongly positively phototactic to all intensities from 0 to 100 candle-power, and is negatively thermotactic at a temperature of about 28° C.

In a very interesting paper on Mendel's law and the heredity of albinism, W. E. Castle and G. M. Allen show that complete albinism, without a recorded exception, behaves as a recessive character in inheritance, and that the facts are in general accord with Mendelian principles. P. E. Sargent discusses the structure and functions, development and phylogeny of that archaic portion of the mesencephalic roof known as the torus longitudinalis which is characteristic of Teleosts. T. G. Lee attacks a not less difficult problem—the implantation of the ovum in the gopher, which he finds to be quite unique as regards the nature and history of the pre-placental "fixation-mass" formed by the trophoblast. J. H. Gerould makes a comparison of the early stages of Sipunculus and Phascolosoma, and seeks to show that the "serosa" of the former represents the remains of a degenerating prototroch equivalent to that of the latter, which is in turn homologous with the primitive condition seen in mesotrochal Annelids.

G. H. Parker takes us once more into the open air in his study of the positive and negative phototropism of the mourning-cloak butterfly (*Vanessa antiopa*). It is interesting that the negative phototropism is only seen in intense sunlight and after the butterfly has established a certain state of metabolism by flying about for a while, and that the position assumed in negative phototropism exposes the colour patterns of the wings to fullest illumination, and has probably something to do with bringing the sexes together during the breeding season. Ida H. Hyde presents a new interpretation of the structure of the eye of Pecten, supplementing and correcting previous descriptions. The long series of memoirs ends with one by H. B. Ward on the larvæ of *Dermatobia hominis*—an Oestrid or bot-fly, widely distributed in America, though not in the States, which occurs commonly in the skin of cattle, pigs, and dogs, and less frequently in some other creatures, including—unfortunately—man.

We cannot conclude our rapid review of this huge volume without directing attention to the great range of zoological territory which the memoirs cover, to the high standard of workmanship which they exhibit, and to the unanimity with which the various authors recognise their indebtedness to their master, Edward Laurens Mark. J. A. T.

SYNTHESIS OF VITAL PRODUCTS.

The Chemical Synthesis of Vital Products, and the Inter-relations between Organic Compounds. By Prof. Raphael Meldola, F.R.S. Vol. i. Hydrocarbons, Alcohols and Phenols, Aldehydes, Ketones, Carbohydrates and Glucosides, Sulphur and Cyanogen Compounds, Camphor and Terpenes, Colouring-matters of the Flavone Group. Pp. xvi+338. (London: E. Arnold, 1904.) Price 21*s.* net.

IN spite of the long and daily increasing list of successful chemical syntheses of substances which are primarily produced as the result of processes occurring in living organisms, one constantly hears from physiologists the complaint that the synthetic work of chemists, wonderful as it may be in itself, throws no light on the biochemical problem of how the same substances are generated in the bodies of plants or animals. The points of view of the organic

chemist and the physiologist are entirely distinct. The chemist, in studying a biochemical product, starts by dissecting it into a number of known atomic groups, and when this analytic work is complete, he seeks to confirm his conclusions as to the constitution of the substance by piecing these atomic groups together again, so as to reproduce the substance synthetically. In accomplishing the latter part of his task, the question of imitating biochemical conditions never even occurs to him, inasmuch as for his purpose the simplest and most efficient laboratory processes are the best; and when he has solved the problem from his point of view he is satisfied. That alizarin and indigo can not only be synthesised, but that they can be synthesised so cheaply that the natural products cannot compete with them in the market, is doubtless a triumph both for the chemist and for the technologist; but so long as each step of these syntheses is effected either by means of such chemical agents or under such conditions of temperature as would be fatal to life in any form, it is evident that the results are devoid of any biochemical bearing, and that the physiologist is justified in disregarding them. Meanwhile, therefore, so far as the important subject of the synthesis of vital products is concerned, there is no helpful interaction between chemistry and physiology. Each goes its own way.

It is with the object of endeavouring to remove this reproach from these sciences and of bringing about a better understanding between them that Prof. Meldola has written the present work, of which the first volume is now before us. The work is, as the author states, "a record of the synthetical achievements of generations of workers arranged with a distinct biochemical bias." In fact, the title of one of the introductory chapters, "Organic Chemistry from the Bio-centric Standpoint," might have served as a subtitle for the entire work.

This biocentric standpoint has, as the author indicates, necessitated an arrangement of the subject-matter differing materially from that usually followed in works on organic chemistry. In these the derivatives are arranged under the parent compound, or chemical type, from which in many cases they can be produced by processes of laboratory synthesis. But,

"According to the present scheme each vital product is in itself a biochemical type quite independently of the chemical type to which it may be referred, and the synthesis of each product, instead of being mentioned incidentally in connexion with the group to which it belongs as a point of minor interest, is here brought into the first rank of importance. In other words, the chemical type is in this work subordinated to the individual compound—a mode of treatment for which every justification will be conceded when it is pointed out that in vital syntheses there are unquestionable genetic relationships between compounds of quite different types" (p. 12).

Another necessity arising from the biocentric standpoint has been the recognition of "down-grade synthesis" as well as of "up-grade synthesis"—of the synthetic products obtained from complex generators by fission as well as of those obtained from simpler generators by union. Thus a number of substances generally recognised as vital products do not occur as such in the living organism, but are produced by hydrolytic fission, sometimes during the process of isolating them: thus alizarin from the glucoside ruberythric acid. The justification for registering these as vital products lies in the fact that their atomic complexes are pre-existent in the glucosides and similar compounds from which they are obtained.

The details of these classifications are worked out by the author with very great skill and with exhaustive knowledge of the subject. References are everywhere given, no fewer than forty-five periodicals, not to mention the patent literature, being quoted from. Among the syntheses enumerated we have not succeeded in detecting any omissions. The author does not claim to have sifted critically the enormous mass of experimental records which he has brought together; he leaves to the investigators themselves the responsibility for their statements. His object is "to bring practical workers, whether chemists, physiologists, or technologists, into communication with the various authorities quoted."

The author admits that we are at present profoundly ignorant of the modes of synthetic action which go on within the living organism, and he points to the necessity for a more systematic study of the chemical stages in which such action occurs—a branch of investigation for which plant life offers especial facilities. He points to Charabot's researches on the development of the terpene alcohols and ketones as examples of the pioneering work required. He is firm in his belief that such work will not only increase our knowledge of biochemistry, but will place us in a position to imitate the conditions of biochemical synthesis. He writes:—

"If, some decades hence, a work on similar lines to the present should ever be compiled, it may be anticipated with confidence that the laboratory methods for synthesising vital products will have approximated more closely to the physiological processes" (p. 9).

This confidence in the future powers of the chemist is closely connected with the author's attitude towards Neovitalism. He says:—

"I think it advisable to place on record the opinion that the present achievements in the domain of chemical synthesis furnish no warrant for the belief that the chemical processes of the living organism are in any sense transcendental, or that they must be regarded as belonging to a class of special material transformations which human science will never be able to reproduce. Such an admission as the latter would be tantamount to a proclamation of Neovitalism. . . . . There is no warrant for the belief that the physics or chemistry of animals and plants is ultra-scientific" (Preface, p. vi).

To the present reviewer the terms "transcendental" and "ultra-scientific" seem to beg the question. It is surely a matter for legitimate and entirely "scientific" inquiry, whether our present laws of chemistry and physics, which have been deduced solely from the study of dead matter, apply without qualification to living matter. Possibly, when the conditions of the biochemical problem are more thoroughly understood, it may be, contrary to Prof. Meldola's belief, just as

easy to show that we can never, in our beakers and retorts, imitate the biochemical conditions of vital synthesis as it is for a mathematician to prove the transcendence of π.

This view, like its opposite, is, however, in the present state of our knowledge, rather a matter of opinion than of proof.

In conclusion we congratulate the author on having produced a most useful work—a work of almost ultra-German thoroughness—and one which will be an immense boon to all interested in the subject with which it deals.

IONISATION AND ABSORPTION.

The Becquerel Rays and the Properties of Radium. By the Hon. R. J. Strutt. Pp. vii + 214. (London: Edward Arnold, 1904.) Price 8*s.* 6*d.* net.

A NUMBER of books dealing with radio-activity and the kindred phenomena have already appeared; and it is a bold thing on the part of an author to place another before the public. However, with the exception of Prof. Rutherford's inimitable treatise on the subject, none of the previous works have been characterised by any striking individuality, so that there is, or rather was, still room for a vigorous statement of the general features of the subject from a popular point of view. This the author of the present work has accomplished in a manner that leaves little room for criticism. He possesses to a remarkable degree the faculty of stating difficult questions in a simple way, and of expressing the answers in a language which is easily understood.

In a book of this kind there is usually a good deal of treatment which appears somewhat slipshod when regarded from a strictly scientific standpoint; but such a charge cannot with justice be maintained against the present volume. Naturally some of the most intricate points, such as the effect of a magnet on a moving electric charge, have to be treated analogically to make them represent anything real to a mind inexpert in dealing with this class of phenomena; but here the author has not only been fortunate in choosing familiar instances, but those chosen have been true analogies, and accurately represent the physical features of the case. The whole treatment is characterised by vigour and interest, and is such as we should have every reason to expect from the pen of so well-known an investigator in this branch of physical science as the author.

It is scarcely necessary to analyse in detail the contents of the book, but the whole forms a clear and concise presentation of the great question of the relationship between electricity and matter, which is of overpowering interest to physicists at the present time. In the first chapter we are made familiar with the various phenomena accompanying electric discharge in rarefied gases, and are thus placed in a position to understand the working of what may be regarded as a miniature discharge tube, viz. a radio-active atom. After describing the various manifestations of radio-activity and the properties of the radiations, the author considers the various products of radio-active change. We are thus led to a probable view of the mode of origin of the chemical elements, in the evolution of which the inert gases seem to form the final stage. The last chapter forms a very lucid account of the electrical theory of mass and the various views of atomic structure based thereon.

Unfortunately there is one serious blot on the general excellence of the book, and that is the treatment of absorption in chapter iv. Almost at the outset (p. 87), the author contradicts himself owing to the word "greater" having crept in where he doubtless intended to say "less." This uncorrected error is not likely to cause much trouble to those who are familiar with the subject, but we imagine the beginner will be greatly perplexed by trying to reconcile this statement with what follows.

Apart from this, it seems a great pity that so much stress should be laid on Madame Curie's experiments on the absorption of the α-rays from polonium, as it is doubtful what conclusion can be drawn from them except that practically all the rays are stopped by about four centimetres of air. In the experiments referred to a quantity of polonium was placed at a variable distance below two parallel plates three centimetres apart. A hole in the lower plate covered by wire gauze allowed the α-rays from the polonium to penetrate the region between the two plates, and the ionisation it produced there was taken to measure its "intensity." Madame Curie then investigated the diminution in the ionisation produced by placing a sheet of aluminium foil 0·001 cm. thick (equivalent to 2 cm. of air) over the lower plate, when the polonium was at different distances below it. When the polonium was 0·5 cm. away the aluminium cut down the radiation to one-quarter its previous value, whilst when the distance was 1·9 cm. the ionisation was reduced to one-twentieth. This shows clearly, as Madame Curie pointed out, that the α-rays which have passed through a certain thickness of matter are less penetrating than those which have not. The question, however, which is of most interest in the present state of the subject is how the ionisation per centimetre of path varies with the amount of matter previously passed through. These experiments furnish no very certain answer to this question, since when the aluminium foil is inserted the whole of the radiation is absorbed long before it reaches the upper plate, so that the different experiments are not strictly comparable. The whole question of absorption is very intricate, and it is undesirable to dwell further upon it here. There is still plenty of room for experimental investigation on this subject. For instance, Townsend's experiments on ionisation by collision and Durack's on that produced by the Lenard and Becquerel rays show that the number of ions produced per cm. by a moving corpuscle increases with the velocity up to a certain point, and then decreases. It would be of interest to see whether, as is probably the case, this holds for the positively charged α-rays as well.

The book contains three useful appendices. The first describes a number of simple experiments illustrating the essential features of radio-activity; the

second gives the simple theory of the deflection of kathode rays, for the benefit of those not entirely unacquainted with mathematics; while the third describes the chemical processes involved in the extraction of the radio-active products from pitchblende residues.

The general arrangement is good, but there appears to be more than the usual allowance of uncorrected errors in spelling and composition. We hope that a second edition will give the author an opportunity of correcting these.

On the whole the book may be thoroughly recommended to the general reader as an accurate and attractive account of the latest aspect of scientific thought on the structure of matter; whilst the specialist will find numerous passages which are suggestive and stimulating.

O. W. RICHARDSON.

LABORATORY EXERCISES IN BREWING.

Laboratory Studies for Brewing Students. By A. J. Brown, M.Sc., &c. Pp. xviii + 193. (London: Longmans, Green and Co.) Price 7*s.* 6*d.* net.

THE brewing school at Birmingham is fortunate in possessing Prof. Brown as its head, and we hail the appearance of his book as extending its advantages to students of brewing generally.

These Laboratory Studies describe a systematic series of experiments illustrating the scientific principles underlying brewing. The author is careful to point out that he does not aim at dispensing with a teacher. Assuming a knowledge of chemical manipulation, he gives the detail necessary for the successful performance of each experiment, and draws the appropriate conclusion. He frequently connects the conclusions with others from allied experiments, and even to some extent with brewing practice, but at each step more and more scope is left for the teacher to discuss the bearing of the results on one another and on large scale work. If the author published his own lectures we should doubtless find them an exceedingly valuable complement to the work before us.

The book is divided into four sections:—(1) barley and malting; (2) principles of the mashing process; (3) fermentation; (4) hops. These sections are further subdivided into parts and paragraphs, the latter corresponding to each experiment.

The first section follows the changes in outward appearance from the flowering stage to the ripe barley corn, and thence passes on to the anatomy of the corn and to its conversion into malt.

Under the heading dealing with the varieties, we find one of the many instances of the way in which the author equips his men for taking their part in the controversies of present day brewing but avoids all dogmatising on points still *sub judice*. The experiments are planned so that the student will know all the characteristics of, *e.g.*, Chevallier (we adopt Mr. Beaven's spelling of the rev. gentleman's name) and Goldthorpe, but he is left with an open mind as to the vexed question of their rival merits.

Dealing with the technical examination of malt (and, indeed, also of barley and hops), we are glad to find due recognition given to expert knowledge—the student being specially commended to the teacher for instruction in it. For we are apt nowadays to underrate the knowledge accumulated by the practical man—what corresponds to the "farmer's eye" is still of immense value to the brewer.

Section i., part v., devoted to the chemical examination of malt, is as good as any in the book. Heron's method of determining the yield of extract is very fairly criticised, and we leave the subject with a full appreciation of its value and difficulties. The footnote of p. 46, that "a thoroughly satisfactory malt mill is yet to be introduced," should appeal to all interested in brewing.

Section ii., the principles of the mashing process, deals with the changes which take place when malt and water are brought together at various temperatures and sketches the analysis of wort as far as the carbohydrates (much the largest constituents) are concerned. We were sorry that, in giving the experiment showing that the influence of heat in restricting starch transformation is due to modification of the diastase, no reference is given to Kjeldahl's "Recherches sur les ferments producteurs de sucre" (*Résumé du Compte rendu des Travaux du Laboratoire de Carlsberg*, i, 109), but this is perhaps on account of its being in a foreign language and so unsuitable for students.

Section iii. is devoted to fermentation, but, as there are already books, chiefly by the Hansen school, dealing with this important subject, this section is a good deal curtailed. We are, however, glad to see (even if they are in small print) experiments on the author's important discovery that the maximum number to which yeast cells multiply in a nutritive solution depends, not on the number of cells with which the solution is seeded, but on the volume of the solution, granted, of course, a sufficiency of food.

Section iv., on hops, concludes the volume. We wish an experiment had been included to show the restrictive action of hops on the acid-forming bacteria, but such an experiment is not a very easy one for students.

It will have been noticed that the book adheres to the usual plan of beginning with barley and ending with beer. This seems inconsistent with the custom of passing from the well known to the less well known, and we should like to see tried the opposite plan of starting with beer and tracing it back into its constituents.

In training men for technical work the course should be; first, a general grounding in science; secondly, practical experience of the art in question; thirdly, a study of the scientific principles involved. If this be so the work before us should not only be of service to students but also to those brewers who desire to look into the experiments on which the principles of their art are founded.

OUR BOOK SHELF.

Morphologie und Biologie der Zelle. By Dr. Alexander Gurwitsch. Pp. xix+437. (Jena: Gustav Fischer, 1904.)

We are told in the preface that this book is intended for the use of beginners. The author must, however, have had Macaulay's omniscient schoolboy looming large in his imagination when he thus appraised the character of his completed work. Many of the topics discussed are quite the reverse of elementary, and the general treatment adopted throughout is lacking in that quality of lucidity which is essential to success, especially in a work that is written for the use of beginners. The fact is the author has attempted too much, and although his book may be serviceable to readers already tolerably familiar with cytology, it can, we imagine, hardly hope to appeal to the class for which it is stated to have been designed.

The general plan of the work is somewhat novel and has much to recommend it, whatever one may think of the manner in which Dr. Gurwitsch has actually executed his task. Thus, whilst a considerable description of cell-structure is naturally included, it is on the physical and physiological aspects of the problems that attention is mainly concentrated. Some of the sections, in particular those dealing with metabolism, are suggestive and well worth reading, although one not seldom misses expected allusion to recent work. Indeed, it almost seems at times that the author is rather needlessly attacking positions which have already ceased to possess any real importance.

A considerable number of pages are devoted to the subject of nuclear and cell division, as well as to a discussion of conflicting theoretical explanations of the process of mitosis. The advanced student will here find much to interest him if he will take pains to dig it out. But the whole question of reduction is omitted, on the ground that the author regards it as foreign to the main purpose of his book. We cannot but regret his decision, since the processes therein concerned serve to throw light on many difficulties connected with an ordinary mitosis that are not otherwise easily cleared up.

The last portion of the book is given up to a discussion as to whether the cell is to be regarded as an elementary organism or as the unit of organisation, and the question is treated both from the view of the Protozoa and Metazoa. The discussion is difficult to follow, and the answer really depends on what meaning is attached to the somewhat elusive definitions employed. It is, of course, obvious that the significance attaching to the unit will not always be the same, for this will have a different value for the morphologist and the physiologist respectively.

We confess that, whilst the book as a whole possesses undoubted merits, it nevertheless strikes us as the result of a premature effort. There is much evidence of undue haste, for example in the amazing number of glaring typographical errors; the names of authorities quoted, no less than ordinary words, repeatedly assume an unfamiliar appearance. But however irritating this may be to the reader, it would after all be a trifling matter if the subject as a whole had been presented in a well digested fashion. J. B. F.

A New Geometry for Senior Forms. By S. Barnard, M.A., and J. M. Child, B.A. Pp. xv+331. (London: Macmillan and Co., Ltd., 1904.) Price 3*s.* 6*d.*

This text-book is intended primarily for the use of students who are reading for the Oxford and Cambridge local examinations; the London intermediate examinations; mathematics, stages iii. and iv., South Kensington, and examinations of like nature. The first half of the book is a very happy combination of practical work and deductive reasoning. Much scale drawing is done, it is to be hoped with proper appliances in a proper manner, and teachers and students can select from a large number of graphical exercises appearing at short intervals, many of which have been taken by permission from recent examination papers. Trigonometrical ratios for acute angles are introduced and formulæ established relating to triangles, a short table of sines, cosines, and tangents being employed for numerical calculations. This section also deals with the geometry and mensuration of the simple solids, the formulæ used being all proved. The prismoidal formulæ and suggestions for the treatment of irregularly shaped figures seem unfortunately to have been overlooked. There are a few pages on the geometry of plane motion where the idea of a vector might have been appropriately and very usefully introduced.

The second or "theoretical" half of the book is mainly concerned with the formal establishment of theorems relating, amongst other matters, to the connection between algebra and geometry (after Euclid ii.), to circles, to ratio, proportion, and similar figures, and to solid geometry as in Euclid xi. A little modern geometry is given, but there is no description of how form and position in space are defined and exhibited by scale drawings.

The authors have produced one of the best of the new text-books which are following closely the progress of reform rather than leading the way. The volume can be heartily recommended to students who are preparing for mathematical examinations under recently revised schedules.

Studien über die Albuminoide mit besonderer Berücksichtigung des Spongin und der Keratine. (Studies on Albuminoids, with Special Reference to Spongin and the Keratins.) By Dr. Eduard Strauss. Pp. 128. (Heidelberg: C. Winter, 1904.) Price 3·20 marks.

This little book does not treat, as its title might lead some to suppose, of the albuminous substances in general, but of that limited group of them to which the term albuminoid is usually restricted by physiologists. This group includes spongin, cornein, gorgonine, onuphine, conchiolin, spirographin, and silk, which are products (mainly skeletal in function) of the invertebrate world; and collagen, reticulin, elastin, and the keratins, which are found among the vertebrata. One notes in this list the absence of chitin among the invertebrate products, the reason being that this material has now been shown not to be a member of the proteid group at all. Reticulin, also, which is mentioned, and was originally described by Siegfried, does not really exist. Miss Tebb conclusively proved it to be an artifact from collagen, and this view is accepted by Dr. Strauss.

The first seventy pages deal with a general account of these substances taken one by one. The remainder of the book deals with some original work on the digestion products of spongin and the keratins. The proteoses so formed were separated by Pick's method, and their properties differ somewhat from, though in the main resemble, the similar products of proteolysis derived from other and better known sources. Among them two gluco-albumoses are described. Iodine occurs not only in gorgonine, the organic substratum in certain corals, but also in spongin.

This contribution to science is interesting, but deals with such a small corner of biochemistry that it will appeal to very few. We doubt whether it is wise to magnify its importance by making it the subject of a special book. The first part of the work is dealt with, though perhaps not quite so fully, in all text-books of

physiological chemistry, and the second part might quite well have formed the subject of a brief paper in one of the numerous journals devoted to such subjects.

W. D. H.

Pages from a Country Diary. By P. Somers. Pp. vi+280; illustrated. (London: Edward Arnold, 1904.) Price 7*s.* 6*d.*

THIS is one of those delightful books written in the form of a discursive diary, somewhat after the style of Sir Herbert Maxwell's "Memories of the Months," which may be taken up and read during every spare half-hour until the reader finds with regret that he has come to the last page. Almost every kind of topic and pursuit connected with country life receives a share of attention, among them, to a brief extent, the habits and ways of birds and other animals. Among statements connected with natural history is one (on the authority of a well known taxidermist) that albino pheasants always have diseased liver; this, however, if true, can scarcely be cause and effect, since such birds have white plumage from the first, and they surely cannot be hatched with liver-disease. Special interest attaches to the statement that a hen grouse of normal colouring produced an entire brood of cream-coloured chicks, since this seems to afford an instance of how a new colour-phase might be produced by discontinuous variation. The subsequent history of the brood is not recorded—probably its members were all shot.

Several references are made to otters and their habits, and, although he is a thorough sportsman, the author cannot refrain from uttering a word of sympathy with these beautiful animals when surrounded in the water by a pack of hungry otter-hounds. On the other hand he has nothing but scorn for the sickly sentimentality of those who would forbid such manly sports as hare-hunting and stag-hunting, even when the deer is a so-called tame animal.

A Scheme for the Detection of the more common Classes of Carbon Compounds. By Frank E. Weston, B.Sc. Pp. viii+56. (London: Longmans, Green and Co., Ltd., 1904.) Price 2*s.*

THIS little book is intended for students who are preparing in chemistry for the final B.Sc. examination of the University of London. The author, who is lecturer on chemistry at the polytechnic in Regent Street, has elaborated the scheme now offered as the result of many years' experience with his own classes. There certainly has been a dearth of "systematic schemes" for the detection of carbon compounds, and from this point of view the book should be useful. Whether it will have any real educational value will depend very much upon the manner in which it is used. If, as in the case of the "systematic schemes" for the detection of inorganic substances, the identification of organic compounds is to be reduced to a purely mechanical series of operations involving no real scientific knowledge on the part of the student, the present book will do more harm than good to the cause of education, although it may help candidates through the final B.Sc. as intended. On the other hand, if used intelligently in connection with the scientific treatment of organic chemistry, it may be made of some educational use. The selection of compounds has on the whole been judiciously made, and we have no fault to find with the treatment excepting to point out that certain crudities of style and inconsistencies of spelling seem to indicate either imperfect knowledge or imperfect revision. What quantity, for example, is meant by "a pinch"? Why should the word "monohydricphenols" appear on one page and "trihydric phenols" on another? There are too many slips of this kind in such a small book to enable us to recommend it unhesitatingly to students in its present form.

Photograms of the Year 1904. By the Editors and Staff of the *Photogram*, assisted by A. C. R. Carter. Pp. xlviii+176. (London: Dawbarn and Ward, Ltd., 1904.) Price 2*s.* net.

IN these pages we have typical photographic pictures of the year reproduced and criticised. This statement does not apply simply to British productions, but extends to those made in many lands where pictorial photography is practised. Robert Demachy discourses on the pictures exhibited at the annual series of photographic events in France. British Columbian progress is recorded by H. Mortimer Lamb. The editor of the Australian *Photographic Journal* gives some notes of the advances made in his country, while "A new Departure in American Pictorialism" is written by Savakichi Hartmann. These are followed by articles on the work of the year, suggestions to would-be picture-makers by H. Snowden Ward, and "Royal and Ring." The two great exhibitions, the Photographic Salon and the Royal, are dealt with by A. C. R. Carter. The "American Salon" and "Western Workers in the United States" conclude the volume. It may be mentioned that this publication is the tenth annual issue, and equals, if it does not exceed, both in quality and number of illustrations, those that preceded it. Most of the reproductions are the work of Messrs. Carl Hentschel, Ltd.

It seems scarcely necessary to add that those of our readers who follow this special branch of photography will find in this volume material which should prove of great value to them.

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.*]

Heterogenetic Fungus-germs.

THE development of brown fungus cells in connection with Zoogloea, as described in NATURE, November 24, by Dr. Bastian, is very familiar to me, and probably to all who attempt pure cultures of fungi.

Various species of microscopic fungi belonging to the genus Cladosporium are everywhere present on fading and dead leaves. The spores, and also the vegetable portions of these fungi, constantly assume the form called *Dematium pullulans* by De Bary. Such forms produce exceedingly minute colourless conidia, which can pass through thick filter paper. Under normal conditions these minute conidia on germination form delicate hyaline hyphæ which give origin to a Cladosporium. If cultures of these conidia become infested with bacteria that form Zoogloea the hyphæ become invested with a comparatively thick, brown cell-wall, and form either compact masses of cells or irregular hyphæ consisting of short cells, constricted at the septa, exactly as shown in Dr. Bastian's Fig. 12. In a disease of *Prunus japonica*, caused by a Cladosporium, large masses of gum, just sufficiently dense to prevent dripping, issued from the wounds. The mycelium of the fungus spread into this gum, and produced myriads of brown cells arranged in chains.

The semi-liquid gum caused the same abnormal development as that produced by Zoogloea. A plate showing the entire course of development of the fungus in the gum is contained in the *Kew Bulletin*, December, 1898. As these fungi only develop on fading leaves, it was not to be expected that they would appear in infusions of young grass.

Herbarium, Kew. GEORGE MASSEE.

Note on Radio-activity.

IN the course of some experiments on the chemical behaviour of the β and γ rays from radium (Ramsay and Cooke, NATURE, August 11) solutions were obtained containing a radio-active substance which could sometimes be removed from the solution by the formation in it of a suitable precipitate. Sometimes when such a solution, containing ammonium salts, and in which several precipitations had already taken place, was evaporated to dryness on the lid of a porcelain crucible the residue was found to be capable of lessening the rate of leak of the electroscope, *i.e.* it behaved in the opposite way to an active residue, which would increase the rate of leak. This "anti-activity" has been observed on several occasions, and seems to be a specific property of the matter examined, and not to be due to any variable condition of the electroscope; thus the natural leak taken before is the same as that taken immediately after such an experiment.

I have not found any mention of a similar phenomenon in the literature on radio-activity, but should be glad to know if like results have been noticed by other observers. An explanation of the "anti-activity" would seem to be either that the leaf of the electroscope, which was always negatively charged, receives particles carrying a similar charge, which particles cause little ionisation of the air, or that the rays exert a de-ionising power on the air, if one can conceive of such an action. W. TERNENT COOKE.

Chemical Department, University College,
Gower Street, W.C.

Blue Flints at Bournemouth.

THERE is an old man living here, in Bournemouth, who years ago was employed in re-laying a part of the Poole Road, some little distance within the western boundary of the borough. He says that he helped to put down a quantity of refuse from the gas-works mixed up with flints, &c.—for this was before the days when the Poole Road began to be mended with granite. Now it so happened that this very man was employed to dig up and remove the surface of the road in preparation for the laying down of the tram lines, and of the wood pavement with which the whole road is now covered; and he says that he helped to dig up the very stuff which years ago he had helped to put down, and that this old road material was carted off to the new road then in course of construction upon the common and along the top of the cliff close by this part of the Poole Road. The flints, he says, came out blue, and are the blue flints now to be seen in patches upon this new road along the west sea-front. J. W. SHARPE.

Bournemouth.

Intelligence of Animals.

As some stray remarks of mine seem to have set this discussion agoing, I should be glad if you would kindly allow me to supplement your correspondents' interesting letters by two or three further stories which have come directly under my own observation. They are intended to be illustrative of methods of *reasoning about reason* in animals, particularly dogs. It will be observed that each story has its own distinctive shade of inaccuracy, and that the shade grows deeper as you proceed.

I trust, however, I shall by no means be taken as doubting the correctness of the facts sent you by your scientific readers, though I admit I might plead guilty to an indictment for suspecting seriously their interpretation. In the case of one or two of them I should not be surprised if some much more simple explanation than the one put forward might have been overlooked.

(1) Some years ago I had a favourite Irish terrier, Tim. Tim was a brave little chap, and would not quail before a lion. Like all of his strain, he had, I may say in passing, the rather human habit of grinning when amused, and would smile back at you in quite a comical fashion. This not too common trait is, I think, noteworthy.

When a mere puppy, Tim, in one bound, leaped into the household's good graces, and by no less meritorious an action than by saving us all from being burned alive. It was this way. Some newspapers thrown carelessly near the library grate caught fire; but Tim, who was snoozing on the hearth-rug, bounded up and rushed to the cook, making such a row that that good lady dashed upstairs and tramped out the budding conflagration.

I am loth to point out that the young terrier could have had no more idea of a conflagration than Juno's geese when they cackled had of the Gallic invasion, from which by so doing they are said to have saved the Roman Capitol, and, further, I am greatly afraid that on the occasion showed not the foresight set down to his credit, but for once in his life—cowardice. The results, indeed, as not rarely happens from that species of wisdom, were satisfactory, and the appropriation of the praise on Tim's part quite after the manner of fully acknowledged rationals.

(2) In adult life Tim used to earn his breakfast of mornings by carrying my boots up to my room. Where his astuteness and "reasoning power" came in was by always fetching up polished boots, though he might have three or four pairs to pick and choose from. Of polished pairs he would invariably seize my light ones if they were at hand—a hint, the housekeeper used to insist, that he wished that I should "go off with myself" and visit friends.

When "doggie" stories are circling I seldom fail to extract this from my budget, and I am always tempted to add little flourishes. At all events, I never feel called upon to explain that Tim possessed no acquired taste for bog-mud, and accordingly he discarded soiled shoes. Further, though Tim was by no means lazy, he set store by Helmholtz's great principle of the conservation of energy. He had experimented and discovered for himself that there was far less using up of brawn and muscle in bearing along and aloft a thin than a heavy, thick-soled boot. All this by no means appeared on the surface, and so his superlative judiciousness was a source of delight to the cook, and of bewilderment to her visitors, all the year round.

(3) A farmer residing near me has a strong, useful mongrel, Major by name. Though Major is a cur of low degree, his wisdom is great and "uncanny." Like every other dog around here he would almost know your thinking—to use the pet phrase—and certainly would understand your talking. The latter statement can be proved, and I beg to undertake the demonstration.

For agriculturists in these parts fairs are the grand monthly carnivals. Some months ago, on the eve of one, our farmer said to his wife as they sat by the fireside, "Jane, I think I must chain up Major to-night and not have him follow us to-morrow as he did on the last occasion." "Would you believe it," so the farmer relates it, "on hearing his sentence out marched Major, most indignant." Next morning at an early hour, as Jane and himself proceeded to the fair, there he was sitting on his tail on a fence looking out for them more than a mile from home! And so he was at the fun of the fair as well as another.

Our farmer never conjectured there might have been in the meantime for the mongrel an attraction of his own in the direction of the town, though the torn ear was there to set him thinking. *Qui vult decipi, decipiatur.*

(4) Another neighbour possesses a spotted dog which he calls a water spaniel. Though he, no less than every other puppy, whelp, and hound in the country, may be distinguished for intelligence, he and they are certainly not noted for good looks or long pedigrees. This particular thoroughbred, amongst many things, (*a*) can go on a message to any house he is directed to within a radius of three miles! (*b*) can catch any hare he sets his eyes upon! and yet (*c*) will be fifteen years old to a day if he lives until January 2 next!

Explanation:—His owner sometimes gives a loose rein to a splendidly vivid imagination.

I yield to no one both in my respect and liking for our canine friends and in my admiration for their affection, their highest developed quality. But I am inclined to think their good points and "thinking powers" are often vastly exaggerated by friendly and carelessly observing eyes. Much that surprises may be of the type of one or other of the four stories above given. Imperfect, ill-trained observation, reading into actions motives and purposes which were never dreamt of, setting aside the simple for the marvellous, assisted by a heavier or lighter dash of Munchausenism, would turn folly into wisdom and wisdom into folly. By the help of any one of these principles one is quite capable of seeing in the most aimless action the profundity of the gods.

Creevelea, co. Leitrim. JOSEPH MEEHAN.

SOME SCIENTIFIC CENTRES.

VI.—THE PHYSICAL LABORATORY AT THE MUSEUM D'HISTOIRE NATURELLE.

THE Museums d'Histoire naturelle, in the beautiful surroundings of the Jardin des Plantes in Paris, founded in 1793, form an institution of acknowledged eminence; whilst the lectures delivered there are by the most renowned professors, and on most, if not all, branches of the natural sciences. It was Cardinal Richelieu, as we know, who founded the Jardin des Plantes somewhere about 1626, not long before the establishment of the French Academy by the same great Minister of State.

The physical laboratory in particular of these museums has been the seat of many discoveries and the centre from which has radiated some of the best thought, as well as some of the best work, that has animated the academy and through it the scientific world for three-quarters of a century. It is not often the case with science, nor, indeed, with other branches of learning, that in a single family there should be found for three generations a series of distinguished men of the highest order of intellect who have devoted their lives and best energies to its pursuit and attained to universal fame. More seldom is it, then, that when the lineage is thus preserved unbroken, the members thereof should all be devoted to the one and to the self-same calling. For three generations the Becquerels have occupied in succession the same chair at the same institution, namely, the Museum d'Histoire naturelle in Paris. The number of papers which have been read before the Academie des Sciences by the Becquerels extends to seven or eight hundred.

Henri Becquerel, whose portrait in his laboratory at the Museum d'Histoire naturelle is here reproduced, is, we venture to think, perhaps the most distinguished of his race. His father, Alexander Edmond, is known as the inventor of the phosphoroscope and the author of "La Lumière," a work of great value in its day, whilst his grandfather, Antoine César, was likewise famous for a long series of researches, chiefly on chemical dynamics and electrocapillary phenomena. His electromagnetic balance is of historic interest in the development of the galvanometer, although long since abandoned for practical purposes.

Thus the history of the physical laboratory at the Museum d'Histoire naturelle may be said to run parallel with the history of the Becquerels, and the two to be so closely interwoven that to describe the part played by one and the influence exerted by it in the development and advancement of knowledge is perhaps equivalent to writing that of the other in detail. It was not so with other scientific centres of this series; there there were many discontinuities, here the continuity is one.

The technical process of gilding due to de la Rive was based upon Becquerel's observation in 1834 of the deposition of metals on the negative electrode when the poles of a pile are immersed in solutions of various metallic salts; that the two solutions needed could be kept apart by the use of animal membranes without preventing the passage of the current, and that with very feeble currents the deposition of metal is even and uniform on the surface of the electrode. Although rivalled by many others in the application of these principles, many were the facts and many the methods which he announced with rapid succession in laying the foundations of the art of electro-plating.

It was to the study of electrocapillary phenomena, which he was the first to observe in 1867, that his later years were devoted. The discovery was a curious one, the result, if we mistake not, of the deposition of

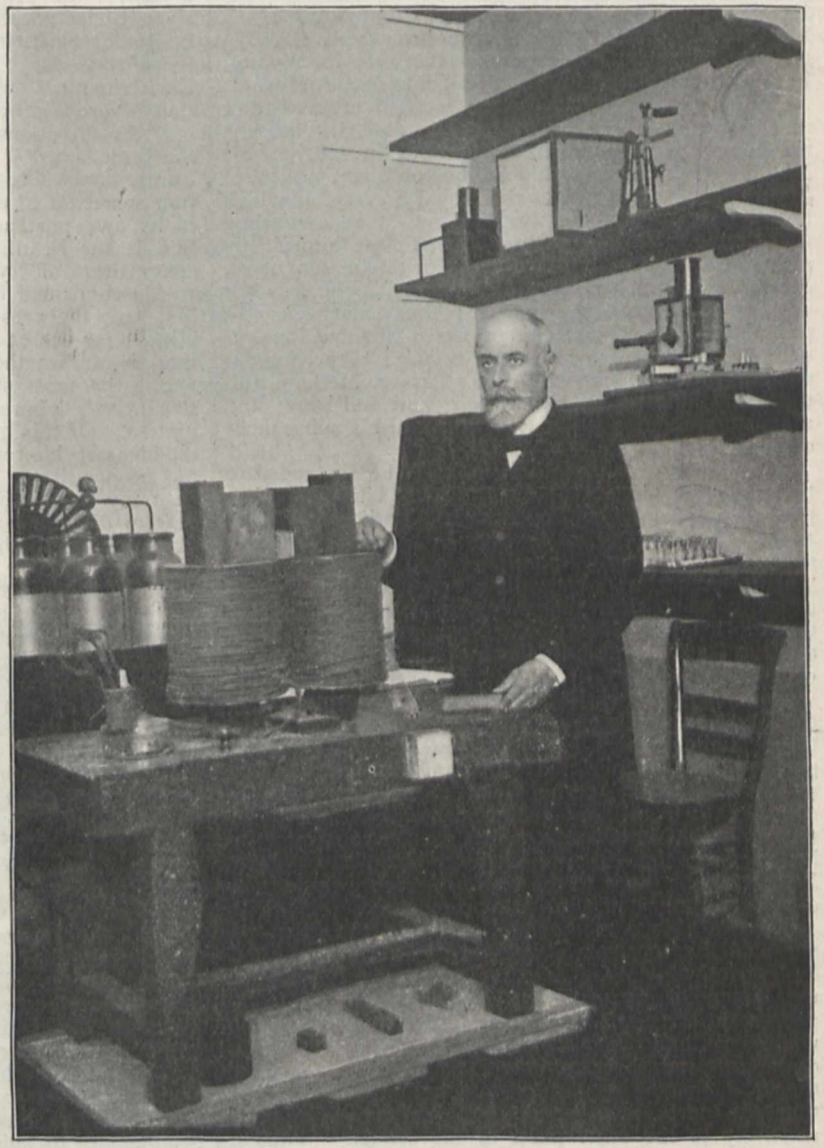

FIG. 1.—Prof. Henri Becquerel in his Laboratory at the Paris Museum d'Histoire naturelle.

metallic copper on a crack in a test-tube containing a solution of cupric sulphate, and immersed in another solution of sodic sulphide. The investigation of this phenomenon was full of interest, and not the least was the suggestion that the deposition of metals in veins in rocks is due to the same cause as that which he observed in the broken test-tube.

A member of the French Academy from 1829, eight years before being called to the chair which he filled to the end of his life, he was also a corresponding member of the Royal Society, and received from it its greatest honour, the Copley medal, and from the Emperor Napoleon III. the Cross of Commander of the Legion of Honour. Thus with him there closed a chapter, a long, an interesting, and an eventful chapter, in the history of the Museums d'Histoire naturelle.

Edmond Becquerel, although a pupil of his father and for a considerable time his assistant at the museums, did not teach there, and, indeed, as Sir William Crookes has said in his obituary notice of him in the *Proceedings* of the Royal Society, of which he was a foreign member, it may "be remarked that though he had early distinguished himself by scientific works of high value, and as the son of an eminent and much respected Academician he was not without influence, yet none of the great scientific establishments of his country offered him an appointment." He finally, however, secured a permanent position at the Conservatoire des Arts et Métiers, and there the abilities so long latent had full play, and manifested themselves by the success of his subsequent career.

At the death of his father, in 1878, he succeeded to the chair of physics at the museum, and this important position he continued to hold until his death in 1892. Brought up as he was in a scientific atmosphere, he evidently inherited from his father his "acute power of observation," and that "infinite capacity of taking pains which seems to be the essential characteristic of the Newtons, the Faradays, and the Darwins, and, in short, of all the great leaders of science."

Since 1892 Henri Becquerel has been professor at the Museum d'Histoire naturelle, and has continued those studies which his ancestors in days gone by pursued with ardour and with success, not the less marked, although perhaps, on the whole, notwithstanding their brilliant achievements, less fruitful in revealing that knowledge which was to come; for by his memoirs on the radio-activity of matter Henri Becquerel has given to the world of science the results of a very remarkable series of researches.

There are four methods of studying the infra-red parts of the spectrum: the thermopile, as employed by Tyndall and others, the radiomicrometer of Boys, the bolometer as used by Langley, and the phosphorescent screen of Becquerel. After exposure to the violet rays, and if the screen is subjected to the action of the infra-red, the phosphorescence becomes so intense that the energy accumulated is radiated so rapidly that the parts thus acted upon become quite dark relatively to the other parts of the screen. Thus a map of the infra-red can be produced and studied at leisure so long as the phosphorescence of the screen lasts, or, indeed, photographs of the screen thus affected may be taken. The effect is due most probably to heat, and is therefore a case of thermoluminescence. Under the influence of heat the collisions between molecules become more frequent and more violent, and the energy absorbed from the more refrangible rays, and stored up in the substance, by some means at present not very clearly understood, is once more yielded up to the æther and radiated away. The energy is stored up in unstable molecular aggregates which gradually disintegrate, as radio-active molecules have been found to do,[1] the change of absorption which accompanies fluorescence being due to the formation of these molecular groups.

The absorption spectrum of crystals exhibits many anomalies, from which Becquerel has extracted a most important principle. If a crystal is composed of two isomorphous substances the molecular elasticity of which varies in different directions, so that the absorption varies too, the absorption spectrum will likewise vary in different directions, so that it is thus possible to detect the presence of different substances, since in two isomorphous substances the directions of molecular elasticity do not correspond, and therefore the directions of absorption would likewise differ. Each chemical substance, therefore, affects the direction of propagation and of absorption.

If the directions of absorption do not coincide with the optic axes, it is due to the presence of different isomorphous substances in the crystal. The absorption spectrum of each substance remains different and in its own particular direction, whilst that of refraction is the resultant effect. By this contrivance the composition of crystals has been examined and afterwards confirmed by chemical means, whilst in many instances the presence of substances in quantities too minute for the chemist to notice has been detected by this elegant method of analysis.

But the most striking work that has issued from Becquerel's laboratory relates to the radio-activity of matter. Of this great discovery, separating as it does the ideas of this century from those of the last, so much has been written, upon their far-reaching importance, so many ideas have been discussed in these columns, that to discourse upon them here would be but vain repetition of all that has been said before; yet, paradoxical though it may seem, it is unquestionably the work of all works that most definitely separates, and at the same time most closely unites, the two sciences of physics and chemistry, whilst it brings into prominence what may appropriately be called a new science—that of radio-activity—a science which neither physics nor chemistry can claim within its old province, and yet neither can disclaim, nor would it very readily do so if it could.

What is the influence which these laboratories have exerted and exert? We may ask, what is the influence of the Royal Institution? Is it not to be measured by the work which has been done there and by the ideas which have been scattered from those great fountains of thought—if they can be measured? How many youthful imaginations, how many enthusiastic aspirations have been aroused within those venerable halls, of the Becquerels as of the Davys, the Faradays, and the Tyndalls? Parisian lecturers are *savants*, philosophers, and orators. For although the Teuton regards the gift of eloquence (we hope it is his own) as the gift to be designated as "gab," the southerner or the Celt thinks it indispensable in the expression of a clear mind and of a great soul, at once saturated with thoughts and the grandeur of its subject; and in France this counts for more than it usually does among us.

These lectures are a source of inspiration to the multitude as well as to the grave, and their importance cannot be overrated.

Having said thus much of the laboratories of the Museum d'Histoire naturelle, we may perhaps be permitted to add a word as to the central figure in this centre of scientific thought, of M. Henri Becquerel; from none need we expect greater freedom, greater ease, or kindlier consideration. The brief summary

[1] British Association and *Electrician*, 1900-02; and *Phil. Mag.*, 1901 *Phil. Trans.*, 1897

of his researches and of that of his predecessors is the record of this branch of the museums, and also of the debt which knowledge owes, and must ever owe, to the influence of one of the most remarkable of the pioneer laboratories and great European centres of scientific work.

JOHN BUTLER BURKE.

THE "NATURE-STUDY" OF BIRDS.[1]

THIS book fulfils the chief conditions we have previously insisted upon as being essential in all new works relating to the birds of the British Isles, in that it is original, interesting, exquisitely illustrated from living subjects, and not burdened with technical names. Indeed, the latter are conspicuous by their complete absence, thereby, no doubt, rendering the volume much more acceptable to readers of all classes than it would have been had it included the usual superfluous intercalations in bracketed italics. Mr. Boraston, it appears, took to the "nature-study" of birds comparatively late in life, and in his case it may be truly said "better late than never," for had he never done so lovers of nature in general, and of birds in particular, would have been deprived of a very charming volume containing a number of fresh ideas and suggestive observations. Having once decided to take up the outdoor study of bird-life, the author entered on his task with characteristic energy, and at once saw how essential it was for him to follow in the steps of the Messrs. Kearton and to employ the camera to perpetuate the scenes that he so much enjoyed if his work was to be one that would appeal successfully to the public.

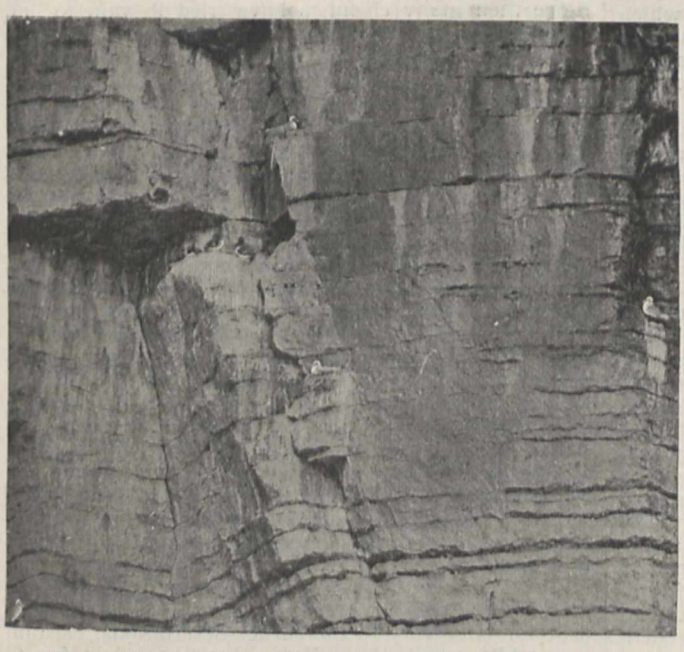

FIG. 1.—Kittiwakes on an Anglesea Cliff. From "Birds by Land and Sea."

How successful have been the results, both from the literary and the artistic point of view, readers of his book will not, we venture to think, be long in deciding. To whet their appetites, we herewith reproduce

FIG. 2.—Young Ringed Plovers crouching. From "Birds by Land and Sea.'

a couple of the illustrations, all of which, by the way, are taken from the author's own photographs.

The volume opens with the latter of what the author terms the two critical periods of bird-life, namely, March and September, when the migratory species are in the thick of their departure from or arrival at the British Islands. From September until May the seasonal observations of the year forming the subject of the volume relate to the bird-life of the neighbourhood of the author's home at Stretford, near Manchester, but during June the scene is transferred to the wild coast of Anglesea and Puffin Island, while in July and August we once more return to the home district. Perhaps the Anglesea interlude forms the most interesting part of the volume; but whether on a holiday or whether at home, the author seems to be endowed with a marvellous capacity for work, both in the matter of making and recording observations and in taking photographs.

On the wild cliffs of Anglesea, as we are told on p. 210, "stalking" birds for the purpose of taking their portraits by a well planned snap-shot demands a considerable amount of coolness and steadiness on the part of the observer, as if he becomes too much absorbed in the object of his pursuit awkward accidents are likely to occur; and even if such undesirable contingencies are successfully avoided, disappointments from unsuspected or unavoidable causes are only too likely in many instances to annul the results of all the toil and trouble. Who, for instance, will fail to commiserate the author on having lost the chance of "snapping" a sitting nightjar (p. 202), from the fact that he actually did not see the bird for some seconds, and then, when "his eyes were opened," the camera slipped?

[1] "Birds by Land and Sea: the Record of a Year's Work with Field glass and Camera." By J. M. Boraston. Pp. xiv+282; illustrated. (London: John Lane, 1905.) Price 10s. 6d. net.

As an example of the successful accomplishment of a difficult task, we reproduce (Fig. 1) the photograph of kittiwake gulls nesting on the precipitous face of a cliff, approach to which was effected by climbing down a narrow gulley and then scrambling over seaweed-clad boulders, to the imminent peril of the camera.

As a specimen of really excellent bird-photography, we present to our readers the picture of a group of young ringed plovers (Fig. 2), the mottled down of which harmonises so admirably at a short distance with their surroundings.

If it be said that this notice is purely commendatory, and contains nothing in the way of criticism, the reply is that we have found nothing to criticise or to condemn. It is real nature-study. R. L.

THE ARTIFICIAL PRODUCTION OF RUBIES BY FUSION.[1]

THIS memoir opens with a short historical account of the attempts previously made to produce rubies by fusion, starting with the researches undertaken by Gaudin with the view of obtaining fused alumina in a transparent state. He obtained by fusing potassium or ammonium alum, together with a little chrome alum, small globules, which became opaque on solidification, but had the composition of the ruby. These were shown by Becquerel to have the cleavage of corundum, and contained small cavities lined with crystals of ruby. Gaudin concluded that alumina could not exist in the vitreous state, and this view was supported by C. Sainte-Claire Deville, on account of the uniform density of the oxide before and after fusion. The facts at present known are in support of this view, for the transparent alumina obtained by fusion is a completely crystalline mass. The problem was not further investigated until, in 1886, Charles Friedel described an experiment by which corundum was obtained by fusion, presenting most of the properties of the ruby, but differing from the natural product by the presence of certain included bubbles, and by a rather low density.

As the production of the so-called "Geneva rubies" remained a trade secret, M. Verneuil started a series of investigations, following up the work of Gaudin. He found that to obtain the fused material in a transparent state certain conditions must be rigorously fulfilled. He compares the solidification of alumina to that of water, which forms according to the method of cooling transparent or opaque ice. An important observation which appears to have escaped Gaudin is that it is only the portions of alumina which are fused in the cooler parts of the flame which remain transparent on solidification. One of the greatest experimental difficulties is that, however carefully the cooling is conducted, the fused mass is excessively brittle. This brittleness is least marked when a very small supporting surface is employed. The apparatus devised by M. Verneuil is very ingenious. The blow-pipe and furnace tube must be absolutely vertical. The finely powdered alumina, containing the requisite quantity of chromic oxide, and specially purified, is admitted by means of a fine sieve, which is given a series of regular taps, controlled by an electromagnet, so that the material falls down the tube intermittently in a series of thin layers. It forms a cone at the bottom, and as soon as this cone reaches a hot enough part of the tube the apex fuses, and the fused material then extends gradually upwards in a long filament. This eventually reaches a still hotter part of the furnace, and develops a spherical mass instead of growing further; this spherical globule when solidified forms the ruby. The cooling has to be very gradual, so that the crystalline particles have time to become regularly arranged, or an opaque product is obtained. If the ovoid mass is carefully detached when cold, it splits up into two nearly equal portions, but not along a cleavage-plane. The product so obtained is an individual crystal, and the direction of its principal optic axis is never very different from that of the major axis of the ovoid.

The product when cut cannot be distinguished by its chemical, physical, or optical properties from a stone cut from a natural ruby. The operation may be considered successful when the clear product weighs 12 to 15 carats, and has a real diameter of 5 or 6 millimetres. It is, however, impossible to obtain stones larger than ¼ carat free from included bubbles and cracks, and experts can therefore readily distinguish the artificial gems from natural ones. These flaws do not in any way detract from the beauty of the stones; they are often clearer than many natural rubies, which are seldom found perfect.

The paper is illustrated by diagrams of the very ingenious apparatus devised by the author.

[1] "Memoire sur la Reproduction artificielle du Rubis par Fusion." By A. Verneuil. (*Annales de Chimie et de Physique*, 8e série, t. ii., September.)

CALCIUM METAL.

ELECTROMETALLURGY has at last succeeded in producing metallic calcium in commercial quantities, and at what must be considered a relatively low price. Until within a few weeks ago this metal had only been available in very small amounts, and remained a rare laboratory specimen; it is now obtainable at a price per kilogram less than that charged by most chemical dealers for a small one-gram sample. Humphry Davy first formed the amalgam by electrolysing lime, mixed with mercuric oxide and slightly moistened, with a mercury kathode; he isolated the metal in small quantities by distilling off the mercury. Since then many chemists have tried in vain to find a method suitable for its preparation on a larger scale. Matthiesen, making use of Bunsen's suggestion of applying high current density at the kathode, only succeeded in obtaining a few grams at a time by electrolysis of the fused chloride, or of mixtures of calcium and other chlorides having a lower fusing point. Henri Moissan, as the result of a critical study of the numerous proposed methods, was able to prepare somewhat larger quantities of the metal. His method was essentially a modification of that proposed by Liès-Bodart and Jobin in 1858, which consisted in reducing fused calcium iodide with metallic sodium. Moissan found that molten sodium forms an excellent solvent for calcium, and by heating calcium iodide with a large excess of sodium obtained on cooling a cake of the sodium-calcium alloy resting on the sodium iodide. Small quantities of the alloy were thrown into well cooled absolute alcohol, which reacts with the sodium leaving the calcium pure, but in the state of a fine crystalline powder. This powder can be agglomerated by pressure and fusion, and thus Moissan prepared the fine specimen ingots of this metal which so greatly interested visitors to the Paris Exhibition of 1900. It is largely to him that we are indebted for a knowledge of the properties of the pure metal, of which he prepared some 4 kilos. by this process. Contrary to the earlier descriptions, calcium is a white metal, the yellow coloration being due to a film of nitride; its melting point is about 760° C., and its density 1.85. The definite compounds which it forms directly with hydrogen and nitrogen promise useful applications in the laboratory in cases where it is necessary to remove these gases.

The next advance was made almost simultaneously by Borchers and Stockem at Aix-la-Chapelle, and

Ruff and Plato at Berlin. The method employed by these workers was in principle that of Matthiesen, but by suitable construction of apparatus and regulation of temperature much better yields were obtained, and the metal was thus prepared in larger quantities. Borchers and Stockem electrolysed molten calcium chloride, which was maintained at a temperature below the fusing point of calcium; they ascribe the low yields at higher temperatures to the reaction of fused calcium with calcium chloride to form a subchloride. Using an iron rod as kathode, they obtained a metal sponge which was pressed with tongs before removing from the electrolyte. The raw material prepared in this way contained some 10 per cent. of calcium chloride, which could, however, be almost entirely removed by subsequent fusion of the metal.

The final step in the evolution of the commercial process was taken by Suter and Redlich, of the Elektrochemische-Werke, Bitterfeld. By the ingenious employment of a kathode which only just touches the surface of the fused calcium chloride, they obtain a small layer of fused calcium under the kathode; before the calcium has collected in sufficient amount to flow away the electrode is very slightly raised; the metal thus comes into a cooler zone and solidifies. By continuing the process a rather irregular rod of calcium is built up, which itself forms the kathode. The metal is supplied in these rough rods, which in outward appearance strongly resemble cabbage stalks, but show a white metallic surface when cut through.

The present price quoted in Germany is about 20*s.* a kilogram retail, or 12*s.* a kilo. in 100 kilogram lots, which quotation alone proves the feasibility of the process. The technical product is said to contain about 97·11 per cent. pure calcium, 1·64 per cent. calcium chloride, and 0·4 per cent. sodium. If one may judge by the case of metallic sodium, there will doubtless be difficulties in finding any large demand for the metal, but it will obviously be much appreciated for experimental purposes in many chemical and physical laboratories.

R. S. HUTTON.

NOTES.

WE regret to announce that Sir Lowthian Bell, Bart., F.R.S., died on Tuesday, at eighty-eight years of age.

THE death of Mr. Norman Maccoll, late editor of the *Athenaeum*, at sixty-one years of age, will be deeply regretted by many men of science. Mr. Maccoll did much to further the interests of science, and to cultivate sympathy with the pursuit of natural knowledge among readers not actively engaged in scientific work.

ON Saturday last, direct telegraphic communication was established between Liverpool and Teheran, in Persia, a distance of four thousand miles. The line belongs to the Indo-European Telegraph Company.

ON Tuesday next, December 27, Mr. Henry Cunynghame will deliver at the Royal Institution the first of a Christmas course of six lectures adapted to a juvenile auditory on ancient and modern methods of measuring time, experimentally illustrated.

AT the December meeting of the Astronomical Society of France an address was given by Mr. de Watteville on the temperatures of stars. The lecturer described a series of experiments made by him in the Count de Labaume Pluvinel laboratory, and exhibited a series of photographs of spectra obtained by him, reproducing the principal types described by Sir Norman Lockyer. The president congratulated the speaker on having obtained such brilliant results, on the subject of which he has already delivered a thesis at the Sorbonne.

IT is announced by the *Athenaeum* that the Circolo Matematico di Palermo intends to offer an international prize for geometry at the fourth International Mathematical Congress, which will meet at Rome in 1908. The prize will consist of a small gold medal, to be called the Guiccia medal, after its founder, and of 3000 francs, and will be given by preference, though not necessarily, to an essay which advances the knowledge of the theory of algebraical curves of space. The treatises may be written in Italian, French, German, or English, and must be sent to the president of the Circolo Matematico before July 1, 1907.

WE learn from the *Times* that on Friday last President Loubet received Dr. Otto Nordenskjöld, who was presented by the Minister for Sweden and Norway in Paris. On the evening of the same day Dr. Nordenskjöld delivered a lecture on his Antarctic explorations before the French Geographical Society. Prince Gustav Adolph and Prince William of Sweden were present, and several Ministers were represented. Dr. Nordenskjöld was the guest on Saturday afternoon of the Paris Municipal Council at the Hôtel de Ville. He was welcomed by the president of the council, who presented him with a silver medal commemorating his visit to the city. On Saturday evening Dr. Nordenskjöld delivered a lecture before a large and distinguished audience at the Sorbonne.

THE death is announced of Mr. C. G. Barrett, one of the editors of the *Entomologist's Monthly Magazine*, at the age of sixty-eight years.

IT is stated that at a meeting of the French Surgical Society held on December 14 a report of the committee appointed to investigate Dr. Doyen's researches on cancer and its microbe was read, and that some of the conclusions support Dr. Doyen's claims. No authentic details have, however, as yet been published.

THE following recent deaths are announced in the *Bulletin* of the French Physical Society and the *Popular Science Monthly*:—M. Jeunet, late professor of physics; Prof. Lespiault, of the University of Bordeaux; Prof. Joseph Thimont, of the École Ste.-Geneviève and other institutions; Prof. Clemens A. Winckler, professor of chemistry at Dresden; Prof. Max Berbels, of Berlin, noted for his publications on ethnology; Major Henry F. Alvord, chief of the dairy division of the U.S. Department of Agriculture.

IN the *Bulletin* of the French Physical Society, No. 219, the death is announced of Prof. Macé de Lépinay, of Marseilles, a former member of the council of the society. Prof. Macé de Lépinay's researches were mostly connected with optics, and had special reference to the determination of wave-lengths by means of interference phenomena, on the lines first laid down by Fizeau. The methods used were interference due to double refraction, interference of a direct ray with one passing through a lamina of the crystal, and interference of two rays, one passing once and the other twice through the lamina. A further series of researches dealt with the inverse problem of determining the specific mass of water. Most of the experiments were performed with sodium light. Prof. Macé de Lépinay's latest researches were conducted conjointly with M. Buisson, who proposes to complete them.

GLASS hives for the observation of bees at work have been in use for many years, and latterly ants' nests have been on view at the Crystal Palace; but it may be new to many of our readers to learn that Messrs. A. W. Gamage, Ltd., of Holborn, have actually put on sale a contrivance called "The Lubbock Formicarium," which is really a

portable ants' nest, which can be moved anywhere without trouble or inconvenience, and which, it is claimed, will last for upwards of six years with ordinary care. The species selected is the small yellow ant, *Formica flava*, and the nest is enclosed in a frame 10 inches square, resembling a picture frame, except that it must, of course, be laid flat, and the cover must be kept over it except when the ants are under observation. The nest contains ants in their various stages, and some of the other insects which are associated with them; and it is supplied with or without a queen, and accompanied by full directions as to management. This novelty has attracted considerable attention already, and the visitors, many of whom are children, show much interest in this novel exhibition.

DR. CHARLES WALDSTEIN gave a lecture on "Herculaneum and the Proposed International Excavation" at the Royal Academy on December 14. He remarked that from Herculaneum many beautiful works might be expected. The city and district of Herculaneum were overwhelmed with volcanic material, but this is not the impenetrably hard lava commonly supposed. Geologists have shown that, apart from actual contact with air, the material is perfectly friable and manageable for the excavator. The beautiful works from the city which are to be seen at Naples show that the disaster was not destructive of the beauty of the works of art at Herculaneum. Manuscripts which can be unrolled and read, as well as glass and marble, with no trace of fire on them, give good hope of what may be expected from thorough excavation. The catastrophe was a marvellous preservation of a provincial city's life at the moment of arrest. The King has expressed approval of the proposed international excavation, and the King of Italy, as well as his Prime Minister, promise support. The President of the United States, the German Emperor, the President and Government of the French Republic, the Emperor of Austria, and the King of Sweden encourage the undertaking. There is already a committee in Vienna, and it is hoped to secure the cooperation of many other national committees. Mr. Neville Rolfe, our Consul at Naples, has told Dr. Waldstein that there is ample work for many years without infringement of private rights.

OUR Norwegian namesake—*Naturen*—for November contains an illustrated account of the mammoth discovered in the Kolyma district in 1901, and now mounted in the St. Petersburg Museum. The monster has been set up in the position in which it was found, namely, endeavouring to struggle out of a quicksand or crevasse.

IN the issue of the *Sitzungsberichte* of the Vienna Academy for November 10 Dr. F. Werner gives an account of the zoological results of his recent expedition to Egypt and Nubia. The most important part of the collection appears to consist of orthopterous insects—a group hitherto very imperfectly known from the countries in question, and of which a large series of specimens was obtained. Very noteworthy is the discovery of certain Central Asian species of the group in the heart of this part of Africa. A fish and a fresh-water mussel previously supposed to be confined to the Upper Nile are recorded from the delta, and some interesting observations with regard to certain reptiles have also been made.

WE are indebted to the publisher—G. Freytag, of Leipzig—for copies of the two issues of the new (twenty-sixth) edition of Pokorny's "Naturgeschichte des Tierreiches," a well known zoological text-book for schools. The present enlarged edition has been supervised by Mr. M. Fischer, of Mülhausen. The book is issued in two forms, one more expensive than the other. In the cheaper issue (of which the price is 3*s*. 6*d*.) there are only five coloured plates, whereas in the more expensive one (price 4*s*. 6*d*.) the number of illustrations of this description is twenty-nine. Some difference in the arrangement and number of the cuts distinguishes the two issues. Considering the price of the volume, the coloured illustrations are all that could be desired. The fact of the work reaching its twenty-sixth edition is a sufficient guarantee of its fitness for its special purpose.

WE have received a copy of a new monthly publication, *Indian Public Health* (No. 4, vol. i.), which is to be devoted to the discussion of public health questions in our Indian Empire. We cannot help expressing the opinion that it is undesirable to multiply small journals, of which there are already too many. It would be better to enlarge the scope of the existing journals.

IN the *Journal* of the Quekett Microscopical Club (ix., No. 55) Mr. T. B. Rosseter gives a good description of the anatomy of *Taenia sinuosa*, a tapeworm of geese, and proves by feeding experiments that the cysticercoids inhabit certain copepods and ostracods; and Mr. Wesché investigates some new sense-organs of Diptera, concluding that where the antennæ are not particularly sensitive, the palpi have structures to compensate, and may bear organs of touch, taste, and smell, but not more than two of these at the same time. He also describes certain organs, probably of sense, on the legs of many species, the function of which is doubtful.

WE have received "Researches in Helminthology and Parasitology," by Prof. Joseph Leidy, edited by his son, Dr. Joseph Leidy (*Smithsonian Miscellaneous Collections*, part of vol. xlvi.). It gives a summary of Prof. Leidy's contributions to science, with bibliography, and should prove of considerable value to those engaged in these branches of research. Commencing in 1849, Prof. Leidy's contributions were continued without intermission down to 1889, and are no less than 578 in number, many being of considerable importance, and embracing parasites of all kinds, as well as some papers on comparative anatomy.

IN the report for the year 1903–4 on the administration of the Government Museum and Connemara Public Library, Madras, amongst other interesting matter the following paragraph appears:—"A prolonged tour was made in the Mysore province in connection with the ethnographic survey, with the primary object of continuing my researches into the character of the Canarese cranium (*vide* Museum *Bulletin*, iv., 2, 1901). The work was carried out under conditions of considerable difficulty, caused by the terror of the natives, who mistook me for a recruiting sergeant bent on seizing them for employment in South Africa or for the Somali war, and fled before my approach from town to town. The little spot, which I am in the habit of making with Aspinall's paint to indicate the position of the fronto-nasal suture when measuring the nose, was supposed to possess blistering properties, and to turn into a number on the forehead, which would serve as a means of identification. The untimely death of a Korava outside a town where I was halting was attributed to my evil eye. Villages were denuded of all save senile men, women and children. The vendors of food-stuffs in one bazaar finding business slack owing to the flight of their customers, raised their prices, and a missionary complained that the price of butter had gone up. My arrival at one important town

was coincident with a temple festival, whereat there were not sufficient men left to drag the temple car in procession. The headman of another town, when he came to take leave of me, apologised for the scrubby appearance of his chin, as the local barber had fled. One man, who had volunteered to be tested with the tintometer, was suddenly seized with fear, and, throwing his body-cloth at my feet, ran away and was no more seen. An elderly municipal peon wept bitterly when undergoing the process of measurement. Such are a few examples of the results which attend the progress of the Government anthropologist." Mr. Edgar Thurston finds that the average cephalic index of various groups of natives in the southern (Tamil and Malayalam) districts of the Madras Presidency ranges from 72·6 to 76·5, while that in the Canarese and Maratha area ranges from 77·1 to 81·8. The significance of this brachycephalic element is not yet elucidated.

In the *Transactions* of the Academy of Science of St. Louis, vol. xiii., No. 8, Mr. J. A. Harris gives some details of polygamy and floral abnormalities in species of Solanum. A collection of flowers of *Solanum carolinense* showed about twenty staminate to eighty perfect flowers. A second paper by the same writer describes the germination of seedlings with unequal cotyledons of *Pachira campestris*, a genus sometimes allied with Bombax.

The formation of a botanic garden in sandhills does not perhaps suggest utility or success, but in the *Gardener's Chronicle* (November 19) Dr. Masters gives an account of the practical results obtained by experiments carried out in the garden, or, as it may be called, the experimental station established in the Belgian dunes at Coxyde. As an instance of the way in which experimental results are sometimes opposed to theoretical supposition, the writer describes the successful formation of a forest of dwarf poplars in the sandhills, and even suggests that they would act as nurses to seedling pines.

It is characteristic of the scattered groups of islands which lie between the parallels of 45° and 60° south that in their flora they all contain a proportion of what has been termed a Fuegian element. Amongst these are the so-called Southern Islands of New Zealand, of which the latest account is that given by Dr. Cockayne in the *Transactions* of the New Zealand Institute, vol. xxxvi. The plant associations of the Auckland Isles include a forest formation, with *Olearia lyallii* as the dominant tree, which Dr. Cockayne regards as the primitive forest, and one that was previously more extensive, but which has been curtailed by the spread of a *rata* forest similar to the rata forests found in New Zealand. This fact, and the existence of a well marked New Zealand element in the flora are points of evidence in favour of a former extension of New Zealand to the south.

Mr. A. Tingle, of the Imperial Provincial College, Chinanfu, Shantung, has sent a further communication upon the flowering of the bamboo, in which he supplements—in view of the letters of Prof. J. B. Farmer, F.R.S., in our issue for August 11, and of Mr. J. S. Gamble, F.R.S., in Nature for September 1—the information supplied in his previous letter. Mr. Tingle is unable to tell the species of the bamboos that flowered, but he reports that they were small, growing to a height of about 4 metres, and that the stems averaged about 4 cm. in circumference near the ground. All the bamboos have died since flowering. Mr. Tingle points out that the bamboo will grow in Shantung only if carefully cultivated in a garden. The seasons, he remarks, have been in no way exceptional in Shantung.

Among the interesting collection of models of Palæozoic seeds and cones exhibited by Mr. H. E. H. Smedley at a recent meeting of the Linnean Society, a few are of special interest to palæobotanists. The example selected for illustration here is that of the group of three models of the sporophylls of the lycopodiaceous cone, Lepidocarpon, from the Carboniferous formation. The model on the left shows the general morphology of a single sporophyll, from which will be seen the peculiar shape of the integument and micropyle, much resembling a hand-bag. The centre model demonstrates the general anatomy as seen in the

Fig. 1.—Palæozoic cones.

transverse section, and shows the complete lamina of the sporophyll, while that on the right clearly exhibits the complex internal structure of the sporangium containing four megaspores, one of which has developed a seed-like formation filling nearly the whole of the sporangium, the other three being abortive. In urging an affinity between the lycopodiaceous cones and the gymnosperms, the author submitted the following points of agreement:—Integument and micropyle, the single functional megaspore in the sporangium, and the detachment of the seed-like organ as a whole.

The report of the Meteorological Council for the year ending March 31, 1904, shows increased activity, and is somewhat more bulky than its predecessors, extending to more than 200 pages; the report proper embraces only some 30 pages; the remainder is composed of appendices which contain details of the operations of the office. No change has taken place in the constitution of the council during the year, nor is any clue given to the future of the office resulting from the deliberations of the Meteorological Grant Committee; their report, however, was not issued until after the period to which the council's report refers. While the work of a former Government department is arduously performed, the Meteorological Office continues to hold a very anomalous position compared with similar establishments in other countries; it performs valuable public duties, but has not the status of a Government office, although supported by a Government grant. The operations may be summarised under four principal heads:—(1) ocean meteorology, the collection, tabulation, and discussion of meteorological data for all parts of the ocean, and the preparation and issue of charts and the supply of instruments to the Royal Navy and mercantile marine; (2) the issue of storm warnings to all seaports willing to receive them, of daily weather forecasts, and of forecasts for agriculturists during harvest seasons; (3) the climatology of the British Isles,

statistics relating to British colonies and dependencies, and replies to numerous meteorological inquiries from all sources; (4) the discussion of automatic registers received from the observatories and other stations in connection with the office. The library contains weather maps and other publications received from all parts of the world, and these are available to all persons wishing to consult them.

PART x. of the *Bulletin* of the Department of Agriculture of Jamaica contains an interesting article by Mr. H. H. Cousins, the Government chemist, on the possibility of manufacturing starch from cassava on such a scale as to undersell German potato starch in the English market. The high proportion of starch in cassava makes the latter twice as valuable as the potato as a raw material, and cassava has the additional advantage that it is not liable to fungoid diseases such as produce extraordinary variations in the annual potato crop in Germany. The seasons of its growth and harvest are, moreover, perfectly unrestricted.

SOME apparatus left by the late M. Félix Worms de Romilly has been offered by the French Physical Society for distribution to its members.

THE Association of Engineers of the School of Liège is organising, under Government patronage, a congress of mining, metallurgy, applied mechanics and geology, to be held at Liège from June 26 to July 1, 1905, on the occasion of the Universal Exhibition.

IN the *Physikalische Zeitschrift* for December 1 Mr. Hermann Bonin contributes an interesting report on steam turbines, based on the writings of Stodola, Feldmann, Gutermuth, and Boveri. In it the Laval, Curtis, Rateau, Zölly, and Parsons turbines are figured, and their peculiar features discussed.

PROF. R. W. WOOD contributes a paper on *n*-rays to the *Physikalische Zeitschrift* for December, and suggests that those experimenters who obtain positive and those who obtain negative results should arrange to make a series of joint experiments in the way that has been done in a similar case by Crémieu and Pender.

WE have received a thesis by Messrs. H. C. Crowell and G. C. D. Lenth on the "Doble" needle-regulating nozzle for fire hoses and other jets. This nozzle is furnished with a convergent mouth-piece in the centre of which is a peculiarly shaped "needle," the effect of which on the stream lines is to obviate the spraying noticeable with ordinary jets, and thus to increase the efficiency. The paper is printed by permission of the Massachusetts Institute of Technology.

PROF. N. UMOW contributes to *Terrestrial Magnetism and Applied Electricity* an ingenious method of constructing magnetic charts. It consists in developing the magnetic potential in a series of spherical harmonics, and representing on a Mercator's chart the poles of the various harmonics and curves showing their zeros and so forth. The advantage of this system is that instead of drawing a large number of magnetic curves, it is possible to convey more exact information by drawing a comparatively small number of curves indicating the various terms in Gauss's expansion.

IN a paper read before the Institution of Mechanical Engineers on November 18 Messrs. A. E. Seaton and A. Jude emphasise the need of testing materials which are to be subjected to rapidly repeated or to alternating loads by other methods than by merely determining the tensile strength and elastic limit. A form of apparatus is described by means of which the ability of a notched bar of the material to withstand impact can be measured, and it is shown that although a high tensile strength may be accompanied by a small resistance to shock, a bar which responds satisfactorily to the impact test always has sufficient tensile strength and elasticity. The best results as regards resistance to shock are obtained with those steels which contain only a small proportion of carbon, an extraordinarily rapid increase of brittleness occurring with an increase in the percentage of carbon. The line of fracture of the metal follows the direction of the ferrite and avoids the perlite. Oil quenching has the effect of increasing the shock strength of steel to a value which is 500 per cent. to 600 per cent. greater than that of the natural steel in its best condition.

A NEW and revised edition of stage iii. of Mr. Vincent T. Murché's "Object Lessons in Elementary Science based on the Scheme issued by the London School Board" has been issued by Messrs. Macmillan and Co., Ltd.

IN the November, 1904, issue of the *Central*, the magazine of the Central Technical College Old Students' Association, Prof. H. E. Armstrong, F.R.S., continues his papers on the mechanism of combustion, and there is an illustrated description of the Manhattan railway power station of New York, contributed by Mr. W. A. Del Mar.

IN addition to the enumeration of classes and other administrative matter, the *Johns Hopkins University Circular* for November, 1904, contains one or two original papers. Among these may be mentioned one by Prof. W. B. Clark on the Matawan formation of Maryland, Delaware, and New Jersey, and its relations to overlying and underlying formations.

THE Department of Agriculture and Technical Instruction for Ireland has issued a pamphlet entitled "Notes for Manual Instructors." Manual instruction is comparatively new in Ireland; the conditions are different from those in other countries, and there are initial difficulties to be overcome. For these reasons the notes here brought together should be of real assistance to teachers of the subject.

A COPY of an almanac for the year 1905, compiled at the offices of the Egyptian Survey Department, and published by the National Printing Department at Cairo, has been received. The almanac provides full particulars of the dates of all the important meetings of the various Government departments, and gives information on points in connection with the Government regulations which should be of service to tourists and residents.

IN view of the largely increased facilities provided within the past few years by the publication departments of various institutions, and more especially by the Carnegie Institution, for the promotion of original research with its incident publications, the Wagner Free Institute of Science, Philadelphia, has decided to discontinue for the present its work in this department, and to devote its energies more exclusively to other purposes indicated by its founder.

WE have received a copy of the "Guide to the Archives of the Government of the United States in Washington," just published by the Carnegie Institution of Washington. The guide was begun by Mr. C. H. Van Tyne and Mr. W. G. Leland, and completed by the newly organised Bureau of Historical Research. The original purpose of the guide was to gather information of the whereabouts of important historical materials, but as the work proceeded it was found desirable carefully to deal with all administrative records. The work, in fact, developed into a survey of all the branches, bureaus, and divisions of the Federal Government in Washington.

Two new volumes have been added to Ostwald's series of scientific classics, published by Mr. W. Engelmann, Leipzig (London: Williams and Norgate), bringing the number of reprints and translations in the collection up to 145. One of the volumes is a translation, by Herr F. Plehn, of Kepler's "Dioptrice," with an introduction, notes, and sketch of Kepler's life and work. The second volume (No. 145) contains reprints of two papers by Kekulé, edited with notes by Herr A. Ladenburg; the papers are:—"Über die Constitution und die Metamorphosen der chemischen Verbindungen und über die chemische Natur des Kohlenstoffs" and "Untersuchungen über aromatische Verbindungen."

THE annual report of the Smithsonian Institution for the year ending June 30, 1903, has been received. As usual, the general appendix makes up the greater part of the volume. The excellent and varied selection of beautifully illustrated papers by men of science of all nationalities, constituting the general appendix, provides a trustworthy indication of the extent and nature of the progress in science during the twelve months with which the report deals. It is impossible here to give even the titles of the fifty-three papers included. Some of the papers have been reprinted from NATURE and other periodicals, some are addresses delivered before scientific bodies, and a few are new contributions. In addition to these works there are a number of translations of papers originally published in other languages. The first place is given to a reprint of the general description of the moon included by Prof. N. S. Shaler in the introductory chapter of his memoir on "A Comparison of the Features of the Earth and the Moon." This paper is illustrated by ten magnificent plates. The work done on radium and radio-activity is chronicled in papers by M. E. Curie, Prof. J. J. Thomson, Sir William Ramsay, Mr. Soddy, Sir Oliver Lodge, Sir William Crookes—the names being mentioned in the order in which the papers are printed. Geographical research is represented by contributions by Captain E. W. Creak, Mr. Alfred H. Brooks, Commander Peary, Sir Clements R. Markham, Dr. Otto Nordenskjöld, M. G. Ts. Tsybikoff, and others. The articles on geographical and zoological subjects are illustrated very profusely, and the volume will make a valuable addition to reference libraries fortunate enough to secure copies of it.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF A NEW COMET (1904 *d*).—A telegram from the Kiel Centralstelle announces that a new comet was discovered by M. Giacobini at Nice on December 17·11. Its position at 17h. 41·3m. (M.T. Nice) was

R.A. = 16h. 14m. 40s., dec. = +27° 28′,

and its movement was in a north-easterly direction.

This position is situated on the western boundary of the constellation Hercules, about 44m. east of α Coronæ, which has approximately the same declination (27° 2′), and is favourably situated for observation during the three or four hours preceding dawn.

A second telegram from Kiel informs us that the comet was again observed at Nice on December 18. Its position at 16h. 44m. (M.T. Nice) was as follows:—

R.A. = 16h. 17m. 3·4s., dec. = +27° 54′ 8″.

TEMPEL'S COMET (1904 *c*).—The following details of M. St. Javelle's re-discovery of Tempel's second comet are given in No. 3984 of the *Astronomische Nachrichten*:—

	M.T. Nice	R.A. (app.)	Dec. (app.)
	h. m. s.	h. m. s.	° ′ ″
Nov. 30 ...	6 7 48 ...	19 36 39·89 ...	−24 48 37·3
Dec. 1 ...	5 55 10 ...	19 40 23·58 ...	−24 46 17·5

The comet was a feeble and ill-defined object as seen in the Nice equatorial of 0·76 m. aperture, and had the appearance of a whitish spot 1′·5 to 2′·0 in extent; no nucleus was visible.

A continued abstract of M. Coniel's daily ephemeris (*Astronomische Nachrichten*, No. 3971) is given below:—

12*h*. *M.T. Paris.*

1904	α (app.)	δ (app.)	log Δ	$1:r^2\Delta^2$
	h. m. s.	° ′		
Dec. 20 ...	20 51 30 ...	−22 55 ...	0·31206 ...	0·113
,, 22 ...	20 58 39 ...	−22 36 ...	0·31480	
,, 24 ...	21 5 43 ...	−22 17 ...	0·31760 ...	0·108
,, 26 ...	21 12 44 ...	−21 57 ...	0·32044	
,, 28 ...	21 19 41 ...	−21 35 ...	0·32333 ...	0·103
,, 30 ...	21 26 35 ...	−21 13 ...	0·32626	
1905 Jan. 1 ...	21 33 24 ...	−20 50 ..	0·32924 ...	0·098

ENCKE'S COMET (1904 *b*).—An observation of Encke's comet was made by Herr van d Bilt at Utrecht on December 8. At 8h. 3m. 46s. (M.T. Utrecht) the position of the comet was

α (app.) = 20h. 46m. 22·11s., δ (app.) = +5° 12′ 29″·5,

and its magnitude was estimated as 7·5. This observation indicated that a correction of +41s., +1′·2 was necessary to the ephemeris published by Messrs. Kaminsky and Ocoulitsch in *Astronomische Nachrichten*, No. 3981 (*Astronomische Nachrichten*, No. 3985).

OBSERVATIONS OF OCCULTATIONS BY PLANETS.—Dr. T. J. J. See, writing to the *Astronomische Nachrichten* (No. 3984), explains the futility of making observations of occultations by planets for the purpose of determining the extent of the planetary atmospheres. He points out that the extent of the irradiation about a planet's disc, at night time, in every case exceeds the probable extent of the planet's atmosphere, so that the star is lost in the irradiation zone before the interposition of the atmosphere between it and the observer.

Thus observations of this character, made during the hours of darkness when the irradiation affects the observation, can never succeed in determining the amount of refraction suffered by the star light in passing through the planet's atmosphere, because the star is always hidden before it reaches even the outer limit of that atmosphere.

RELATIVE DRIFT OF THE HYADES STARS.—In a paper communicated to the British Astronomical Association Dr. Downing, F.R.S., discusses the resulting values obtained by Herr Weersma, and published in No. 13 of the Groningen Astronomical Laboratory *Publications*, in order to determine the relative drift of the sixty-six Hyades stars dealt with by the latter observer.

The results of the discussion show that these stars may be arranged in three chief groups as regards the amount and direction of their annual motion. The first group contains thirty-eight stars, including most of the bright ones except Aldebaran, having a mean motion of 0″·096 per year in the mean direction 106° from north towards east. In the second group Aldebaran and three faint stars are included, and the annual mean motion is as much as 0″·160 in the mean direction 160°. In both these groups the magnitudes are in no way related to the amounts of movement, some of the fainter stars, in fact, having a greater apparent motion than the brighter ones in the same group. The values for the third group are 0″·036 and 254° respectively, and it is reasonably conjectured that this group is at a greater distance from our system than the others (*Journal* British Astronomical Association, No. 1, vol. xv.).

DESIGNATIONS OF THE VARIABLE STARS DISCOVERED DURING 1904.—In No. 3984 of the *Astronomische Nachrichten* the Variable Star Commission of the Astronomischen Gesellschaft publish a catalogue of fifty-eight new variables, discovered by various observers during the present year. They give for each star the number by which it will in future be known, the temporary designation which this replaces, its coordinates and the amount of precession in each coordinate, for 1900, and the magnitude. The catalogue is followed by a detailed account of the discovery, variations, and general characteristics of each variable.

THE "COMPANION TO THE OBSERVATORY."—The 1905 edition of the well-known "Companion to the Observatory," published at 1s. 6d. by Messrs. Taylor and Francis, contains its usual complement of useful data for all kinds of astronomical observations. Ephemerides for the planets and their satellites, the Greenwich magnetic elements, the times of maxima and minima and the periods of numerous variable stars and data relating to a number of double stars are given amongst the mass of information contained.

As in previous years, Mr. Denning gives the dates and radiant points of the principal meteor showers and Mr. Maw has supplied the double-star tables, whilst the ephemerides of an ever-increasing number of variable stars have been taken from advance proofs generously contributed by M. Lœwy.

GLACIATION IN NORTH AMERICA.[1]

THIS volume, which has only recently reached us, is by no means of merely local interest. The first 226 pages form a treatise on glacial geology in general, and represent the author's views after some twelve years of study of drift deposits in the field. No one who examines plates i. to vi. can mistake the character of these deposits; these excellent photographic pictures would meet, indeed, with international acceptance. On p. 30 we have some suggestive figures given as to the area of existing glaciers, from which it appears that the whole drift-covered country in North America is only ten times as large as that still covered by ice in Greenland. The Antarctic ice-sheet, moreover, is as extensive as that postulated for North America in "Glacial" times, a fact that effectually "removes the element of incredibility which, at first thought, attaches to so striking a theory as that of the glacial origin of the drift." The northern ice, however, as Mr. Salisbury immediately points out, extended into temperate latitudes, and special explanations must thus be sought. New Jersey, we may observe, lies on the latitude of Lisbon and Sicily in the northern hemisphere, and corresponds with Cape Town and Melbourne in the southern and more glacial hemisphere. Mr. Salisbury at present seeks the cause of older widespread glaciations (p. 192) in Chamberlin's hypothesis of variations in the amount of carbon dioxide in the atmosphere. Elevation accelerates rock-decay, and this process promotes refrigeration by withdrawing carbon dioxide from the air. The possibility of variation in the constitution of the atmosphere, owing to the emanations of volcanoes, is also touched on as one of many other causes controlling the supply of carbon dioxide.

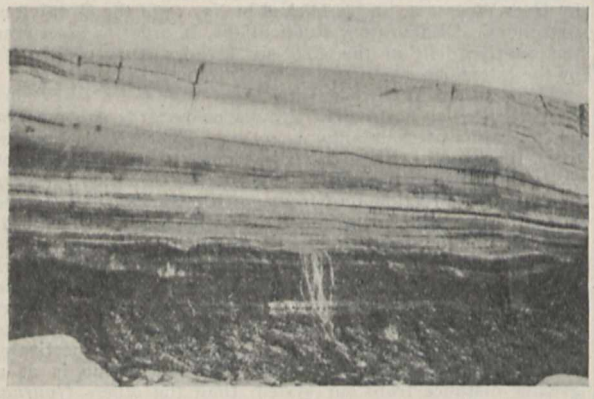

FIG. 1.—Side of a glacier in Greenland, showing the moraine-débris in the lower part, while the upper ice is almost free from it.

Plates xviii. and xix. are valuable for the comparison they afford between the landscapes formed by the uniform ice-cap of Greenland and the protrusion of peaks through a dwindling ice-area in the familiar scenes of Switzerland. Other interesting photographs from Greenland occur on plates xxv. and xxvi., and one of them is here reproduced (Fig. 1).

The general propositions stated by the author are illustrated by examples of moraine-material, striated surfaces, &c., from New Jersey, so that dwellers in that State may now acquire a new insight into the topographic features round them. Mr. Salisbury restricts the word *kame* to material washed out from and left against the irregular margin of a glacier (p. 116), while *eskers* represent the channels of subglacial streams. Seeing how these two terms have been interchanged, as the author's references show (p. 136), it might have been well to invent a new word for the special type of water-formed terminal moraine which the author describes here as a kame. Chapter v., on changes in drainage resulting from glaciation, contains a very suggestive study of the former glacial lakes in the flat basin west of Newark. The concluding 550 pages are concerned with "local details," the meaning of which becomes clear after so excellent an introduction. One of the most striking illustrations is that facing p. 537 (Fig. 2), where the "plucking" away of blocks along the joint-planes of a glaciated surface is clearly shown by the step-like structure and abrupt details of the lee side of a *roche moutonnée*. This term, by the by, does not seem to be defined in the earlier portion of the book.

FIG. 2.—Glaciated surface of "trap" at Weehawken, New Jersey.

In conclusion, we could wish that some "State Survey" would give us a similarly comprehensive memoir for the glacial provinces of the British Isles. G. A. J. C.

[1] "The Glacial Geology of New Jersey." By Rollin D. Salisbury. Vol. v. of the Final Report of the State Geologist. Pp. xxviii+802; plates and folding maps. (Trenton, N.J.: MacCrellish and Quigley, 1902.)

THE PEOPLE OF THE NORTH-EAST OF SCOTLAND.[1]

IT is to the credit of the Anatomical and Anthropological Society of the University of Aberdeen that it can issue *Proceedings* in a form far superior to those of the Anatomical Society of Great Britain and Ireland—the only other anatomical society in this country. Even in the contents of its *Proceedings* the younger society, founded and fostered by the professor of anatomy in the university, compares not unfavourably with the older society.

Naturally one turns first to those papers which deal with the people in the north-east of Scotland. By common repute they are a shrewd, "hard-headed" race. In a well written paper on the contents of short cists found in Aberdeenshire and neighbouring counties, Dr. Alexander Low tells all that can at present be known of their ancestors, the prehistoric inhabitants of this part. The picture drawn by Dr. Low is founded on the broken skeletons of eight men and

[1] *Proceedings* of the Anatomical and Anthropological Society of Aberdeen University, 1902–04. Pp. 155, 28 plates, 22 figs. in text. (Aberdeen: University Press, 1904.)

two women which, owing to the foresight of the late Prof. Struthers and of Prof. Reid, have been slowly accumulated and safely preserved in the anatomical museum of the university. These prehistoric Aberdonians were of low stature (5 feet 2 inches to 5 feet 4 inches), with rounded heads which measured in breadth from 82 per cent. to 85 per cent. of their length. One can see, by referring to "An Analysis of Anthropometric Statistics," a contribution made to this volume of the *Proceedings* by Mr. John Gray, that only about 12 per cent. of the present inhabitants of Aberdeenshire possess heads which, in the proportion of their diameters, resemble those of the prehistoric race. Further, it is evident that the present inhabitants of Aberdeenshire stand, as regards the diameter of the head—the only racial characteristic that can be dealt with—in an intermediate position between the long-headed highlanders of the west of Scotland and the short-headed prehistoric people of the east coast. The natural inference appears to be that the present race of the north-east of Scotland is the result of a fusion of the east and west types—but the west has exerted the stronger influence. One of the two female skulls described by Dr. Low is that of a woman who, in shape of head, belonged to the west rather than to the east type. She may have been an exceptional member of the "short-cyst" race, but it is more probable that she was a western woman captured by the eastern invaders. Those who seek to discover the factors which determine the shape of the head will find most valuable material in the fourteen plates contributed by Prof. Reid. They represent serial sections of the heads of two subjects which had been very successfully prepared.

In these *Proceedings* one can recognise the influence that the Anatomical Society exerts on the medical graduates of Aberdeen. A skeleton of a Chinese coolie sent from Singapore, a Boxer's skull brought from north China, five Wa Kamba skulls and ten Wasoga crania collected in Uganda, provide material for the junior members to examine and report on. A paper contributed by Dr. F. W. Moir contains the results of a prolonged study of the people of Ashanti. Is it not strange that the University of London, in the very centre of the Empire, offers no such stimulus to its medical graduates as is given in Aberdeen? When the board of studies for human anatomy and morphology was recently constituted in the University of London the study of human races was, for all practical purposes, completely excluded.

The eyesight of the people in the north-east of Scotland is remarkably good. Drs. Usher and Stoddart found, from the examination of 400 students, that 15 per cent. were myopic or short sighted; Fuchs found in Germany that 60 per cent. of students at a corresponding age were myopic; Norris and Oliver give 28 per cent. as the corresponding figure for American students. About three in every hundred of the Aberdeen school children are myopic; the proportion in Edinburgh is almost twice that number. Seven per cent. of the Aberdeen police are short-sighted.

In conclusion, it is to be hoped that the oblivion which so frequently overtakes the *Proceedings* of local societies, because of their inaccessibility to other workers, will spare the *Proceedings* of which this volume is but one of a series.

HYDROLOGY IN THE UNITED STATES.

THE Geological Survey Department of the United States embraces much wider duties than those covered by the similar department in this country, and the following notes upon some of the various matters with which it deals, and of the trouble taken to afford information as to the mineral resources and water supply of America, may be of interest.

The United States Geological Survey Department was created by an Act of Congress in 1879. From time to time its duties, as originally set out, have been considerably extended. For administrative purposes the survey is now divided into branches and divisions, comprising geology, topography, hydrography, with offices charged with administration and the publication of maps and reports.

The department of the Geological Survey has charge and classification of all public lands; the examination of the geological structure, mineral resources, and the products of the national domains; the survey of forest reserves and the preparation of topographic and geologic maps. The hydrographic and hydrological branch has charge of all investigations relating to the occurrence of water as a mineral and as a source of wealth to the country. It is engaged in making systematic measurements of the rivers and streams throughout the States, and of the flow of water and the supply available, whether for domestic use or as a source of power. It also, through the Reclamation Service, prepares plans for the construction of reservoirs, canals, and other works for the irrigation of arid lands, of which there are very large areas in America, and superintends the carrying out of works that have been decided on for reclamation.

To show the thorough way in which the work of the department is carried out and the pains taken to ensure efficiency, recently a conference was called by the chief engineer for the purpose of enabling the heads of the engineering staff of the Reclamation Service (twenty-five in number) to become acquainted with their work, and of exchanging views and information as to the works in hand and those planned for the future, and so secure uniformity of method in carrying out their work. At this conference an address was given by the chief engineer on the duties of the officers engaged in the work, and papers were read by the engineers having charge of the various works in execution. A record of these proceedings, with copies of the papers and other information, is given in one of the State papers issued by the department.[1]

Nearly two hundred engineers, hydrographers, and topographers are in the employ of the Reclamation Department alone, and comprehensive instructions are issued as to the management of the works, rates of pay for assistants and workmen, and other matters. One condition laid down by the State is that in all constructive work eight hours shall constitute a day's work for all labourers and mechanics.

For the use of the staff engaged in the hydrological department a manual[2] has been issued containing instructions as to the proper method of taking observations and the best form of float and current meters to be used under different conditions, with illustrations of the different kinds of meters in use and the method of using the same from bridge, cable, and boat stations; forms of reports, diagrams of discharge and current observations; with formulæ and tables to be used in computations.

From time to time the reports sent in by the staff as to the results of the various surveys and works going on are issued by the department, some of which, relating to water supply and irrigation, the relation of rainfall to run off and the floods in the Mississippi, have been noticed in NATURE of January 7, July 28, and November 3, the last reports, Nos. 89, 90, 91, being on the water resources of the Salinas Valley, the geology and water resources of the lower James River Valley, and on the natural features and economic development of drainage areas in Ohio.[3]

1 "Proceedings of the First Conference of Engineers of the Reclamation Service, with accompanying Papers." Compiled by F. H. Newell. Water Supply and Irrigation Paper, No. 93. (Washington: Government Printing Office, 1904.)

2 "Hydrographic Manual of the U.S. Geological Survey." Water Supply Papers, No. 94.

3 "On Destructive Floods in the United States in 1903"; "On the Progress of Stream Measurements for 1903"; "Underground Waters in Southern Louisiana"; "Contributions to the Hydrology of the Eastern United States in 1903"; "The Underground Waters of Arizona."

"Water Resources of the Salinas Valley, California." Paper No. 89.

"Geology and Water Resources of the Lower James River Valley." Water Supply and Irrigation Paper, No. 90.

"The Natural Features and Economic Development of the Sandusky, Maumee, Muskingum, and Miami Drainage Areas in Ohio." Water Supply and Irrigation Paper, No. 91.

"Destructive Floods in the United States in 1903." By E. C. Murphy Paper No. 96.

"Report on the Progress of Stream Measurements for the Calendar Year 1903." By J. C. Hayt. Paper No. 97.

"Report on the Progress of Stream Measurements for the Calendar Year 1903." By J. C. Hayt. Paper No. 98.

"Underground Waters of Southern Louisiana." By G. D. Harris. Paper No. 101.

"Contributions to the Hydrology of Eastern United States." By M. L. Fuller. Paper No. 102.

"The Underground Waters of Gila Valley, Arizona." By W. T. Lee. Paper No. 104. (Washington: Government Printing Office, 1904.)

A BIBLIOGRAPHY OF AGRICULTURAL SCIENCE.[1]

THE yearly increasing output of scientific workers, like the fleas that have "lesser fleas to bite 'em," has called into being another class of workers who have to abstract the papers into Jahresberichte, Centralblatter, records, and the like, the next step in the *ad infinitum* process being represented by the indexes which appear every decade or so to the abstracts themselves. By no other means would the investigator be able to "read up the literature" before attacking a new problem, and though there may be two opinions as to the wisdom of so doing, there can be none as to the desirability of having the power if need be. The present volume consists of a subject index to the first twelve volumes of the *Experiment Station Record*, the well known series of abstracts of both American and European papers in agricultural science which is issued monthly by the United States Department of Agriculture, and distributed so liberally to all foreign workers. The *Experiment Station Record* is, indeed, something more than a journal of abstracts; it contains from time to time special articles resuming the current state of knowledge about particular subjects, and written by some acknowledged expert; for example, in this index we find mentioned special articles by Kühn, Stohmann, Kellner, Zuntz, and Hagemann on nutrition investigations alone.

The abstracts proper in the *Experiment Station Record* are generally very full; like all abstracts, they vary much in value, but generally they fulfil their real purpose of telling one whether it is worth while to read the original paper or not. Naturally, with a subject like agriculture, touching on so many sciences, the abstracts cover a very wide field; chemistry, botany, zoology, geology, all have their special journals which must be looked through lest any article bearing on agriculture escape; meteorology, bacteriology, veterinary science, horticulture also contribute, in addition to the great volume of journals in every country which are devoted solely to agricultural topics. The present index only adds to the debt of gratitude which all British workers in this field have long owed to the United States Department of Agriculture; in fact, if one wants to find the reference to some English experiment, by far the best if not the only way of tracing it is to hunt up its abstract in the *Experiment Station Record*. Such a pursuit will now be greatly facilitated by the present general index, which represents a putting together of the very full indexes to each of the annual volumes. A further feature of value is a complete list of *Bulletins* issued by the various divisions of the U.S. Department of Agriculture, with references to the abstracts in the *Record*. When we add that the department has also published card indexes to the more important foreign agricultural publications, as, for example, to the well known *Landw. Versuchsstationen*, we get a further idea of the completeness with which the United States Department of Agriculture is pursuing its self-imposed task of bibliography.

[1] "General Index to Experiment Station Record." Vols. i. to xii., 1889–1901. Pp. 671. U.S. Department of Agriculture. (Washington, 1903.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AT the Darmstadt Technical College Mr. Clarence Feldmann has been appointed professor of electrotechnics.

PROF. W. NERNST, director of the departments of physical chemistry and electrochemistry at Göttingen, has accepted the chair at Berlin previously occupied by Prof. Landolt.

PROF. ARRHENIUS has declined the appointment offered him at Berlin, the Swedish Academy of Sciences having founded a Nobel Institute of Physical Chemistry with Prof. Arrhenius as director.

DUBLIN University has conferred the degrees of Master in Surgery and Doctor in Medicine *honoris causa* on Sir Frederick Treves, C.B., and the degree of Doctor in Science *honoris causa* on Major Ronald Ross, C.B., F.R.S.

DR. E. W. SKEATS, demonstrator in geology at the Royal College of Science, has been appointed to the chair of geology and mineralogy in the University of Melbourne in succession to Prof. J. W. Gregory, F.R.S., now professor of geology at Glasgow University.

CHAIRS for research and teaching in protozoology and in helminthology are about to be established at the London School of Tropical Medicine, the funds being provided by certain colonial Governments. The importance of these branches of research in tropical medicine is unquestionable, and it is gratifying to know that this is appreciated by the Governments which have thus assisted the study of the subjects.

DR. JOLY has been appointed ordinary professor of mathematics at Lausanne; Dr. Heinrich Liebmann, hitherto recognised teacher in mathematics, has been appointed assistant professor of philosophy at Leipzig; Dr. Roland Scholl, assistant professor of chemistry at the technical college, Carlsruhe; Dr. Arthur Wehnelt assistant professor of theoretical and applied physics at Erlangen; Dr. Georg Edler von Georgievics, hitherto professor of chemical technology at Bielitz, is to succeed Prof. Karl Zulkowski at the German Technical College at Prague.

THE annual conference of teachers, arranged by the London County Council, will be held on January 5–7 next at the Medical Examination Hall, Victoria Embankment. At the first meeting, addresses on the teaching of arithmetic will be given by Mr. C. T. Millis and Mr. S. O. Andrew, and the discussion will be opened by Mr. A. W. Siddons. Other subjects to be brought forward at subsequent meetings are:—the psychology of dictation, the teaching of reading, art teaching in Japan, the influence on handicraft of art teaching in elementary and secondary schools, the art training of the artisan, and true and false applications of Froebel's principles.

THE promoters of the movement for providing the University College of North Wales with new buildings on the site presented by the Corporation of Bangor have within the last few days been greatly encouraged in the task by an announcement that Mr. Owen Owen will contribute 1000*l.* to the building fund. This donation, taken in conjunction with the recent bequest to the college by the late Dr. Isaac Roberts of the sum which is expected to reach about 15,000*l.*, and by the late Mr. John Hughes, of Liverpool, and Mr. Richard Hughes, of Llanfwrog, Anglesey, of 5000*l.* and 1500*l.* respectively for the purpose of establishing scholarships, affords a welcome indication of the interest which is now being taken in the fortunes of the college by Welshmen having the like means and wish to benefit the cause of higher education.

AT a recent meeting with reference to Swanley Horticultural College, presided over by Lady Brassey, Mr. J. C. Medd urged the claims of the college to recognition by the Board of Agriculture, and showed how the institution now fulfilled the conditions which it ought to do, if it were to expect an annual grant from that Government department. He also alluded to the nature-study course for teachers which was held at Swanley during the summer holidays. Sir John Cockburn pointed out that all educational establishments that did their duty were in need of funds, and that Swanley College was no exception. Mr. Buckmaster, chief inspector to the Board of Education, spoke of the efficiency of Swanley College at the present time, and thought that all energy should be directed towards maintaining and improving the position which Swanley had attained rather than to inaugurating similar undertakings.

ADDRESSING the boys at St. Clement Danes' Holborn Estate Grammar School on Monday, Lord Alverstone remarked that it was the knowledge acquired in youth which lasted longest. The effort to retain impressions in later life was in marked contrast to that made when the brain was younger. Modern languages, therefore, should be earnestly and carefully studied at school. He was glad to see a considerable number of pupils had gained honours in English literature. In the hurry and race of modern life there was a tendency to advocate education which would be of immediate assistance to professional life; but he was strongly of opinion that up to the age of sixteen or seventeen a boy's education should be general, and the temptation to specialise too much should be resisted. A boy would be a better student and would make a better man.

of the world if up to seventeen he received a liberal education rather than one directed to any special object. Most educationists would agree with Lord Alverstone in his objection to specialisation at school; but in connection with this subject it is pertinent to ask whether the study of Greek is not specialisation to a boy who is taught English and Latin properly.

AT the annual speech day of Scarborough Municipal School on Tuesday, the Right Hon. A. H. Dyke Acland, chairman of the governing body of the school, remarked that if he were asked what the secondary schools of the country needed most he would say more money, fewer examinations, and a more effective instruction in English language and literature. They wanted the means which would enable them to try to follow the example of other countries in the matter of secondary education. The culprit in this case was not the Board of Education but the Treasury. If it had to put down ten millions for elementary education it tried to take it out of secondary education, and at this present moment of our country's history there was nothing which needed more assistance than secondary education. With regard to examinations, Mr. Acland strongly contended that the old system of paper examinations was not a true test of the efficiency of a school, and was often altogether deceptive. The true test was when half a dozen inspectors spent four days and watched the work of the pupils, as was done at Scarborough. In America there were almost no examinations, and in Germany the ordinary paper examination of which we thought so much was unknown.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, October 27.—"Some Physical Characters of the Sodium Borates, with a New and Rapid Method for the Determination of Melting Points." By C. H. **Burgess** and A. **Holt**, jun.

The glasses obtained by fusing sodium carbonate with boric anhydride can be transformed either wholly or in part on prolonged heating into stable, crystalline varieties, which invariably melt at higher temperatures than the glasses from which they were derived.

A study of the melting points of the crystalline and vitreous forms of mixtures of different compositions leads to the conclusion that only two sodium borates can be obtained by fusion—$Na_2O.4B_2O_3$ and $Na_2O.B_2O_3$.

The addition of Na_2O to boric anhydride produces in the first place a solution of the borate $Na_2O.4B_2O_3$ in boric anhydride. This then becomes supersaturated, and the borate in excess separates on heating for some time. The amount which separates continues to increase until the mixture has the composition of nearly pure $Na_2O.4B_2O_3$, when complete crystallisation occurs. Between this point and the compound $Na_2O.B_2O_3$, the crystalline forms appear to be solid solutions of the two above mentioned borates, anhydrous borax itself being almost the eutectic point. In mixtures containing more sodium than $Na_2O.B_2O_3$, the crystals seem to be solid solutions of this compound with sodium carbonate. The glasses appear to be the superfused and metastable forms of the crystals.

Analyses of glasses and crystals of various composition confirm the observations derived from the melting points. The melting point method employed consisted essentially of a platinum wire which was heated electrically, to which a small bead of the substance under investigation was hung. A light weight was attached to the bead. When the wire was heated to the melting point of the substance the bead and weight fell off. The resistance of the wire was determined at this moment, and thence the temperature. The method proved good for substances like glass, which have hitherto not been supposed to melt at any definite temperature.

November 17.—"On the Group IV. Lines of Silicium." By Sir Norman **Lockyer**, K.C.B., LL.D., Sc.D., F.R.S., and F. E. **Baxandall**, A.R.C.Sc.

In previous communications to the Royal Society an account has been given of the behaviour of the lines of silicium under varying experimental conditions, and as a result of the inquiry the lines were divided into four distinctive groups. The genuineness of the lines of group iv., as silicium lines, has recently been questioned by M. de Gramont, of Paris. He concludes that, as the lines of group iv. always disappear from his spectra with the air lines, they are really due to oxygen or nitrogen. This is so much at variance with the Kensington conclusions that it has been considered necessary to give, in the present paper, the photographic evidence on which those conclusions were based. Reproductions of photographs of silicium spectra under various electrical conditions are given, and from the behaviour of the Si iv. lines in the different photographs it is claimed that they cannot be due to anything other than silicium.

In the vacuum-tube spectrum of SiF_4 the Si iv. lines are seen to be stronger than even the strongest of Neovius's air lines, which appear in the same spectrum.

In one of the reproductions, the spark spectrum of sodium-silico-fluoride, volatilised between platinum poles, is compared with the spark spectrum of air, also made incandescent between platinum poles. In each spectrum the ordinary lines of nitrogen and oxygen are well seen. The silicium lines in question are shown in the former spectrum, but have no corresponding lines in the air spectrum. It is also mentioned that these lines do not occur in the Kensington spark spectrum of any element other than silicium.

There are, according to Neovius, very weak lines of oxygen or nitrogen near the positions of the silicium lines (4089·1 and 4116·4). These faint air lines are possibly the lines which Gramont gets in his spectra, but from the evidence adduced in the present paper they are not the lines which appear so strongly in the Kensington silicium spectra.

In another reproduction the SiF_4 spectrum is given alongside that of ϵ Orionis, and the identity of position of the Si iv. lines and strong lines in the stellar spectrum is shown.

Linnean Society, December 1.—Prof. W. A. Herdman, F.R.S., president, in the chair.—Proteid digestion in animals and plants: Prof. S. H. **Vines**, F.R.S. In this discourse Prof. Vines first remarked that the foundation of our knowledge of gastric digestion in animals was laid by van Helmont so long ago as early in the seventeenth century ("Ortus Medicinæ," 1648), who held that it was effected by an "acid ferment." But in spite of continued research by Réaumur, Stevens, Spallanzani and others, it was not until two hundred years later that the ferment was actually detected. This important discovery was made in 1836 by the celebrated Schwann, who gave to the ferment the name "pepsin." In the course of subsequent investigation, it came to be recognised that the digestion of the food is not by any means completed in the stomach, but that the greater part of the digestive process is carried on in the small intestine (duodenum) by the pancreatic secretion. Claude Bernard ascertained in 1856 that the pancreatic juice contains a ferment that digests proteids; to this ferment the name "trypsin" was given by Kühne in 1876. These two were the only proteases known until quite recently (1901) a new protease, termed "erepsin" by Cohnheim, its discoverer, was added to the list. Like trypsin, this protease peptolyses peptones, and is active in alkaline liquids; but its peptonising power is much less marked, as it is without action on albumin and fibrin, though it can peptonise casein. The discovery of erepsin suggested the possibility that trypsin might be, not a single enzyme, as had hitherto been thought, but a mixture of enzymes, possibly of peptonising with peptolysing enzymes. Research in this direction has, in the hands of Dr. Vernon, already (1903) shown that what is generally known as trypsin is a mixture of erepsin (pancreato-erepsin) with what may be termed trypsin proper. It is not inconceivable that analysis may be carried still further, and that trypsin proper may itself be found to be a mixture of a peptonising with a peptolysing enzyme. Prof. Vines next turned to proteid-digestion in plants. His own contribution, made within the last three years, consists of a number of observations on many different plants or parts of plants, showing that a protease of some kind is probably to be found in all parts of all plants at one stage or other of their development. It appears that whilst all plants that have been investigated can effect peptolysis,

only a limited number have been found capable of digesting fibrin. Prof. Vines has ascertained that in certain cases (yeast, mushroom) the tissues contain a mixture of erepsin with a fibrin-digesting enzyme, a result which finds its analogue in Vernon's researches on pancreatic trypsin.

Entomological Society, December 7.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Mr. H. St. J. **Donisthorpe** exhibited *Quedius nigrocoeruleus*, taken by Mr. H. C. Dollman in a rabbit-hole at Ditchling, Sussex, this being the fourth recorded British specimen.—Prof. T. Hudson **Beare** exhibited a specimen of the rare Longicorn *Tetropium castaneum*, taken about two years ago in the vicinity of the quays at Hartlepool, and probably introduced from abroad.—Mr. G. J. **Arrow** exhibited a series of the Lamellicorn beetles from the Burchell collection, and remarked that Burchell had at the time of their capture, some seventy years ago, already noted their powers of producing musical sound.—Mr. C. O. **Waterhouse** exhibited drawings illustrating the development of the front wing in the pupa of the Tusser silk moth, showing the relation of the tracheæ to the veins, prepared for exhibition in the Natural History Museum. He also exhibited some coffee berries from Uganda injured by a small beetle belonging to the Scolytidiæ, and two coleopterous larvæ from the Burchell collection from Brazil, submitted to him for determination by Prof. Poulton. One was a heteromerous larva two inches long, much resembling the larva of Helops. The more interesting one was noted by Burchell to be luminous, and appeared to be the larva of an Elaterid.—Mr. J. J. **Walker** exhibited the type-specimen of *Haplothorax burchelli*, G. R. Waterhouse, from the Hope collection, a remarkable Carabid discovered by Burchell in St. Helena. It is now exceedingly rare, if not entirely extinct, in its sole locality, the late Mr. Wollaston, during his visit to the island in 1875–6, having entirely failed to find the beetle alive, though its dead and mutilated remains were often met with.—The **President** exhibited cases showing the results of breeding experiments upon *Papilio cenea* conducted by Mr. G. F. Leigh, who had for the first time bred the *trophonius* form from *trophonius* itself. He also exhibited a photograph, taken by Mr. Alfred Robinson, of the Oxford University Museum, showing the Xylocopid model and its Asilid mimic, exhibited by Mr. E. E. Green at a recent meeting. The example was particularly interesting, inasmuch as Mr. Green's record of the mimic circling round its model tended to support the view that the bee is the prey of the fly.—*Erebia palarica*, n.sp., and *Erebia stygne*, chiefly in regard to its association with *E. evias*, in Spain: Dr. T. A. **Chapman.** The author described *Erebia palarica*, a new species from the Cantabrian range; he said it was phylogenetically a recent offshoot of *E. stygne*, and the largest and most brilliant in colouring of all the known members of the family.—Entomological experiences during a tour through India and Ceylon, October 10, 1903, to March 26, 1904: Dr. G. B. **Longstaff.**

Geological Society, December 7.—Dr. J. E. Marr, F.R.S., president, in the chair.—The chemical and mineralogical evidence as to the origin of the dolomites of southern Tyrol: Prof. E. W. **Skeats.** Recent work on modern coral-reefs has shown that these limestones contain very little, if any, insoluble residue. The study of the relative proportions of the organisms composing these reefs, and the alterations that they undergo, has further shown that corals play a subordinate part in them, and that calcareous algæ, foraminifera, and other organisms form the bulk of the rocks of the reefs. The author has applied this information in the examination of collections from the much debated area of the dolomites of southern Tyrol. The chemical examination of numerous specimens from the Schlern dolomites of the Schlern, the Langkofl, the Marmolata, the Sella, the St. Cassian district, the Richthofen Reef, and numerous other localities is described, so far as relates to the proportions of lime and magnesia and of insoluble residue. These results are compared with similar analyses of limestones from lower and higher horizons.

Physical Society, December 8.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—On a rapid method of approximate harmonic analysis: Prof. S. P. **Thompson.** For the study of alternating electric currents and for several other applications, harmonic analysis is simplified by the consideration that all the even terms in the Fourier expansion are absent. In this case the second half-period is similar to the first half-period, but with the ordinates of the corresponding angles reversed in sign. Given a complicated harmonic curve containing constituents of the odd orders only, the zero-line can always be drawn so that the constant term vanishes from the Fourier series, the mean ordinate being zero; and it is then always possible to choose as origin a point for which the ordinates at 0° and 180° are zero. The paper gives a *résumé* of the various methods which have been employed for harmonic analysis by reduction from simultaneous equations, graphical means, and by harmonic analysers. The method adopted by the author is a simplification of a general method of analysis published by Prof. Runge.—A high frequency alternator: W. **Duddell.** The author described and showed in action a high-frequency alternator which he had constructed in 1900 for some experiments on the resistance of the electric arc, and with which frequencies up to 120,000 ~ per second had been obtained. An illustration will perhaps convey some idea of how high a frequency of 120,000 ~ per second really is. In plotting curves for ordinary frequencies of 50 to 100 ~ per second, a scale often adopted is 10 inches for 100 ~. If it were attempted to plot a curve up to 120,000 ~ per second to this scale, the curve paper would require to be 12,000 inches, or nearly *one-fifth of a mile long*.—Exhibition of experiments to show the retardation of the signalling current on 3500 miles of the Pacific cable between Vancouver and Fanning Island: Prof. W. E. **Ayrton.** The experiments were performed upon a cable electrically equivalent to the portion of the Pacific cable between Vancouver and Fanning Island, the product of the capacity (in mfds.) and the resistance (in ohms) being nine millions. Three dead-beat galvanometers were employed to indicate the current at the beginning, in the middle, and at the end of the cable. It was shown that upon applying an E.M.F. at one end of the cable the current at that end was enormously greater than its steady value, and that one-fifth of a second elapsed before any indications of current were shown at the far end of the cable. By that time the current at the sending end was 3·7 times its steady value, and after two-fifths of a second it had fallen to 2·3 times its steady value. In about five seconds the current became steady.

Royal Astronomical Society, December 9.—Prof. H. H. Turner in the chair.—On a very sensitive method of determining the irregularities of a pivot, and on the influence of the pivot errors of the Radcliffe transit circle upon the right ascensions of the Radcliffe catalogue: Dr. **Rambaut.** The method is a modification of that of M. Hamy, a small steel pin being inserted in each pivot; by means of a lever arrangement horizontal as well as vertical displacements, due to pivot irregularities, can be observed. The apparatus, which had been found entirely satisfactory, was fully described and illustrated.—On the validity of meteor radiants as determined from three observed tracks: Mr. **Chapman.** —A note accompanying a photograph of the detached nebula in Cygnus: W. S. **Franks.** The nebula was the one recently photographed by Dr. Max Wolf; the present plate, taken with the late Dr. Isaac Roberts's 20-inch reflector, showed the details of the nebula on a larger scale. A second note by Mr. Franks upon dark nebulosities was also read; it was illustrated by four photographs of long lenticular nebulæ, each of which was sharply divided longitudinally throughout its entire length by a dark line. The author suggested that these nebulæ, probably spirals seen edgeways, were cooler at their extreme edges, and that this band of cooler matter absorbed their light and caused the appearance of the dark bands seen in the photographs.—Two papers on the lunar theory, one being a note on the completion of the solution of the main problem: Prof. Ernest W. **Brown.**—An analysis of 145 terms in the moon's longitude: P. H. **Cowell.**—On the decline in the magnitude of the variable 159, 1904 Pegasi: Mr. **Wickham.**

Zoological Society, December 13.—Mr. Herbert Druce, vice-president, in the chair.—Some specimens of a gazelle from Palestine: a new species: Oldfield **Thomas**, F.R.S. —The anthropoid apes, illustrated by a large collection of mounted skins, skeletons, and skulls: the Hon. Walter

Rothschild. The gorilla from South Cameroon and the white-faced chimpanzee of the Gaboon were characterised as new.—The cranial osteology of the clupeoid fishes: Dr. W. G. **Ridewood.**—Characters and synonymy of the British species of sponges of the genus Leucosolenia: Prof. E. A. **Minchin.**—Descriptions of eighteen species of land-shells belonging to the genus Macrochlamys and its allies: Dr. W. T. **Blanford,** F.R.S.—Descriptions of a new genus and thirty-two new species of phytophagous Coleoptera of the family Halticidæ from South and Central America: M. **Jacoby.**

CAMBRIDGE

Philosophical Society, November 28.—Prof. Marshall Ward, president, in the chair.—Remarks on Piroplasmosis with exhibition of specimens: G. H. F. **Nuttall.**—Note on some peculiar features in seedlings of Peperomia: A. W. **Hill.** The seedlings of *Peperomia umbilicata* were found in the Andes of Bolivia at about 13,500 feet above sea-level. The species is a geophilous one with small bulbs and peltate leaves. The peculiarity of the seedlings lies in the fact that, though they are dicotyledonous in structure, only one of the two cotyledons leaves the seed to function as an assimilating organ; the other remains permanently in the seed as an absorbent organ. The other bulbous species from the Andes apparently show the same features of germination, and several other species from Central America, preserved in the herbaria of Kew and South Kensington, whilst differing in their vegetative habits, show a similar type of germination.—Exhibition of new and rare Arachnids taken near Cambridge: C. **Warburton** and N. D. F. **Pearce.**—The inheritance of tortoiseshell and related colours in cats: L. **Doncaster.** Tortoiseshell cats are heterozygotes, containing the two colours black and orange. They can be produced by mating orange with black, but a tortoiseshell paired with either orange or black may throw all three colours. Male tortoiseshells are exceedingly rare, and the normal colour of the black-orange heterozygote in the male is orange, the black in this case being completely recessive. When a male tortoiseshell is paired with a female, all three colours may be produced in the kittens. Cream and blue are dilute forms of orange and black, and behave similarly when crossed, the females being "blue tortoiseshells," the males creams. Creams may be obtained by pairing blue with orange, the dilution being transferred from one colour to the other. Blue is recessive to black, and so probably is cream to orange; it appears also that blue may be completely recessive to orange in the female, although black by orange in the female gives tortoiseshell.

MANCHESTER.

Literary and Philosophical Society, November 29.—Prof. W. Boyd Dawkins, F.R.S., president, in the chair.—Determination of wave-lengths in the extreme ultra-violet part of the spectrum: H. **Morris-Airey.** After a brief historical sketch of the work of earlier investigators, the classical experiments of Schumann were described. Schumann was not able to measure the wave-lengths of the new lines beyond 185$\mu\mu$, which he photographed, on account of our defective knowledge of the dispersion of the material of which his prism was constructed. The author attempted to do this by producing the spectra by means of a concave grating *in vacuo,* but without success. However, using a plane transmission grating ruled on a plate of white fluor-spar, to resolve the light from a powerful induction coil discharge between aluminium electrodes four new standard wave-lengths were measured extending to the wave-length 169$\mu\mu$. The experiments were carried out, after Schumann, *in vacuo,* and the spectra recorded on photographic plates specially designed for the work.

PARIS.

Academy of Sciences, December 12.—M. Mascart in the chair.—Remarks on some thermochemical rules relating to the possibility and the prediction of chemical reactions: M. **Berthelot.** The author discusses the statement that a chemical reaction must always be accompanied with an evolution of heat, and refers to his earlier works to show the exact meaning to be attributed to the words chemical reaction.—The determination of the difference in longitude between Greenwich and Paris made in 1902: M. **Lœwy.** A detailed account is given of the precautions necessary for the accurate determination of this constant. Particular care was given to the study of the personal equation of each observer, and to reduce still further the errors due to this source, the English and French observers changed stations. The mean result obtained by the latter for the difference of longitude between Paris and Greenwich was 9m. 20·974s.—On the element Z_δ: Lecoq **de Boisbaudran.** In discussing the presence of a band $\lambda=488$, M. Urbain regards the existence of a new element corresponding to this band as hypothetical. The author gives reasons for his statement that this band is really due to a new element, and maintains the accuracy of his work published in 1895.—Observations of the sun made at the Observatory of Lyons with the 16 cm. Brunner equatorial during the third quarter of 1904: L. **Guillaume.** The results are summarised in three tables giving the numbers of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—On the approximation of incommensurables and of trigonometric series: M. **Fatou.**—On continuous space groups, finite and infinite: M. **Le Vavasseur.**—Remarks on a method for the study of the convergence of certain continuous fractions: H. **Padé.**—The detonation of explosive substances under water: M. **Jacob.**—An electrically driven nickel-steel pendulum: Jean **Mascart.** A preliminary account of the results obtained with a pendulum of invar, driven by the electrical arrangement devised by M. Lippmann. Its rate was about two seconds per day. The author regards it as preferable to use several pendulums of this kind, which can be set up with ease, to attempt an absolute compensation.—On the registration of the *n*-rays by photography: G. **Weiss** and L. **Bull.** A description of the arrangement adopted is given in detail, the object being to produce three squares in contact with each other, the centre one corresponding to the effect produced by the phosphorescent surface when not exposed to the rays. The two outer squares should have been darker if an increase of the light intensity had been produced under the action of the rays. The experiment was repeated a great number of times, varying the nature of the plates, the time of exposure, and the intensity of lighting. The shortest exposure was twenty seconds, and the longest five minutes. In no case was a positive result obtained, there being no difference between the intensity of the squares corresponding to the time of action of the rays.—On some new derivatives of tetrahydrobenzene: Léon **Brunel.** By the simultaneous action of iodine (in the presence of mercury oxide) and acetic anhydride upon tetrahydrobenzene an iodoacetate is formed, $CH_3.CO_2.C_6H_{10}I$.—The synthesis and study of cyclic substituted thio-hydantoins: Emm. **Pozzi-Escot.** The method of preparation adopted consisted in acting upon the *a-b*-disubstituted thio-ureas with a monoalkyl fatty acid.—On the possibility of producing a non-brittle steel, tempered blue: Ch. **Frémont.** It is generally supposed that all irons and steels, whatever their quality, become brittle under shock at temperatures between 200° C. and 450° C. An example is given showing that this is not necessarily the case.—On a method of decomposition of complex statistical curves into irreducible curves: Charles **Henry.**—On the accessory glands of the larvæ of the Lepidoptera: L. **Bordas.**—The development of the tentacles of the Campanulariidæ and the Plumulariidæ: Armand **Billard.**—The resistance to desiccation of some fungi: Mme. Z. **Gatin-Gruzewska.** It has been found that certain fungi, including three species of Polyporus, are not killed by a prolonged drying at 37° C., as the dried fungi, when moistened, possess the same respiratory coefficient as the undried plant. The amount of carbon dioxide given off per hour is, however, less in the former case than in the latter.—On the constitution of arable earth: A. **Delage** and H. **Lagatu.** By the application of the methods of petrography to the smallest particles of arable earth, the authors come to the conclusion that instead of the earth being, as is usually represented in classical works on the subject, the result of a disaggregation followed by a decomposition of the mineral constituents of rocks, it simply consists of the various minerals of the rocks from which it is derived in a very fine state of division. The mica, quartz, felspar, calcite, tourmaline, apatite, &c., are per-

fectly normal, and show no signs of decomposition or of localised corrosion. The advantages of this method of examining arable earths, when used to supplement the results of a chemical examination, are pointed out.—On a new potato suitable for cultivation in damp soils: M. **Labergerie.** *Solanum Commersoni*, which up to the present has been regarded as only good for forage, has been found to give an excellent edible tuber, and it possesses the great advantage of preferring a damp soil for its growth.—On the gasification of vegetable combustibles and the generation of an economical motive power in agriculture: L. **Bordenave.** An account of the production of gaseous fuel from agricultural refuse, used in conjunction with a gas engine designed for gas of low calorific value.—The Coal-measures in French Lorraine: Francis **Laur.** The views of the author regarding the prolongation of the Saarbruck basin into France, following an axial line Neukirchen-Pont-à-Mousson, have been confirmed by two borings 700 metres deep. Further borings are in progress for the thorough exploration of the coal field. The coal contains 2 per cent. of moisture, 36 per cent. of volatile matter, 49 per cent. of coke, and 13 per cent. of ash.—Glacial growth at the end of the nineteenth century, and the different factors which have determined the anomalies of this growth in the massif of Pelvoux: Ch. **Jacob** and G. **Flusin.** The observations put forward furnish an explanation of the anomalies of glacier growth in this region indicated in 1900 by Kilian.—On subterranean corrosion at Wells (England), and the chronometry of subterranean erosion: E. A. **Martel.**

NEW SOUTH WALES.

Linnean Society, October 26.—Dr. T. Storie Dixson, president, in the chair.—Notes on Australian Lycænidæ, part iv.: G. A. **Waterhouse** and R. E. **Turner.**—Revisional notes on Australian Carabidæ, part i., tribes Carabini, Pamborini, Pseudozænini, Clivinini, and the genus Nebriosoma: T. G. **Sloane.**—Notes on the native flora of New South Wales, part ii.: R. H. **Cambage.** The route traversed—Boggabri to Tingha, *via* Narrabri, Moree, Warialda, and Inverell—offers sufficient variations in altitude and geological formation (including portion of the black soil plains) to provide interesting examples of the results traceable to these factors in the distribution of species under Australian conditions. Thus the effect of climatic influence is exhibited by such species as *Eucalyptus sideroxylon* (ironbark or mugga), *E. conica* (a box-tree), and *E. melanophloia* (silver-leaved ironbark), which in the south grow at lower elevations than is the case towards the north, where they are able to ascend the mountains owing to the warmth of northern latitudes being tempered by the increased elevation. The same influence also allows certain eastern and western species to mingle on the northern highlands, while in the south the Great Dividing Range serves as a cold barrier to keep them apart. As an instance of the influence of geological formation, the case of a sandstone area between Boggabri and Narrabri was mentioned; here *Angophora lanceolata* is a conspicuous feature of the flora.—Notes from the Botanic Gardens, Sydney, No. 10: J. H. **Maiden** and E. **Betche.**—Miscellaneous notes (chiefly taxonomic) on Eucalyptus, part i.: J. H. **Maiden.** The author deals with some plants formerly included under *E. amygdalina*, Labill. The confusion which has gathered around *E. radiata*, Hook. f. (non Sieb.), is finally cleared up. That "white gum" included under *radiata* by Bentham and others is described as a new variety or species under the name *E. numerosa*, from the number of fruits in an umbel.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part v. for 1904, contains the following memoirs communicated to the society:—

July 23.—A. **Sommerfeld**: Contributions to the theory of electrons; (2) bases of a general dynamic of the electron. G. v. d. **Borne**: Seismic records in Göttingen, July–December, 1903. W. **Voigt**: The action of electric vibrations upon optically active bodies. M. **Laue**: On the propagation of radiation in dispersive and absorptive media.

September 10.—J. **Thomae**: On a Gaussian series in various parts of its region of convergence.

INDIA.

Asiatic Society of Bengal, November 2.—Some archæological remains in Bishnath: W. N. **Edwards.** The old earthworks round Bishnath and Pertabghur are described, as well as the Buroi Fortification.—Noviciæ Indicæ, xxiii., four orchids new to the Indian flora: D. **Prain.** Descriptions of two new species, *Microstylis Cardoni* from Chota Nagpur, and *Eulophia Campbellii* from Manbhum and Singbhum; and also of *Lecanorchis japonica*, Bl., and *L. malaccensis*, Ridl., orchids now first added to the Indian flora.—Noviciæ Indicæ, xxiv., some new Indian plants: D. **Prain.** Some notes on species of the orders Anonaceæ, Sterculiaceæ, Celastraceæ, Leguminosæ, Rosaceæ, Combretaceæ, Orobanchaceæ, Labiatæ, and Monotropeæ, together with descriptions of new species.—A language map of west Tibet with notes: A. H. **Francke.** The distribution is given of the Rong, Leth, Sham, Purig, and Balti dialects in the Indus and Shayog valleys, and in Zangskhar and Rubshu.—Additions to the collection of oriental snakes in the Indian Museum, Calcutta: Nelson **Annandale.** A paper adding to our knowledge of the distribution of Typhlopidæ, Uropeltidæ, Colubridæ, and Viperidæ in India.—On *Dioscorea deltoidea*, Wall., *D. quinqueloba*, Thunb., and their allies: D. **Prain** and I. H. **Burkill.**

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