THURSDAY, JUNE 4, 1914.

MEDIEVAL TECHNOLOGY.

The Art of Dying. In two parts. Pp. 356. (Stratford-on-Avon: The Tapestry Studio, n.d.) Price 3*s.* 6*d.* net.

THIS is not a medical or theological disquisition on the most desirable route to Valhalla, but a reprint, in the original spelling, of a book first published in 1705, on the methods then in vogue for colouring textile materials.

It was written for the instruction "of the lovers of the Noble Art of Dying," and the "Ingenious Reader" is informed that the anonymous author was a "Jealous Votary to Physical and Experimental Knowledge" who "purchased the Receipts at a very dear Rate." By means of the book "the Candid Peruser is cheaply obliged with the Select Practical Secrets of several Nations."

In all probability the receipts here collected really represent the best practice of the times, but they now appear very quaint, and a large number of the ingredients were obviously useless. For example, a black on silk was dyed in a vat containing no fewer than twenty-one ingredients, including senna, gentian, marjoram, honey, brandy, antimony, silver, gold, verdigris, copperas, and locksmith's filings. On the other hand (p. 93), "The manner of making a Fatt and preparing hot Suds to dye Woolen blew" gives a description of setting an indigo vat, which would almost stand good for a fermentation vat of the present day.

The second part of the book gives "A Perfect Description of Pot and Weed Ashes," with instructions "how to chuse the best sorts." In this portion there is some very quaint information for the "lovers of Mathematicks" and others: *e.g.* "Take two Fatts, take them to Pieces and of the Planks make one Fatt and it will be found to make four of the other Fatts" (in capacity).

Shipwreck of the vessels in which barrels of ashes were imported was evidently a common experience, as the art of fishing up the barrels with poles made for the purpose is fully described. Possibly, however, the poles were to be borrowed from the smugglers who had frequent occasion to use them for the purpose of recovering the casks of brandy sunk on the approach of the preventive men.

The recrudescence of handcrafts is due to a healthy revolt from present-day industrial conditions and results, but nothing would really be gained, either from the artistic or the economic point of view, by reverting to the old natural colouring matters. As well might we go back to burnt swallows or desiccated snakes for our medicines. The old-world charm of the stage-coach should not prevent us from making use of the convenience of the motor car, and a refusal to make use of modern scientific products would be an unnecessary limitation of the artistic possibilities of hand-made fabrics or other materials.

The book is, however, an interesting historical record. WALTER M. GARDNER.

TAXONOMIC ZOOLOGY.

(1) *Catalogue of the British Species of Pisidium (Recent and Fossil) in the Collections of the British Museum (Natural History).* With Notes on those of Western Europe. By B. B. Woodward. Pp. ix + 144 + xxx plates. (London: British Museum (Natural History); Longmans, Green and Co., 1913.) Price 10*s.* 6*d.*

(2) *The Coleoptera of the British Islands.* By Dr. W. Warde Fowler and H. St. J. Donisthorpe. Pp. xiii + 351 + plates. Vol. vi. (Supplement). (London: Lovell Reeve and Co., Ltd., 1913.) Price 18*s.* net.

(3) *A Revision of the Ichneumonidae.* Based on the Collection in the British Museum (Natural History). Part ii., Tribes Rhyssides, Echthromorphides, Anomalides and Paniscides. By Claude Morley. Pp. x + 140. (London: British Museum (Natural History); Longmans, Green and Co., Ltd., 1913.) Price 5*s.* 6*d.*

(4) *Catalogue of the Heads and Horns of Indian Big Game. Bequeathed by A. O. Hume, C.B., to the British Museum (Natural History).* By R. Lydekker. Pp. xvi + 45. (London: British Museum (Natural History); Longmans, Green and Co., Ltd., 1913.) Price 2*s.*

(5) *The Fauna of British India.* Including Ceylon and Burma. Hymenoptera Vol. iii., Ichneumonidæ: 1. Ichneumones Deltoidei. By Claude Morley. Pp. xxxvi + 531. (London: Taylor and Francis, 1913.) Price 20*s.*

(6) *Catalogue of the Lepidoptera Phalaenae in the British Museum.* Vol. xiii. By Sir George F. Hampson, Bart. Pp. xiv + 609 + xviii plates. (London: British Museum (Natural History); Longmans, Green and Co., Ltd., 1913.) Price 16*s.*

(1) THIS excellent monograph deserves a niche to itself; not, indeed, because of the inherent splendour of its raw material, for it embodies only the exuviæ of a few species of small fresh-water Mollusca, but by reason of its form, its style, and its finished technique. Its quality and dignity are enhanced by the fact that it takes in not only the present condition and past history

of the genus Pisidium, but also the geological relations of the British species.

All taxonomic work on fresh-water Mollusca—perhaps all taxonomy of fresh-water invertebrates—is difficult, even when no obfuscation has accrued from the fitful labours of commentators, because of the infinite little diversities of environment to which fresh-water species are exposed; but the genus Pisidium offers peculiar difficulties, on account of the small size of the shells and the obscurity of their specific features.

There can be little doubt that this fine monograph, with its critical treatment of history and synonomy, its concentrated attention upon crucial hinge characters, its graphic summaries of specific distribution, its exhaustive bibliography, and its copious wealth of figures, will make the way easy for students of the British species of the genus Pisidium. But it is doubtful whether any but an experienced veteran will appreciate the immense labour and unwearied application which this work, involving close examination of many thousands of specimens, recent and fossil, represents.

(2) The sixth volume of this important and useful work consists partly of concise descriptions—accompanied by exact records of distribution—of species added to the British list since the publication of the fifth volume in 1891, and partly of miscellaneous notes and records compiled by Mr. Donisthorpe. There is an interesting introductory chapter by the senior author, in which classification and some other matters of general interest are discussed. For classification he repeats his division of the Coleoptera into three suborders: Adephaga, Polycerata, and Lamellicornia, the Polycerata including the Staphylinoidea and five big groups (Clavicornia, Serricornia, Heteromera, Phytophaga, and Rhynchophora), which some entomologists still regard as suborders.

The species question is briefly alluded to in a few very sensible words, Dr. Fowler apparently not being addicted to the belief that species are entities that sprout into existence ready-made.

(3) In this volume the four tribes Rhyssides, Echthromorphides, Anomalides, and Paniscides are reviewed, the first two tribes being briefly characterised and the last tribe being fully defined, while the limits of the third (Anomalides) are merely indicated by the constituent genera. There are 298 species included, and these are distributed in 30 genera, 71 of the species and 8 of the genera being named and defined as new to knowledge. All the genera and species are differentiated in neat and concise, yet adequate, tables; and beyond this the limits of each genus are critically discussed, and in the case of species the synonomy and geographical distribution, and usually the salient specific attributes, are fully considered. It is a model of a revision, and the only word that can be breathed against it is that in the geographical grouping of the species of the larger genera political instead of zoological divisions of the globe are adopted—which is rather a pity, as the geographical distribution of many of the genera is very suggestive, and deserves to be emphasised. It is to be hoped that in taking this course the author has not been influenced by those extremists of the convergence school who try to flout the systematist out of his calling.

(4) A portrait and an appreciative biographical sketch of the original of this bequest—a man distinguished alike for his ardour in natural history and sport, his culture, and his generosity—take this small volume quite out of the roll of common museum catalogues.

The material catalogued includes ninety-seven picked specimens of Indian big game trophies, making a collection such as, to quote Mr. Lydekker, "it would nowadays be impossible to bring together." Every specimen is meted and appraised acording to mode. No fewer than twenty-four of them have a place in the front rank, four of these—to wit, of the Shou (*Cervus wallichi*), the Tibetan Antelope, the Himalayan Serow, and the Lahul Ibex—being "records"; while eight more—namely, of the Yak, the Bharal, the Sind Wild Goat, the Nilgri Tahr, the Blackbuck, the Yarkand Gazelle, the Yarkand Stag, and the Chital—are, severally, *proxime accesserunt*.

Modest as are its limits, the work bears the author's hall-mark.

(5) This volume, dealing with a group of insects of approved economic value, is a noteworthy addition to the fauna of British India. But if it satisfies expectations it excites them no less, since, though all the great component parts of the Ichneumon family are defined and correlated, it is only an instalment in which about half the known specific forms are arranged and described.

The author's preface, wherein he quotes with full appreciation the saying of Agassiz, that "the purpose of systematic work must be to increase our knowledge of the relationship of animals," at once inspires confidence. This confidence is strengthened by the judicious management and scholarly tone of the introductory chapter, in which a historic account of the family is followed by sections, as clear as they are concise, treating of metamorphosis, structure, and classification. After this, the author's statement that concise tabulation is very difficult, on account of the extraordinary instability of species in this family—an

instability in which, among other contributing factors, cross-breeding may perhaps play a part—arouses little misgiving.

The definitions of genera, of which there are 140, and of species, of which there are 406, are polished, and can be read without fatigue, and conspicuous attributes and suggestive relations are effectively summarised. The text-figures illustrating genera are for the most part very clear and good.

(6) The construction of this monumental work goes steadily on, to the infinite honour of its author.

This thirteenth volume, of more than 600 pages, represents two subfamilies, and part of a third, of the great group Noctuidæ. The species included are of Catocalinæ 379, bringing up the total number for the subfamily to 1022, of Mominæ 74, and of Phytometrimæ 226.

The key to the Catocalinæ is reprinted from vol. xii., for convenience. This key, with its clear dichotomies for no fewer than 109 genera, as well as similar keys to the species of the larger genera, embracing some 26, some 40, and one even 101 species, enables the casual critic to form some idea of the prodigious amount of attentive labour embodied—one might almost say enshrined, when one considers that this is an ordered part of a monument *aere perennius, pyramidum altius*—in this volume.

The illustrations are on a generous scale; in addition to 455 beautiful coloured figures, in eighteen plates separately bound, there are 130 figures in the text, so that every genus is represented at least once.

SIX ESSAYS ON SEX.

(1) *Ursprung der Geschlechtsunterschiede.* By Dr. Paul Kammerer, in Fortschritte der Naturwissenschaftlichen Forschung. Herausgegeben von Prof. Emil Abderhalden. Bd. V., pp. 1–240. (Berlin and Vienna, Urban and Schwarzenberg, 1912.) Price 15 marks.

(2) *Die biologischen Grundlagen der sekundären Geschlechtscharaktere.* By Dr. J. Tandler and Dr. S. Grosz. Pp. 169. (Berlin: Julius Springer, 1913.) Price 8 marks.

(3) *Sex Antagonism.* By Walter Heape. Pp. 217. (London: Constable and Co., Ltd., 1913.) Price 7*s.* 6*d.* net.

(4) *The Nature and Origin of Secondary Sex Characters.* By F. W. Ash. Trans. North Staffordshire Field Club. xlvii. (1913), pp. 79–93.

(5) *Les Problèmes de la Sexualité.* By Prof. Maurice Caullery. Pp. 332. (Paris: Ernest Flammarion, 1913.) Price 3.50 francs.

(6) *Heredity and Sex.* By Prof. T. H. Morgan. Pp. ix + 282. (New York: Columbia University Press; London: Oxford University Press, 1913.) Price 7*s.* 6*d.* net.

(1) DR. KAMMERER has made all students of the biology of sex his debtors by taking a scholarly and critical survey of most of the recent contributions to the subject, and of the experimental work in particular. His treatise is a model of fairness and thoroughness, and must have involved a prodigious industry. He deals with the determination of sex, the theories of sex dimorphism, the results of experiments in castration, regeneration, transplantation, breeding, and environmental influence, and at very considerable length with the recent work on the internal secretions of the reproductive organs. The bibliography occupies twenty-three pages of small type! An attempt may be made to indicate Kammerer's general conclusions. The first important step in the evolution of sexual reproduction was the specialising of germ-cells as distinguished from body-cells. The second was the differentiation of macrogametes and microgametes, which are contrasted in their assimilation capacities, amount of cytoplasm, size, and activity. The factors that condition maleness ("mikrogametismus") or femaleness ("makrogametismus") are ultimately assimilation differences—the thesis, it may be recalled, of "The Evolution of Sex" (1889), to which no reference is made in text or bibliography. The differentiation of sex doubtless occurred very early in phylogeny, and the determination of sex occurs correspondingly early in ontogeny. During maturation the gametes are probably in varying degrees susceptible to environmental influence, so that their predisposition to one sex or the other may be changed, but the higher the animal the less is its susceptibility. Only in plants and in the lower animals can we now succeed in experimentally changing the progamic predisposition, activating the tendency which should otherwise remain latent.

Removal of the essential gonads changes the metabolism of the body, and is usually followed by a degeneration of the subsidiary sex characters. But it is practically impossible to draw a definite line between sex characters and body characters. It seems as though the body were "sexed" through and through. The castration, however early, never prevents the appearance of the embryonic primordium of any character; it merely exerts a quantitative influence on the development. When the essential gonadial substances are introduced by transplantation or injection into a castrated animal, the effects of castration are alleviated or reversed, and what can be done with ovarian sub-

stance can also be done with testicular substance. It is an extraordinary fact that injection of the gonadial substance, or even cerebral substance, of animals in heat (of males especially), may be followed in castrated animals by sexual excitement and symptoms of heat. The eroticised brain is to be regarded as a regulator, which quickens or retards the growth of certain parts by its effect on the blood-vessels, and also affects the tonus of other ganglia.

Kammerer goes on to show that sex characters behave in inheritance like specific or racial characters; they illustrate either blended or alternative inheritance. Indifferent systematic characters may come to be sex-linked; all sex characters are fundamentally species characters, and all species characters are also sex characters. As we shall point out later, this appears to us to be a sound idea exaggerated into an extravagance. Nor can we accept Kammerer's general Lamarckian theory, for which no convincing evidence is adduced, that sex differences have been environmentally impressed on the passive organism or functionally acquired by the active organism. Our only other criticism of a monumental piece of work is that the author seems to be just a little in a hurry to accept conclusions in regard to the efficacy of the gonadial hormones. Some of Mr. Geoffrey Smith's recent work, which is of the highest importance, seems to indicate that we are not shut up to one interpretation.

(2) The fine work of Tandler and Grosz is in many ways like Kammerer's, but it deals in the main with man and mammals. The authors regard the differentiation of dimorphic gametes as the first and fundamental step in the evolution of sex; somatic dimorphism was a later acquisition. The criterion of a sex character is not so much that it has to do with reproduction, but that it responds variably to the stimulus of the internal secretion of the gonads. Sex characters are not novelties, but specific, or generic, or other systematic characters which have been brought into close correlation with the glands of internal secretion, and with those of the gonads in particular. This thesis is supported by masterly argument, and one is not disinclined to admit that, not only in regard to sex characters, but also in regard to other adaptive characters, it has been the method of evolution to get apparently new things out of the most ancient materials. It will be remembered that Dohrn elaborated this idea in his theory of "Funktionswechsel." But it appears to us that Tandler and Grosz have over-generalised. It may be that the antlers of the stag are masculine exaggerations of a systematic character once common to both sexes (and still shared by both in the reindeer), but we think there are many cases, especially among invertebrates (where we know little of internal secretions), which will not admit of a similar interpretation. Is the pouch of the female marsupial, or the pouch of Nototrema, or the shell of the female Argonaut referable to a systematic character originally common to both sexes? The claspers of Selachians are evolved from portions of the pelvic fins, and to that extent from a character common to the two sexes; but is there any warrant for supposing that ancestral female Selachians had anything definitely corresponding to "claspers"? The same kind of remark may be made in reference to many similar cases, such as the extraordinarily specialised tips of the pedipalps in male spiders. And what shall we say of such familiar sex characters as the scrotum of most male mammals or the ovisacs of many female Copepods?

(3) Mr. Heape is well known as an embryologist and investigator of the physiology of reproduction, and his conclusions on the relations of the sexes are entitled to careful consideration. He is of opinion that the male sexual instincts and requirements are quite different from those of the female; environmental changes affect the two sexes differently; antagonism arises when the natural requirements of the two sexes clash. Thus he regards the present phase of the woman's movement ("the present sex war," he calls it) as primarily a biological phenomenon. "It is obvious that the driving force is engendered by desire to alter the laws which regulate the relations, and therefore the relative power of the sexes." At present the male is disturbed and damaged by being compelled to repress his strong generative impulse; the female is disturbed and damaged because she is leaving, or is forced to leave, the straight path of maternity. This seems to us an exaggeration of the sex factor, and we adhere to the belief that the driving force with the great majority of women interested in the wholesome unrest of to-day is the deliberate and conscious desire to alter those social, economic, and political conditions which have tended in the past to prevent large numbers of women from taking their due share in citizenship. We think that Mr. Heape has done good service in emphasising the deep constitutional differences between man and woman, and we heartily agree with his conclusion that "a woman's usefulness, her value in society, and therefore her power and her happiness, depend not on her likeness to, but on her dissimilarity from man." We maintain, however, that the threads of sex have been caught up and intertwined with so many others that, although the importance of no set of threads can be disregarded, the attempt

to refer this or that movement to purely physiological, or purely psychological, or purely economic factors is a false abstraction.

Of great interest and value, as it seems to us, is the author's contribution to the theory of exogamy and totemism. In a discussion with Dr. Frazer—a model expression of vigorous difference of opinion—Mr. Heape maintains that the origin of exogamy, the cause from which the habit arose, is to be looked for in "the natural desire of the male to seek for his mate outside his own family or clan; while totemism, in so far as it is a more or less elaborate system of restricting the wanderings of the errant male, was probably derived from the opposite sex." To the male the sexual gratification is of more moment; the strange woman is more stimulating; hence exogamy. To the female the consequences of sexual consummation are of more moment; she is at heart a mother with a family; hence totemism, a product of the feminine imagination, which has aided enormously in the consolidation of the family. According to Dr. Frazer, it was in ignorance of the physical significance of paternity that the primitive mother explained to herself the quickening of the child in her womb as due to the entrance of a child-spirit from some external object —a tree or fruit, a beast or bird—the totem. Mr. Heape points out the difficulties in the way of accepting this theory, and especially the difficulty of believing in a primitive ignorance of the part the male plays in generation. He suggests that the superstition was the outcome of the pregnant mother's desire, hope, and finally belief that the virtue of something she admired in the outer world might pass into her child and endow it. This is, of course, the merest indication of the author's thesis, which is admirably defended.

(4) Mr. F. W. Ash propounds the view that male secondary characters are, in general, characters of "abandoned function," corresponding to parts which were functional and developed in both sexes in the comparatively recent ancestry; they develop in the adult male because there is nutritive material to spare, they do not develop in the female because "the surplus growth energy is more directly diverted to provide for a fresh generation." The first part of this theory corresponds to the view of Tandler, Grosz, and Kammerer, that sex characters are derived from systematic characters once common to both sexes; the second part of the theory corresponds to the much-discussed "surplusage theory" of Hesse and Doflein. Towards the end of his paper the author maintains that the differences between the sexes depend on differences in nutrition—which favour anabolic or katabolic preponderance—an interpretation argued for by the authors of "The Evolution of Sex" (1889), and recently rehabilitated by others.

(5) If one wishes a descriptive account of the facts of sex, brought well up to date, one has it in Prof. Caullery's volume. He discusses the gametes, hermaphroditism, sex dimorphism, sexual selection, castration, internal secretions, the determination of sex, Mendelism and sex, parthenogenesis, sex and asexual multiplication, sex in plants, and sex in the simplest organisms. We are not impressed with the arrangement of the book (the author has his own views on this subject), but we are impressed with its clearness, carefulness, and scepticism. It almost overdoes objectivity, and we are not left with an evolutionist picture—probably because the author thinks the times are not ripe. He is convinced, however, that sex is an aspect of the whole organism—dependent primarily, though not always finally, on the physico-chemical constitution of the fertilised ovum; and he leaves us with the conundrum: Does the germ determine the sex of the soma, or does the sex of the soma determine the differentiation of the germ? The answer is that the question is wrongly put.

(6) Prof. T. H. Morgan seeks to link together the results of experimental and cytological analysis. Some of his general positions may be summed up:—Sexual reproduction has been utilised in evolution in the building up of new combinations, but it does not furnish materials for progressive advance; sex determination depends on an internal mechanism, which appears to be the same as that which regulates the distribution of Mendelian characters; sex is due, like any other character, to some factor or determiner contained in the sex chromosomes, of such a kind that when present in duplex it turns the scale so that a female organism results, and that when present in simplex, a male results; sex-linked characters, while following Mendel's principle of segregation, are also undeniably associated with the mechanism of sex—that is, with the behaviour of the chromosomes at the time of the formation of the germ-cells; Darwin's theory of sexual selection is open to serious criticism, for there is no clear proof of choice, and there is lack of evidence that selection could effect the sex differences, which may be due to mutations; the secondary sex characters are not all on the same footing (in insects, for instance, their development is independent of the reproductive organs), and it is not likely that their evolution can be explained by any one theory. The author also deals with gynandromorphism, hermaphroditism, and special cases of sex inheritance; and one of the most valuable chapters in

the book is a discussion of fertility and sterility in the light of recent advances. We have to thank Prof. Morgan for these lucid and scholarly lectures on heredity and sex, which express his characteristic combination of critical judgment and synthetic appreciation. The reader is assisted by the numerous illustrations, many of which are very fresh and interesting. J. A. T.

OUR BOOKSHELF.

Das Elisabeth Linné-Phänomen (sogenanntes Blitzen der Blüten) und seine Deutungen. By Prof. F. A. W. Thomas. Pp. 53. (Jena: G. Fischer, 1914.) Price 1.50 marks.

THIS small work has the two-fold object of directing the attention of nature-lovers to the pleasing phenomenon of "Flashing Flowers," which is more exactly defined as the Elizabeth Linnæus Phenomenon, and of giving a scientific explanation of its cause.

Perhaps the most interesting feature of the investigation is the names with which it is associated, beginning with Elizabeth Linnæus (daughter of the great Swedish botanist), who first observed the flashing of Indian Cress flowers at twilight in her father's garden at Hammarby, near Uppsala, and published her observation with a comment from Linnæus himself. Her discovery interested a number of scientific men, who ascribed the appearance to electricity, phosphorescence, etc., or rejected it as imaginary and only visible to those who could see ghosts. High above them all stands Goethe, who answered Elizabeth Linnæus's pertinent question "whether the flashing is in the flower or in the eye," by referring to the effect upon the eye of brilliant complementary colours, and by pointing out that the flashing is only seen in a flower which comes sideways into the field of vision.

Prof. Thomas gives an explanation of the phenomenon. It is perceived, he says, in twilight, which makes red brighter and green duller than they appear in full daylight. As the image of the red flower moves from the peripheral part of the retina, where the rods are red-blind, to the fovea, the red is perceived somewhat more vividly than before, and this image coincides with the Purkinje after-image of the surroundings, giving the impression of a flash. H. W.

Die Wichtigsten Lagerstätten der "Nichterze." By Prof. O. Stutzer. Zweiter Teil: Kohle (Allgemeine Kohlengeologie). Pp. xvi+345+xxix plates. (Berlin: Gebrüder Borntraeger, 1914.) Price 16 marks.

THIS second part of Dr. Stutzer's encyclopædic work is entirely devoted to coal and other carbonaceous deposits. The first, or petrographical, division of the volume deals with the chemical and physical characters of coal and the results of its microscopical examination, with a discussion of the theories of the origin of coal. The aim of the author is to bring together the observations and conclusions of all who have written upon the subject, rather than to advocate any particular views of his own. The second division of the work is stratigraphical, and an immense amount of valuable information is collected and classified concerning coal-seams—their modes of occurrence and the indications which they exhibit of operations taking place during and subsequently to their deposition. The third division of the book is statistical, dealing with coal-supply and coal-production in all parts of the globe, full use being made of the important work on "The Coal Resources of the World," which was inaugurated at the meeting of the Geological Congress at Toronto and published last year. Throughout the work before us no effort seems to have been spared by its author in making the information complete and up-to-date. Among the numerous wood-cuts are given many graphic illustrations, which are of the greatest assistance to the reader, as well as copies of figures derived from the works of a great number of different authors. Taken altogether, this second part of Dr. Stutzer's monograph fully realises the high expectations which must have been formed by all who have used his earlier volume.

Descriptive Geometry. Part i., Lines and Planes. By Prof. John C. Tracey. Part ii., Solids. By Prof. H. B. North and Prof. J. C. Tracey. Pp. x+126. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1914.) Price 8*s.* 6*d.* net.

PERHAPS the most notable feature of this work is its logical development of the subject. Beginning with the point in space we are shown its plan, front elevation, and side elevation, when situated in the various positions relatively to the three planes of projection. Then follows an equally exhaustive treatment of the line and plane. A very complete system of notation, specially suitable for oral instruction as well as for private reading, is carefully defined and strictly adhered to throughout. Also, in the authors' scheme is a unique system of triple columns. In the first column the problem is stated in general terms along with the principles and previous problems involved. In the other two parallel columns we have an illustrative particular case, accompanied by a figure, or by a series of figures exhibiting the successive steps in the solution. The authors give special prominence to three fundamental constructions on which most of the subsequent work is based.

A student who has thoroughly mastered the first part of the book should have little difficulty with the second, which deals with some of the simpler geometrical solids; their projections when situated in easy and in difficult positions; their sections by vertical, inclined, and oblique planes; the development and intersection of their surfaces; and the determination of lines and planes tangential to them.

The general treatment is purposely somewhat abstract, being unrelieved by practical problems or applications. The authors, however, propose to issue later a complete set of exercises for use with this very thorough and sound work on descriptive geometry.

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.]*

Efficiency of Damped Seismographs.

IN NATURE (April 2, 1914, p. 119) I found reprinted a statement of Dr. Cavasino, concerning the influence of damping on recording seismographs, which I think is based upon a misunderstanding.

There is no doubt that when damping is introduced, until the limit of aperiodicity is attained, the proper period of the instrument exists as such. But it is not that point at all which is important, but the fact that more or less heavy damping diminishes the influence of the proper motion of the instrument on the record and enables one to obtain a much more trustworthy picture of the true motion of the ground.

Further, if you have an instrument of low sensitiveness and simply introduce a heavy damping you will make a very bad seismograph; but nobody proceeds in this way. When damping is introduced, one must simultaneously provide to augment the magnification, be it by introducing magnifying levers like those in Wiechert's instruments, or by using galvanometric registration as in the aperiodic seismographs. The lengthening of the proper period of the instrument also gives good results for the longer seismic waves.

If these precautions are taken, heavily damped instruments give absolutely the same moments for the commencement of both first preliminary phases of an earthquake as undamped ones; moreover, the three different components give absolutely the same results. There can be no question of a difference of several minutes, not even of seconds, as Cavasino states. The difference in the times of arrival of the first longitudinal waves for the aperiodic instruments of the Pulkovo seismological station for the three components of the movement of the ground differ from another only by a fraction of a second.

Cavasino's assertion, that damped pendulums give fewer records of earthquakes than undamped ones only depends upon the way in which the damping is introduced, and as a general statement does not hold good. In fact, the *aperiodic* instruments in Pulkovo registered in 1912, 671, and in 1913, 576 earthquakes; the number of azimuths of the epicentre determined at Pulkovo were, in 1912, 137, and in 1913, 103.

In 1913 the number of earthquakes registered by aperiodic instruments were:—In Tiflis, 456; Irkutsk, 738; and Taschkent, 954.

I doubt whether any other seismological station using undamped seismographs has approached these figures. B. GALITZIN.

Laboratoire de Physique de l'Académie
Impériale des Sciences, St. Pétersbourg,
May 11.

Spectra of Secondary X-Rays.

HITHERTO all X-ray spectra have been obtained by using the body, the spectrum of which is to be examined, as an antikathode inside the tube. All the trouble of exhausting the tube, etc., can be avoided by illuminating the substance of which the spectrum is to be determined with the primary rays from a tube of any of the usual types, and only allowing the secondary rays to enter the spectrograph. I have photographed the secondary spectra of copper, zinc, mercury (amalgam of zinc), etc., by this method without any trouble. Zinc amalgam, for instance, shows five rays, two due to zinc, one due to some impurity—probably iron—and two due to mercury.

If a quantity of the substance to be examined is placed in a thin paper bag, the experiment is particularly striking. Using zinc oxide, for instance, the presence of zinc was evident immediately, so that the chemical analysis of a substance inside a closed envelope without in any way touching or manipulating it is no longer beyond the bounds of possibility.

The method promises to be particularly useful for any experiment in which the rays emitted under various conditions are to be examined, such as those on the effect of an electric or magnetic field upon the spectra, with which I am now engaged.

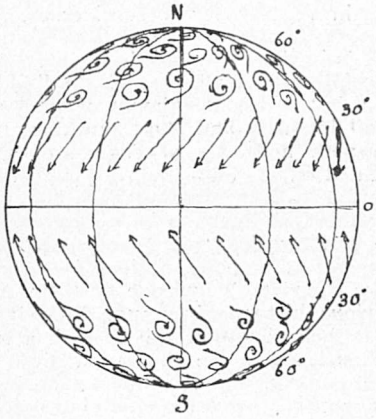
MAURICE DE BROGLIE.

29 Rue Chateaubriand, Paris, May 30.

Weather Forecasts.

AT the conclusion of my former note on this subject (NATURE, February 26, 1914, vol. xcii., p. 711) I said that it seemed improbable that trustworthy forecasts of the weather for twenty-four hours in advance ever would, or could, be made for latitudes far removed from the equator, and in the present communication I give the reasons for that opinion.

Enough is now known concerning the average weather conditions on the globe to show that were it possible to make the surface wind currents visible and to observe their distribution from a distance, the appearance would be very much like that given in the accompanying figure, provided that the surface was level and uniform in quality, *i.e.* all land or all sea.



The wind currents on the actual earth if viewed in this way would no doubt be seen to be considerably affected by differences in the nature of the surface over which they passed, more particularly where that surface was mountainous, but the general character of the flow would still be that given in the figure, namely, that round the equator (leaving seasonal variations out of account), there would be a region of calms bordered on each side by fairly regular trade winds extending roughly to latitude 30° N. and S.; whilst outside this region again, the whole surface would be covered by eddies of various sizes in which the direction of circulation was left-handed in the northern, and right-handed in the southern hemisphere.

If pressure could be observed, as well as the direction of the wind, the central parts of the eddies would always appear as regions of low barometer. Were the observations extended over a few hours, it would be seen that the eddies themselves (*i.e.* their centres) were in motion travelling on the whole to the N.E. and S.E. in the northern and southern hemispheres respectively.

Continuing the observations for days or weeks, it would be found that the eddies were mostly short-lived, few lasting more than two or three days, and that although their average course was N.E. or S.E.,

as stated above, yet individuals among them moved in different directions and with very different speeds.

It would be found also that the variations from the mean with respect to the duration of each eddy, the path of the centre, and the intensity of the circulation about it, were matters of chance; so that the ordinary laws of chance might be applied to determine the probability that in a given place and for a given time the departure from the mean should lie within assigned limits.

Experience over the temperate and polar regions of the world has proved that on the whole certain types of weather are associated with certain surface winds, although the particular relation of each to the other may vary in different places.

In order, therefore, accurately to predict the weather, it is a matter of foremost importance to know what the direction and character of the wind will be at the time and place for which the prediction is issued.

This, however, requires not only a knowledge of the surrounding conditions at the time of issue, but also of the rate at which the conditions are changing, and, since the rate follows no known law, predictions cannot be held to be trustworthy for more than the short time during which the rate may be considered to be constant or to change uniformly.

How long this "short time" may be when reckoned in hours or days varies with the type of eddy or pressure disturbance. When the depressions are large and deep they may retain their life for several days or even more, and in such cases their rate of change may remain regular for a considerable fraction of that time.

It is in these comparatively rare conditions that the best forecasts can be made. Ordinary weather, however, is the accompaniment of shallow depressions of small intensity and short duration, the regularity of the path and rate of change of which cannot be counted on for more than a few hours. In such circumstances any forecast made for a day in advance is almost as likely to be wrong as right, and since the shallow depressions are chief occupants of the temperate and polar regions it seems that even the most complete knowledge of their present state and previous history gives very little information as to what their condition will be even a few hours later.

This leads to the conclusion given in the previous note, namely, that the information furnished by daily weather charts gives a small, but only a small, advantage in favour of forecasts made on the strength of it over the simple guess that the weather will remain as it is.

In some places, though not in England or its immediate surroundings, the diurnal variations are more important than the general pressure distribution, and in mountainous regions impending weather changes can often be foreseen from the behaviour of clouds about the hills.

Success, however, in such cases depends essentially on local experience and not on general knowledge.

A. MALLOCK.

The Plumage Bill.

MY attention has been directed to an article in NATURE of December 11, 1913 (No. 2302, vol. xcii.), entitled "The Plumage Bill," by Sir H. H. Johnston, in which the following statements are made regarding the destruction of bird-life in Nipal:—

(1) "Originally the Nipalese respected almost religiously the fauna of their native land, like most Indian peoples. But of late they have become infected with a truly British love of life destruction. They are incited to this by the agents of the plumage trade in Calcutta and other places, and, of course, find it a lucrative business."

(2) Nipal . . . "is permitted to import and export goods through British India under its own Customs' seals, intact and unquestioned.

"Consequently, though the laws of British India forbid on paper the export of wild birds' plumes or skins, the State of Nipal monthly exports from Calcutta to the feather markets of the world—principally London—thousands of bird skins. The Nipalese have nearly exterminated the Monal pheasant, the Tragopan, and several other gallinaceous marvels."

In replying to the above extracts from the article in question I am concerned mainly with the implication that the Nipal Government, to which I am and have for the last eight years been the accredited British Representative, are concerned with the destruction of bird-life for trade purposes, and are, in fact, the principals in the trade of bird feathers and skins.

Neither the Nipal Government nor any of its officials is privileged to export goods through British India under the Customs' seals of the State, and any traffic in bird feathers and skins such as is described in the article, if it is being carried on at all, must necessarily be done in contravention of the British Indian Customs Regulations, as no exceptions are made in favour of Nipal goods passing through our ports.

The Prime Minister in Nipal, who has seen and read the article, has authorised me to state explicitly that the Nipal Durbar have no interest whatever in the export of feathers from Nipal, and that such export is contrary to the laws of the State.

As regards extract No. (1), it is doubtless true that in old days there were fewer birds and animals destroyed in the country than at present. Originally the religion of the ruling race in the Nipal Valley and of a considerable part of what is now the modern State of Nipal was Buddhism, in which life is held sacred; whereas now the prevailing religion is Hindu "Shivaism," and the worship of Durga. Old-fashioned bows and arrows have also given way to firearms, while the sporting instinct of the Gurkha has in no way lessened with the improvement of the weapons at his disposal.

My own observation, however, in the hills surrounding the Nipal Valley does not confirm the very wide statement that the Monal pheasant, the Tragopan, and other gallinaceous marvels of this secluded country are in any danger of extinction at present.

J. MANNERS-SMITH.

The Residency, Nipal.

MY statements as to the destruction of rare pheasants in the kingdom of Nipal were based, first, on facts which came to my notice when on or near the frontiers of Nipal in 1895, but a good deal more on the recent allegations made in the Calcutta Press, on the reports of an American ornithologist, and on other matter published in the pamphlets of Mr. James Buckland, or read by him at his public lectures. Much of this evidence was before me when the articles (to which Lieut.-Col. Manners-Smith takes exception) were written. But as it is difficult for one who writes a good deal and on many subjects (and has, moreover, in the months that have elapsed been undergoing the inconvenience of alterations to his writing-room) to keep such evidence so that it can remain always at his right hand, I have preferred to take the course of writing to all the persons who furnished these original accounts, asking them to instruct me once again, or at any rate to give me references which can be followed up. As this necessitates writing to America

and to India, as well as to persons in London, some weeks may elapse before I am able to answer the main points in Lieut.-Col. Manners-Smith's letter.

I would, however, inform Lieut.-Col. Manners-Smith that Mr. James Buckland, who had collected all or much of such evidence affecting the Government of Nipal, sought to lay this before his Highness the Prime Minister of that country, when Maharaja Sir Chandra Shamsher Jang visited this country not long ago, but Mr. Buckland was not accorded an interview and not permitted to submit, with all due respect, the case of the rare birds of Nipal, either to the Maharaja or to his English advisers.

I am sincerely glad that any article of mine should have directed the attention of the Government and British Resident of Nipal to the preservation of the Nipalese avifauna, even though that Government may have already dealt effectively with the question. This large independent Himalayan State contains within its limits some of the most wonderful birds in the world, none of which are in any degree whatever harmful to man, and most of which are of exceptional interest and beauty. The whole of the fauna of Nipal stands out as being perhaps the most remarkable of any Asiatic State. The independence of Nipal is scrupulously respected by the British Government, the country is not thrown open to access on the part of foreigners, and it might well be the national ambition of the Nipalese Government that their land should become a refuge for the wonderful birds and mammals still existing in tropical Asia, which are rapidly being exterminated elsewhere. So soon as I have the information asked for, I will forward it for publication in the columns of NATURE.

H. H. JOHNSTON.

Atomic Volume Curves of the Elements.

IN his interesting review of Prof. Letts's book on "Some Fundamental Problems of Chemistry," in NATURE of May 21, Prof. Meldola states that an atomic volume curve which includes the inert elements is there published for the first time.

Will you allow me to say that in our book on "Systematic Inorganic Chemistry," first published in 1906, Dr. Lander and I included an atomic volume curve in which the inert elements were shown; and that in our 1911 edition the curve was amended to indicate the position of helium, then recently liquefied, so that lithium was seen no longer to occupy the crest of the first wave. I may add that in Kipping and Perkin's "Inorganic Chemistry" (1911) a curve similar to ours appears.

R. M. CAVEN.

University College, Nottingham, May 25.

I AM sorry inadvertently to have done an injustice to Drs. Caven and Lander, whose claim for priority over Dr. Letts for having constructed an atomic volume curve comprising the inert elements is certainly justified. At the time of writing the review I was remote from libraries, and I had an impression that the Letts curve had been published by its author long before its inclusion in the work noticed, in which it is referred to as the "new curve" (p. 63).

R. MELDOLA.

Transmission of Electric Waves Round the Bend of the Earth.

I BEG leave to amend a sentence in my letter which appeared in NATURE of May 28. I wrote that the existence of a most favourable wave-length for transmission to a given distance appeared to be contradicted by the diffraction theory. A more leisurely study of Prof. MacDonald's paper shows me that I have in this respect misinterpreted his integrals, and that it is not impossible that the existence of an optimum wave-length may yet be explained by his analysis. This emendation in no way affects the table of ratios I gave or the wording of the conclusion drawn therefrom.

W. ECCLES.

University of London, University College, June 1.

SCIENCE AND THE STATE.

AT a time when our Government is embarking on large schemes of social legislation at a heavy cost to the community, it seems a fitting opportunity to direct attention to one branch of the public service which has hitherto failed to obtain official recognition or financial support.

It is difficult to realise what our state of civilisation would have been were it not for scientific researches conducted mainly at their own expense by private individuals. The progress which has changed the conditions of our life from those prevailing in the so-called barbaric ages has been effected largely at the expense of a body of reformers who have sacrificed their own prosperity for the benefit of the community in a way which no modern Cabinet Minister would dream of doing, and who have been rewarded for their enthusiasm by neglect and discouragement.

The position of these workers has been ably put forward in the article on "Sweating the Scientist," which appeared in *Science Progress* for April, and was mentioned in the Notes column of NATURE on April 30 (p. 219). A further contribution on the same subject appeared in the form of correspondence by Sir Ronald Ross in the *British Medical Journal* from February 7 to March 28. Let us take Sir Ronald Ross's experiences first, and let us then extend the case to the university workers mainly considered in *Science Progress*.

Sir Ronald Ross was in the Indian Army Medical Service from 1881 to 1899, and not only did he discharge his official duties efficiently, but, at great trouble and expense to himself, he instigated his series of investigations on malaria and its transmission by mosquitoes—a task which prevented him from accepting a civil post which was offered him. The success of his researches led to the foundation in 1899 of the schools of tropical medicine in London and Liverpool, and though the scheme received every encouragement from Mr. Joseph Chamberlain and Mr. Austin Chamberlain, practically the whole of the money was raised by private subscription, although we do read of at least one Government grant of 3,550*l.* in 1899. As against this, we contrast the action of the German Government in financing the Hamburg Tropical School.

Sir Ronald Ross became chief lecturer of the Liverpool School, and thus had to resign his Indian commission on a small pension of under 300*l.* The work of the school was of an altogether exceptional character, involving expeditions to West Africa, teaching of students, publication of reports, and maintenance of experts on Government committees. In the expeditions Sir

Ronald Ross met with considerable local opposition from officials, but repeated efforts have finally resulted in the Indian and African Government departments taking action which has vastly improved the public health, and thus caused a large saving of life and of the financial resources of the countries.

In view of these facts, Sir Ronald Ross applied to the India Office for a pension on the higher scale, but this has been refused, and he has thus not only received no reward for his services to the country, but has been penalised by losing the pension which he would have received after full-time service.

We cannot help comparing this treatment to that which was meted out to the Pied Piper by the people of Hamelin, and the story is not unlikely to have a somewhat parallel sequel in the withdrawal of young enthusiasts from the field of scientific research. The Liverpool Tropical School is, we are told, in some danger of losing its staff because they are beginning to lose enthusiasm now that they realise that their duties offer them no prospects for the future, and no recognition of their work. The highest salaries now paid are 600*l.* a year with no fees, and much of the work is done voluntarily, or for a small honorarium. Had these people engaged in clinical work their possible incomes, if successful, would have been far greater.

Passing to the discussion in *Science Progress*, we are glad to see that that journal is instituting an inquiry into the salaries of university teachers and other persons holding paid appointments for work in science. The junior posts range generally from about 120*l.* to 200*l.*, with a minimum of 85*l.* and maximum of 300*l.* For full professorships the most that a candidate has a reasonable prospect of securing is about 600*l.*, with a small contributory pension on compulsory retirement at the age of sixty-five. In the colonies, salaries are not much higher, and not higher in proportion to the cost of living.

It must also be remembered that these salaries are in every case paid for teaching and lecturing work to classes of students, and the necessary routine work associated with the performance of these duties. The only way in which research can be benefited is by the appointment to such chairs of men of scientific distinction, and the provision of assistant lecturers sufficient in number to reduce the actual teaching of the professor to a limit that will allow him free time for undertaking scientific investigations outside the lecture hours. It is only when supervising and initiating work for research students that his scientific work can be included in the duties for which he receives direct payment. If the classes become larger without a corresponding increase in the college finances, his facilities for research are reduced. And such appointments are often only obtained after many years' waiting or tenure of junior appointments, a not inconsiderable portion of the salary of which has been spent in printing testimonials. A further burden on the junior lecturers is the necessity of writing researches or even books published at great expense with a view to the better recognition of their claims for the senior posts.

Many professors do no research, and these probably secure the largest numbers of examination successes and the smallest numbers of pupils who distinguish themselves after leaving college. A professor with fifteen hours a week lecturing *may* manage in a summer holiday to contribute a short note on a new application or modification of a known principle. With six or eight hours a week he may do more substantial work, but he will still cling to the development of known fields of study rather than proceed to the initiation of new fields. But occasionally a scientific worker lights on such a new and far-reaching idea that its development is incompatible with even three *efficient* lectures a week, not because of the *time* taken, but because it monopolises his *brain* to the exclusion of other thoughts. He has the alternative choice between abandoning the research or postponing it indefinitely or living on a reduced income in changed conditions of life calculated to unfit his health for the task he has taken.

Now there are undoubtedly many researches which can be delayed without any very obvious immediate loss to the community, but once an investigator has lighted on a well-defined plan of attacking such a problem as the spread of malaria, it becomes an enormous waste of national efficiency to allow anything to stand in his way of solving it at the earliest possible instant. He should have all facilities and appliances provided by the State, and it is the further duty of the State to reimburse him for any loss of salary which he has incurred by abandoning his previous career with this object in view.

The State grant in aid of scientific investigation is 4000*l.* a year to one learned society, and 1000*l.* for publications! The grants are, we believe, in every case contingent on returns of expenditure being made, and the actual scientific workers are unpaid. The money all goes into the pockets of mechanics, instrument makers, and printers who receive union rates of pay. The mechanism which drives the whole of the machinery receives nothing; and not only does he receive nothing, but, as our contemporary points out, he is often asked to give the Government gratuitous advice on scientific points without receiving any thanks for his services:—

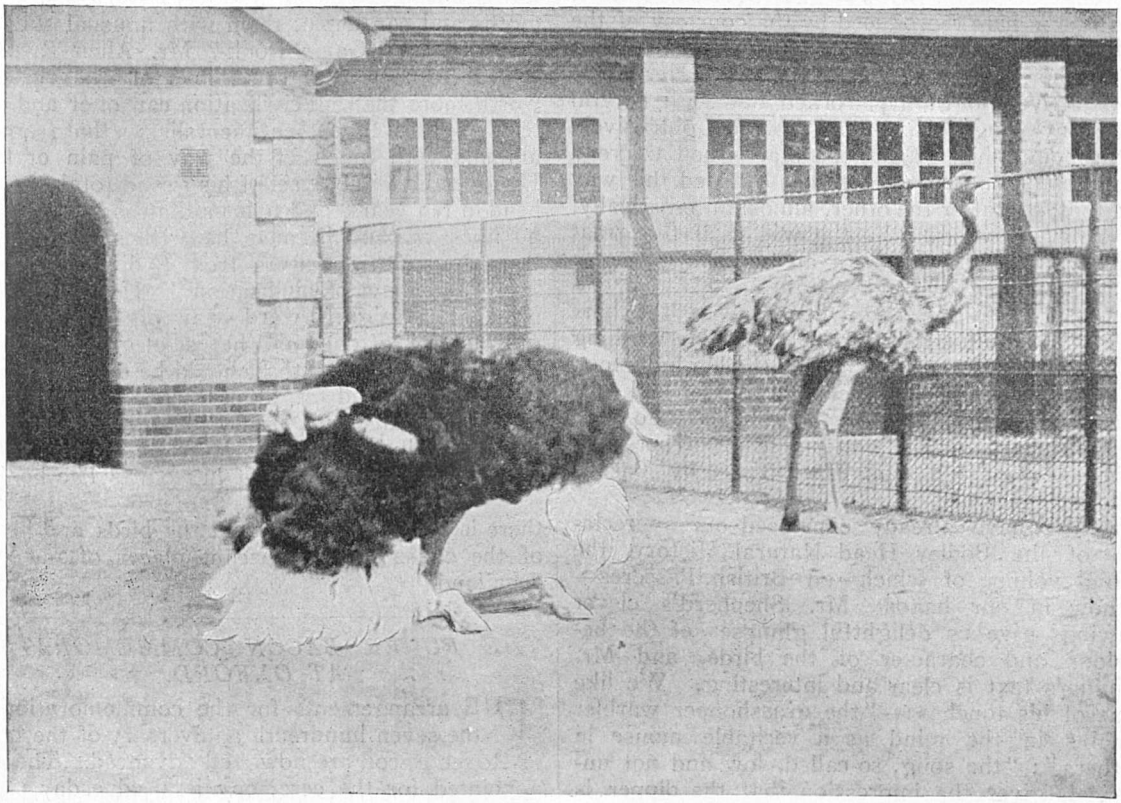
> For example, a Government department wishes for expert advice on some matter—it ought to form a commission of its own and honestly pay the expert members of it. Instead of doing this, the Government department goes to some learned society and asks it to advise on the scientific question at issue. The society is honoured by the request, and obtains the advice gratis from its own members. Thus the Government gets what it requires for nothing; the learned body is overpowered with the honour rendered to it; and the unfortunate worker is the loser.

No system of emoluments could ever be sufficient to induce properly informed students to take

up scientific work merely as a remunerative profession; unhappily some are now induced by scholarships to do so, and find out their mistake too late. What is required is that those who pursue scientific work with a well-defined object, and with a reasonable prospect of benefiting the State by their efforts should receive at least the remuneration which they would obtain if they left the work undone.

POPULAR NATURAL HISTORY.[1]

(1) WE give a hearty welcome to "The English Year"—a series of charming studies in the Natural History of Autumn and Winter by W. Beach Thomas and A. K. Collet. There should be a shelf of these seasonable books—for there is a score of them already—in every country-house; and we should like to see a selection of them in every country school. For they are the best approaches to nature-study. The authors of this beautiful volume take nature as they find it—a moving pageant—and they discourse pleasantly and competently, in excellent style, on coveys of partridges, scattering seeds, cocoons of insects, migrant birds, withering leaves, fruitful hedgerows, showers of gossamer, winter visitors, hibernation, struggle with cold, trees in winter, the hailing of far summer, the salmon's journey, the early songs of birds, and much more besides. Some season-books (we hope for another volume of this one) are too enthusiastic, precious, and impressionist; others go to the opposite extreme of matter-of-fact-ness, and are rather dull "naturalist's calendars"; but the authors have found an effective middle way which is admirable. There are some characteristic notes on Norfolk



Ostrich Displaying. From "Highways and Byways of the Zoological Gardens."

by Mr. A. H. Patterson. The text is enlivened with numerous very interesting drawings by A. W. Seaby who has caught the spirit of things: and it is adorned by a series of reproductions in colour of the work of Sir Alfred East, Harry Becker, C. W. Furse, Buxton Knight, and Haldane Macfall. The whole book is capital value for its price and a credit to its publishers as well as to the authors and artists. We hope that it will have the success it deserves, and that it will help to stimulate the growing interest in seasonal natural history.

(2) Mrs. Pocock has attempted "to carry the Zoological Gardens to those who are unable to go to them," and if she has not achieved this *en bloc*, she has certainly succeeded with particular

[1] (1) "The English Year. Autumn and Winter." By W. Beach Thomas and A. K. Collet. Pp. ix+408+plates. (London and Edinburgh: T. C. and E. C. Jack, n.d.) Price 10*s*. 6*d*. net.
(2) "Highways and Byways of the Zoological Gardens." By Constance I. Pocock. Pp. xii+192+plates. (London: A. and C. Black, 1913.) Price 5*s*. net.
(3) "The Moose." By Agnes Herbert. With 8 full-page illustrations by Patten Wilson. Pp. viii+248. (London: A. and C. Black, 1913.) Price 5*s*. net.
(4) "The Bodley Head Natural History." By E. D. Cuming. With illustrations by J. A. Shepherd. Vol. ii., British Birds, Passeres. Pp. 122. (London: John Lane, 1914.) Price 2*s*. net.
(5) "In the 'Once upon a Time'." By Lilian Gask. Illustrated by Patten Wilson. Pp. 288+plates. (London: George G. Harrap and Co., n.d.) Price 3*s*. 6*d*. net.
(6) "Moths of the Limberlost." With Water Colour and Photographic Illustrations from Life. By Gene Stratton-Porter. Pp. xiv+370. (London: Hodder and Stoughton, 1912.) Price 10*s*. 6*d*. net.
(7) "My Game-Book." By Alan R. Haig Brown. Pp. xvi+239+plates. (London: Witherby and Co., 1913.) Price 5*s*.

corners. As is always the way when a writer has a good story to tell and knows how to tell it, the book convinces and interests us, and we ask for more. Mrs. Pocock tells us about animals she has watched with an attentive and sympathetic eye, and her range is no restricted one—from orang-utans to millipedes, from the elephant to the elephant-shrew—and she throws in quaint items of information which will be fresh to many. If anyone wishes to know how apes received Prof. Boys's soap-bubbles, or what the mynah says to old gentlemen who peer into his cage, or how the ostrich woos his mate, or how the Old World porcupines advertise their presence, or of the vagaries of a snail that was wont at times to get out of its shell, let him read Mrs. Pocock's delightful book. She has been fortunate in securing unsurpassable photographs which adorn her tale, and one is here reproduced by the courtesy of the publishers.

(3) The story of the moose by Agnes Herbert is an effective biography, worked out with careful and convincing realism and not too obtrusively anthropomorphic. From the start when we read of the calf's enormous ears that "turned this way and that, one after the other, almost automatically, listening, listening. . . . ('it was as if the great flaps were so pleased with an hitherto unknown accomplishment that they could not but practise it'") . . . . to the end when we see the lynx sitting "in the lustrous, first light of day washing his glossy coat". . . . ("and as the big bull stood up stiffly, the cat leered over his shoulder and then went on licking fur") . . . . we have to do with scientific and artistic workmanship. There are eight excellent full-page illustrations by Patten Wilson.

(4) We have already expressed our appreciation of the Bodley Head Natural History, the second volume of which—on British Passeres—is now in our hands. Mr. Shepherd's clever drawings give us delightful glimpses of the behaviour and character of the birds, and Mr. Cuming's text is clear and interesting. We like some of his touches:—"the grasshopper warbler remains in the mind as a veritable mouse in feathers"; "the song, so-called, low and not unmusical, gives the impression that the dipper is singing to himself"; "your abiding impression of the tree-creeper is one of vanishing round the corner." The two little volumes we have seen are delightful, but we do not understand the dragging in of rarities like the subalpine warbler, Pallas's willow warbler, the greenish willow warbler, or even the wall creeper. What is the use of it in books of this kind?

(5) In the "Once upon a Time," Lilian Gask has been very successful in making a learned professor tell an active-minded boy about extinct animals and primitive man. The stories of "the ancient lords of land and sea," of man's life in the trees, of the finding of fire, of ancient hunters, and the like are told with accuracy, simplicity, and vividness. We have tried the book on a boy of twelve who thoroughly approved of it. The illustrations by Patten Wilson are full of interest and vitality. The preface stands badly in need of revision.

(6) The gorgeous work entitled "The Moths of the Limberlost" tells of studies made around a now dwindled swamp in north-eastern Indiana. The most living moths we ever saw fly about the pages, and the photographs are only surpassed by the water-colour drawings. The work must rank very high among beautiful "Nature-books," and there is good material in it too in the way of careful observation by a well-trained eye. It seems to us, however, that the text has been far too much diluted with talky stuff that is often utterly unimportant. There is also a regrettable and discordant "chaffing" of technical books and the mistakes they sometimes make. But the author is a true nature-lover who knows her moths and can depict them with unusual skill.

(7) In his "Game Book" Mr. Allen R. Haig Brown confesses that the love of the chase is worth more than all civilisation can offer and protests against the sentimentalism that credits animals with much in the way of pain or fear. He gives us an analysis of his grand total of 5,510 head in ten years, and tells us that he kills because he likes to, and because he wishes to keep the last remnants of nature from finding their way into "the maw of civilisation." He writes in a pleasant, straightforward way of ferreting and pike-fishing, of dogs and hares, of grouse and the "Trossacks," of fish that should be dead becoming lively again, and of other strange occurrences. There are numerous, pretty illustrations throughout the volume, but the insertion of the verses shows a surprising lack of humour. The book is a naïve expression of "the exquisite pleasure that there is to be gathered from the birds and beasts of the chase in the pleasant places of our own dear land."

THE ROGER BACON COMMEMORATION AT OXFORD.

THE arrangements for the commemoration of the seven hundredth anniversary of the birth of Roger Bacon are now well advanced. The day appointed for the ceremony is Wednesday, June 10; the place, as is fitting, being Oxford. Proceedings will begin at noon with the unveiling, by Sir Archibald Geikie, of Mr. Hope-Pinker's statue of the great Franciscan, and its reception by Earl Curzon on behalf of the University. Addresses will be presented by delegates representing various bodies who have joined the movement, and the public orator, Mr. A. D. Godley, will deliver a Latin oration. All this will take place at the university museum. The delegates and some other visitors will be entertained at lunch by the Warden and Fellows of Merton College, and doubtless other lunch parties will be arranged. At three o'clock all visitors will have the opportunity of attending the Romanes lecture. This will be given in the Sheldonian Theatre, the lecturer being Sir J. J. Thomson, of Cambridge, and

his subject the atomic theory. From one to four o'clock various manuscripts and other objects of interest in connection with Roger Bacon and his successors will be on view in the Bodleian Library, and from four to half-past six a garden party will be held at Wadham College.

At the approaching celebration the Vatican library will be represented by Mgr. Ratti, the Institut de France by the Comte d'Haussonville, the University of Paris by Prof. Picavet, the University of Cambridge by Prof. James Ward, the Order of Friars Minor by Dr. P. Hickey, Provincial, and Prof. Paschal Robinson, the Capuchin Order by Fr. Albert (vicar-provincial), and Fr. Cuthbert.

Much has been done of recent years to establish the importance of the work of Roger Bacon in the history of Western thought. His eminence as a linguist, an educational reformer, a mathematician, and physicist was well brought out in the discourse lately delivered by Sir John Sandys before the British Academy. The late Prof. Adamson, speaking of his works, both edited and at present existing only in manuscript, wrote as follows in the "Dictionary of National Biography":—

It is much to be desired that a more thorough and detailed study of the known manuscripts and a more extensive search for others which doubtless exist should be undertaken. Some portions are in a condition suitable for publication, and it is well-nigh an obligation resting on English scholars to continue the good work begun by the late Prof. Brewer. Bacon's works possess much historical value, for his rigorous thinking and pronounced scientific inclinations are not to be regarded as abnormal and isolated phenomena. He represents one current of thought and work in the Middle Ages which must have run strongly though obscurely, and without a thorough comprehension of his position our conceptions of an important century are incomplete and erroneous.

Prof. Picavet, of the Collège de France, adds his testimony as follows:—

L'autorité et le raisonnement ne valent, pour Roger Bacon, qu'en fonction de l'expérience. C'est elle qui doit prononcer en dernier ressort sur les affirmations des anciens comme sur nos propres conceptions. . . . Roger Bacon a donc entre les mains l'instrument qui a rendu possibles toutes les conquêtes de la science moderne.

Subscribers of one guinea and upwards to the Roger Bacon commemoration fund will be entitled to take part in the ceremonies at Oxford, and also to receive the memorial volume, which will contain essays dealing with various aspects of Roger Bacon's work, written by specialists in the various subjects. Subscriptions should be sent to Col. W. H. L. Hime, 20 West Park Road, Kew.

SIR JOSEPH WILSON SWAN, F.R.S.

WE regret to announce the death, in his eighty-sixth year, of Sir Joseph Swan, at Warlingham, Surrey, on May 27. Swan came from a stock exceptionally endowed with inventive abilities on both the paternal and maternal sides, his father and his maternal uncle, Robert Cameron, having both been inventors of note. He was born at Sunderland on October 31, 1828, and there he received his education. He was removed from school at an early age, and having shown a decided taste for chemistry, was apprenticed by his father in the chemical business of Mawson, of Newcastle; of this firm Swan subsequently became a partner, the firm's name being changed to that of Mawson and Swan. At the commencement of his career Swan turned his attention more particularly to the manufacture of photographic supplies, and it is owing to his enterprise that the business of his firm was largely extended in this direction.

The nature of the business with which young Swan was thus associated enabled him to turn to account his inventive talent in bringing about important advances in photography. His patent for carbon printing, being the first commercially practicable process of the kind, was filed in 1862; later he described it in a paper read by him before the Photographic Society in April, 1864. Although the process has been simplified and improved by subsequent workers, in its essential features Swan's invention remains the basis of some of the methods of photographic reproduction still largely in use at the present day. An original investigation made by Swan on the effect of heat in increasing the sensitiveness of a gelatino-bromide silver emulsion led to the production by him of extremely rapid dry plates in 1877, and two years later he invented the bromide printing process.

Swan is, perhaps, better known to the public in connection with his invention of the incandescent carbon filament lamp than in connection with his discoveries in the field of photography. As a lad he had, in 1845, seen the experiment carried out of heating platinum-iridium wire to incandescence by means of an electric current, and this principle was applied by him, so far back as 1860, in the construction of an electric glow lamp, in which strips of carbonised paper or card mounted within an exhausted glass globe were raised to a red heat by an electric current obtained from primary batteries. At that date the method available for obtaining a vacuum was not entirely satisfactory, and in consequence the life of the earliest type of glow lamp was exceedingly short. However, when Sprengel's mercury pump for producing vacua made its appearance in 1865, Swan again turned his attention to the problem of producing a marketable electric glow lamp. Experiments carried out by him showed that high vacua were necessary to prolong the life of the incandescing filaments of which he had been investigating the properties.

In February, 1879, Swan exhibited his improved electric glow lamp at a meeting of the Newcastle Chemical Society, and the first public demonstration on any considerable scale of this new method of illumination was given before the Newcastle Literary and Philosophical Society in October, 1880. In the following month Swan read a paper before the Institution of Electrical Engineers on "The Subdivision of the Electric

Light," in which the suitability of the electric glow lamp for domestic lighting was dealt with.

Swan played a considerable part in connection with the introduction of the improvements in the manufacturing processes which have resulted in the successive reductions in the price of the glow lamp. To him was due the introduction of the "parchmentised thread" filaments formed by treating ordinary crochet cotton-thread with sulphuric acid and then carbonising the same; later he devised the process whereby filaments of exceedingly small diameter and great uniformity were obtained by squirting artificial cellulose by hydraulic pressure through a die; the latter being first shown to the public at the Inventions Exhibition in 1885. It is only very recently that this process of manufacture has given place to the newly developed metal filament lamps.

Swan's activities in the field of electro-chemistry resulted in the invention by him of a rapid process of depositing copper, due to the discovery made by him that the addition of a suitable quantity of gelatine to the solution in the electro-depositing bath much improved the quality of the deposited metal. The process admits of the utilisation of currents of from 1000 to 1500 amperes per square foot of kathode, pure copper wire being at once reeled off from the bath through a die. Swan devoted his attention also to apparatus for measuring electric current, and the improvement of secondary batteries; his activities in the field of invention resulted in the filing of some sixty patent specifications, some in his name alone and others in the joint names of himself and his eldest son.

A recognition of Swan's services to applied science came first from France when, in 1881, he was appointed Chevalier of the Legion of Honour. In 1894 he was elected a Fellow of the Royal Society, and ten years later received a knighthood. The University of Durham also conferred upon him the honorary degrees of M.A. and D.Sc. He was the recipient, in 1903, of a gold medal from the Society of Chemical Industry, and, in 1904, of the Hughes medal from the Royal Society. In 1906 the Royal Society of Arts awarded him its Albert medal, "for the part he took in the invention of the incandescent lamp and for his invention of the carbon process of photographic printing," the medal being presented to him by King George (at that time Prince of Wales).

The career of Swan demonstrates that a scientific training and the possession of inventive faculties are not, as some suppose, necessarily incompatible with the possession of sound business capacity; and, indeed, the subject of this memoir gave ample evidence by his life work that it is possible for a man to be a productive inventor and at the same time successful as a commercial manager.

In Sir Joseph Swan the nation has lost not only a venerable investigator, whose labours did much for the material progress of civilisation, but one who was also possessed of a charming personality which deservedly endeared him to a large circle of friends and acquaintances. W. A. J. O'M.

DR. P. H. PYE-SMITH, F.R.S.

PHILIP HENRY PYE-SMITH was born August 30, 1839, at Billiter Square, E.C. He was the eldest son of Ebenezer Pye-Smith, F.R.C.S., and the grandson of the Rev. Dr. John Pye-Smith, F.R.S., the principal of the Homerton Theological College, well known, nearly a century ago, both as a geologist and theologian. He belonged to a medical family, for his father was a surgeon in the city, his brother Rutherford John Pye-Smith is emeritus professor of surgery at the University of Sheffield, and a nephew is also in the profession.

Dr. Pye-Smith was educated at Mill Hill School, and in 1858 took the B.A. of the University of London. He then entered Guy's Hospital Medical School and attained his M.D. in 1864; he gained the gold medal, thus outstripping two future distinguished colleagues, Moxon and Sir Thomas Stevenson. After a year at continental schools his teaching began by his being appointed demonstrator of anatomy. In 1871 he became assistant physician to Guy's Hospital, and full physician in 1883. He retired from the active staff in 1899, as in that year he reached the retiring age of sixty. He then became consulting physician to the hospital. During the earlier part of his assistant physiciancy he lectured on comparative anatomy, then on physiology, and when he was full physician on medicine. For many years he took charge of the department of diseases of the skin, and was regarded everywhere as one of the highest authorities in this branch of medicine.

In 1870 Pye-Smith was elected a Fellow of the Royal College of Physicians, and he later became examiner, a member of the council, and a censor. From 1900–9 he represented the college on the senate of the University of London, and held the office of vice-chancellor from 1903 to 1905. He was elected a Fellow of the Royal Society in 1886, and served on the council of the society in 1891–92. In 1899 he was appointed by the British Government joint representative with Sir Heron Maxwell at the International Congress on Tuberculosis in Berlin. He was a member of the General Medical Council and treasurer from 1901–7. He gave the address in medicine at the meeting of the British Medical Association at Ipswich in 1900. He was an hon. M.D. of the University of Dublin, an honorary fellow of the Royal College of Physicians of Philadelphia, and of the Royal Academy of Medicine in Ireland.

In 1883 his colleague Fagge died, leaving by his will the manuscript of his famous book on medicine to Pye-Smith for him to complete and see through the press. Pye-Smith greatly appreciated this act of his friend; he worked hard at the task, and was the means of giving to the world one of the best and most original books on medicine. He kept it up to date and edited the subsequent editions, so that it gradually contained more and more of Pye-Smith's writing, and the later editions were published as under the joint authorship of Fagge and Pye-Smith. This was his out-

standing work, but he wrote many medical papers, publishing the chief of them in the Guy's Hospital Reports. He contributed the article on Harvey in the "Encyclopædia Britannica," and delivered the Harveian oration in 1893. He was an admirable speaker, always saying just the right thing in just the right way. Nothing could have been better than the speech he made at the dinner given to Sir Samuel Wilks by his many admirers when he became a baronet.

Pye-Smith's honesty, his high ideals, his geniality, his affection for all learning—modern or ancient, medical or non-medical—and his many kindnesses especially to younger members of the profession, gave him troops of friends, and no one took more pleasure than he in getting them around him. All who knew him admired and liked him. Unhappily, illness kept him in retirement for several years before his death on May 23. In 1894 he married Gertrude, the youngest daughter of the late Arthur Foulger. She and their only child—a son—survive him.

NOTES.

THE Croonian Lecture of the Royal Society will be delivered on Thursday, June 11, by Prof. E. B. Wilson, of Columbia University, on the bearing of cytological research on heredity.

THE Institution of Electrical Engineers will hold a conversazione at the Natural History Museum, South Kensington, on Thursday, June 25. A conversazione of the Institution of Civil Engineers will be held at the institution on Thursday, July 2.

PROF. METCHNIKOFF, of the Pasteur Institute, is to be presented with a "golden" book to celebrate his scientific jubilee and his seventieth birthday. Prof. Metchnikoff, whose scientific work in zoology and microbiology is of a high order, is best known to the general public as the author of "The Prolongation of Life" and "The Nature of Man."

AT the Laryngological Section of the Royal Society of Medicine on May 27, Prof. Gustav Killian, of Berlin, demonstrated his method of examining the larynx and its annexes by means of a new instrument, the "suspension" laryngoscope. At the same time, a case of cancer of the throat was shown which had been treated by high-frequency electric currents—so-called diathermy—with promising results.

THE triennial Parkin prize of 100*l.* in the gift of the Royal College of Physicians of Edinburgh, has been awarded to Dr. Johnston-Lavis. The subject set was, "On the Effects of Volcanic Action in the Production of Epidemic Diseases in the Animal and in the Vegetable Creation, and in the Production of Hurricanes and Abnormal Atmospherical Vicissitudes." The prize essay will be published in book form by Messrs. Bale, Sons and Danielsson, Ltd.

SEVERAL important earthquakes have occurred during the past week. On May 26 a violent earthquake, the centre of which may have been in Central or South America, was recorded in European observatories. On May 27 another strong shock was felt at Panama, but again without damaging the canal works. On the same day an earthquake of unusual intensity, which seems to have originated near Tonga, was recorded at Sydney, the disturbance lasting for three hours.

MR. W. B. GROVE, writing from the University of Birmingham, says that any person interested in the study of the Uredinales may obtain a supply of the rare and remarkable parasite, *Puccinia vincae*, in a fresh condition, by sending a stamped and addressed envelope, or other suitable covering, to him at 46 Duchess Road, Birmingham. The specimens show an abundance of the curious debatable bodies called by Plowright "æcidia."

THE seventh congress of the International Association for Testing Materials will be held under the patronage of H.M. the Czar of Russia, in St. Petersburg, on August 12–17, 1915. Four days will be devoted to the discussion of the most important problems on testing materials. After the congress extensive excursions in the interior of Russia have been arranged. The offices of the British section of the Association are at the Iron and Steel Institute, 28 Victoria Street, London, S.W.

THE council of the Royal Society of Edinburgh has awarded the following prizes:—(1) The Neill prize for the biennial period 1911–12, 1912–13 to Dr. W. S. Bruce, in recognition of the scientific results of his Arctic and Antarctic explorations; (2) the Keith prize for the biennial period 1911–12, 1912–13 to Mr. J. Russell, for his series of investigations relating to magnetic phenomena in metals and the molecular theory of magnetism, the results of which have been published in the Proceedings and Transactions of the society, the last paper having been issued within the period.

MR. JAMES W. MUNRO, Wolfe-Barry student in entomology at the Imperial College of Science and Technology, South Kensington, who is engaged in working out the life-history of *Xestobium tesselatum* with regard to the roof of Westminster Hall, will be glad to be informed of any timber known to be affected with this beetle, and whether it would be possible for him to obtain it by purchase or to examine it for living beetles. He adds:—"Owing to the precarious condition of Westminster Hall roof, it is desirable that my investigations be carried out as soon as possible and a large supply of living beetles is the first essential."

SENSATIONAL paragraphs on seeing by wire have been going the rounds of the daily Press, but there is no indication in these accounts of anything fundamentally different from the plans that were put forward in the early days of the Physical Society, when the late Mr. Shelford Bidwell, Prof. Ayrton, and others were experimenting with selenium. At that time mosaics of selenium were going to do all that is promised now, but they never did. It may be that Dr. A. M. Low, whose apparatus has been described in perfervid terms in the daily Press, has made some progress, but the published accounts of the invention as "the latest scientific discovery" are absurd.

THE trustees of the Ray Lankester Fund are prepared to appoint the "Ray Lankester Investigator" for 1914. The fund has been founded in connection with the Marine Biological Association of the United Kingdom, and enables the trustees to rent a table at the Plymouth Laboratory of the association, and from time to time to appoint to it an investigator for twelve months. The investigator appointed will be expected during the year to spend a total of five months, which need not be continuous, carrying on his researches at Plymouth. The biologist appointed receives from the trust 70*l.*, of which half is to be paid to him when he enters into occupation of his table, and the other half when the five months' research is completed. Applications should be addressed to the director of the laboratory at Plymouth.

WE notice with regret the death, in his fifty-first year, of Prof. George Dean, Regius professor of pathology in the University of Aberdeen. After a distinguished career as a student in the Universities of Aberdeen, Berlin, and Vienna, Prof. Dean became University assistant to the professor of pathology at Aberdeen. In 1897 he was appointed bacteriologist in the serum department of the Lister Institute, and became senior bacteriologist in 1906. He was the author of numerous medical articles and of contributions to the Proceedings of the Royal Society and the transactions of other learned societies. He also introduced a rapid method of immunisation used in the preparation of diphtheria antitoxin. He was a member of the War Office Commission on Typhoid Inoculation.

THE tragic ramming and sinking of the steamer *Empress of Ireland* in the St. Lawrence River, resulting in the loss of more than one thousand human lives, gives particular interest to the article on the *Aquitania* in *Engineering* for May 29. This article deals at length with the subdivision of the ship by bulkheads and the effect on the buoyancy of flooding several compartments at either bow or stern, or wing compartments. Diagrams and curves are given showing that five compartments from the bow or five from the stern, including the three turbine rooms, may be flooded and still leave a satisfactory margin of safety. With all the wing compartments on one side of the ship flooded (taking 5320 tons of water), the ship would heel to the extent of 26°, which is not in any way excessive, although the contingency of such flooding is so remote as to be declared almost impossible. The fore-and-aft bulkheads on each side of the space occupied by the boilers extend for a distance of 450 ft. and are 18 ft. from the ship's skin, thus securing practically a "ship within a ship." The *Aquitania* left Liverpool for her maiden voyage on Saturday, May 30.

AT the meeting of the Cambridge Philosophical Society held on May 18 the following were elected honorary members of the society:—Dr. H. E. Armstrong; Prof. J. Bordet, the University, Brussels; Madame Curie, the Sorbonne, Paris; Prof. F. Czapek, the German University, Prague; Prof. T. W. Edgeworth David, the University, Sydney; Colonel W. C. Gorgas, Medical Corps, U.S.A. Army; Prof. P. H. von Groth, the University, Munich; Prof. Jacques Hadamard, the College of France, Paris; Dr. G. E. Hale, director of the Mount Wilson Solar Observatory; Dr. François A. A. Lacroix, Natural History Museum, Paris; Prof. C. Lapworth, late professor of geology, the University, Birmingham; Prof. H. Lebesgue, the Sorbonne, Paris; Dr. Jacques Loeb, the Rockefeller Institute, New York; Prof. Arthur Looss, the Government School of Medicine, Cairo; Prof. H. A. Lorentz, the University, Leyden; Prof. M. Planck, the University, Berlin; Lieut.-Col. Leonard Rogers, the Medical College, Calcutta; Prof. Gustav Schwalbe, the University, Strassburg; Dr. Karl Schwarzschild, the University, Berlin; Dr. D. H. Scott, foreign secretary, Royal Society; Prof. E. B. Wilson, Columbia University, New York; A. F. Yarrow, Blanefield, Glasgow; Prof. P. Zeeman, the University, Amsterdam. The society will celebrate in 1919 the centenary of its foundation.

IN *Peru To-day* (December, 1913) an interesting account is given of the anti-yellow fever campaign in Iquitos. This principally comprised measures for the destruction of the mosquito-carrier of this disease, the Stegomyia. Previously 500–600 deaths occurred annually from yellow fever, but since the institution of these measures not a single death from yellow fever occurred during the first seven months of 1913. The cost has been about 300*l.* a month.

"ORGANISMS and Origins" is the title of Prof. Dendy's presidential address to the Quekett Microscopical Club (*Journ. Quekett Microscop. Club*, April, 1914, p. 259). The origin of life was dealt with, and reference was made to Dr. Charlton Bastian's experiments. While admitting that Dr. Bastian's *a priori* position is a strong one, Prof. Dendy doubts if comparatively highly organised beings can be evolved so rapidly as seems to be the case in Dr. Bastian's solutions.

A COURSE of three public lectures on altitude and health has recently been delivered by Prof. Roget, of Geneva, under the Chadwick Trust. The lecturer directed attention to the changes which occur in the blood at high altitudes, to the relative freedom of the air from micro-organisms, and to the richness of the solar light in violet and ultra-violet rays. Exposure of the unclothed body to the brilliant alpine sun of winter exercises a marked curative effect on tuberculous conditions.

WITH reference to the mutations of *Bacillus anthracis* induced by exposure to ultra-violet rays (NATURE, April 23, p. 193), attention may be directed to the power which bacteria possess not only of secreting enzymes, but also of adapting the enzyme they secrete to the soil on which they are growing. Thus a bacterium which has been secreting peptonising enzymes on a protein soil will secrete a diastatic enzyme when transferred to a carbohydrate soil, as was demonstrated by Sir Lauder Brunton and the late Dr. Macfadyen (Proc. Royal Soc., vol. xlvi.).

IN the issue of *Folk-lore* for March, recently issued, Mr. W. Crooke discusses the remarkable vernal fire

festival of the Hindus, known as the Holi. A primitive form of the rite is the burning of a tree or pole, apparently symbolising the burning of the old year. To this are added various observances—fire-walking, swinging, burning of bush-fruits—which seem to be connected with the cult of fertility.

AT the last meeting of the Society of Antiquarians of Scotland, Mr. Ludovic Mann discussed certain elaborately carved balls of stone, of which some two hundred examples are known. It was believed that they were found in interments of the bronze and stone ages; but the style of decoration points to the conclusion that they range through the first two or three centuries of our era. Mr. Mann produces some strong evidence to show that they were used as movable poises or weights on weighing beams. He believes that they originated with the Roman *statera*, and that they throw light on the conditions of commerce in Scotland some two thousand years ago.

SINCE oceanography is a subject in which Norwegian physicists and naturalists have taken a prominent part, it is appropriate that a full memoir upon this branch of science appears in the April number of *Naturen*.

SUGGESTIONS with regard to the establishment of special rooms for children in museums are contributed by Mr. W. R. Butterfield, of the Hastings Museum, to the May issue of the *Museums Journal*. To anyone who has watched the aimless manner in which parties of children wander through the galleries of the Natural History Museum, the need and advisability of such special rooms—if only they can be made to attract the class for whom they are intended—will be self-apparent.

THE Zoological Society of Scotland is to be heartily congratulated on the complete success attending the first year's working of the Zoological Park, Edinburgh, of which a full account is given in the report of the council for the year ending March 31, a report notable on account of the number and beauty of the illustrations. Among donations to the menagerie mention may be made of a consignment of antarctic seals and penguins from Messrs. Chr. Salvesen and Co., of Leith, several antelopes and deer from the Duke of Bedford, and an elephant from the Maharaja of Mysore.

A PHOTOGRAPH of the pair of young sea-elephants, or elephant-seals, recently presented by the Duke of Bedford to the Zoological Society forms one of the most striking features in the May number of Mr. Douglas English's *Wild Life*. It is to be regretted that in the accompanying letterpress no mention is made of their place of origin, and the statement that "Head" Island (instead of Heard Island) is one of the breeding places of the species is misleading. It may also be mentioned that "neoteny" (p. 16) is not a term likely to be familiar to the class of readers for whom this publication is intended.

SEVERAL observers have in recent years experimented on the eggs of various animals by means of the centrifuge, with the view of determining the effects upon development of a redistribution of the various constituents of the cytoplasm. The latest contribution to this particular branch of the science of experimental embryology is a long memoir by Dr. J. W. Jenkinson, "The Relation between the Structure and the Development of the Centrifuged Egg of the Frog," published in the *Quarterly Journal of Microscopical Science* (vol. lx., part 1). This author finds that, as a result of centrifuging, the constituents of the cytoplasm are driven past one another in opposite directions, and that this disarrangement brings about distortion of development, or even prevents it altogether. Normal development appears to be conditioned by a definite arrangement of the visible cytoplasmic constituents, with the exception of the pigment. The yolk, glycogen, and fat, not being living substances, cannot, however, be properly termed organogenetic, and no evidence of the existence of distinct organogenetic bodies in the living protoplasm was obtained in the case of the frog's egg. Dr. Jenkinson arrives at the general conclusion, however, that the causes upon which the primary differentiation of the embryo depends are located in the cytoplasm. He maintains that the cytoplasm transmits those characters which determine the large group to which an organism belongs. Generic, specific, and varietal characters, on the other hand, are supposed to be carried by the chromatin substances of the nucleus, which, however, depends upon differences in the cytoplasm for the manifestation of its activities.

ACCORDING to investigations by Mr. J. N. Currie on the flavour of Roquefort cheese (*Journal of Agricultural Research*, vol. ii., No. 1) it has been found that a considerable amount of the fat is hydrolysed during the ripening period. The chief factor in this process would appear to be *Penicillium roqueforti*, which produces a water-soluble lipase, and thus leads to the accumulation of the acids of milk fat in both the free and combined forms. Of these acids, caproic, caprylic, and capric, and their readily hydrolysable salts, have a peppery taste, and are responsible for the characteristic burning effect of Roquefort cheese upon the tongue and palate.

SIR T. H. HOLLAND provides a very valuable bibliographical and critical index to "Indian Geological Terminology" in vol. xliii., part 1, of the Memoirs of the Geological Survey of India. Such lists are seldom readable, being intended only for reference; but in this case a student, going through these well-written pages with a map of India at his side, will learn a great deal about the geology of the country, and, incidentally, about the men who have developed our knowledge and the principles of stratigraphical research.

THE Geologists' Association furnishes in its Proceedings much useful information as to districts visited on excursions, and many of the descriptive papers serve to bring our text-book knowledge up to date. In recent issues a valuable series of papers has appeared on the Aberdeen and Arbroath area (vol. xxiii., part 5). The picturesque regions of southern Mayo and Sligo, still too little known, are described in vol. xxiv., part 2, with eight photographs of scenery and rock-structure; while the Mesozoic beds round

Nottingham are excellently illustrated in vol. xxv., part 2. In this last part, moreover, H. Dewey and R. A. Smith sustain the view that the sequence of Palæolithic culture at Swanscombe, in Kent, is identical with that established in France and Belgium. The publications of local societies also bear witness to the activity of geological observers, and especially of the amateurs who add so much to scientific knowledge in England. H. C. Beasley thus continues the description of the remarkable Triassic footprints at Storeton (Proc. Liverpool Geological Society, vol. xi., part iv.), and D. Woolacott furnishes an important paper on the stratigraphy and tectonics of the Permian of Durham (Proc. Univ. of Durham Philosophical Society, vol. v., part 5).

THE recent memoirs of the Geological Survey of Great Britain, each of which describes a sheet of the series of colour-printed maps, include "The Country around Newton Abbot," by W. Ussher and other authors, and "Fareham and Havant," by H. J. O. White. In the former, Clement Reid confirms Heer's correlation of the Bovey Tracey Beds with continental representatives now classed as highest Oligocene. The map (Sheet 339) includes the edge of the Dartmoor granite, and the seaside resorts of Exmouth, Dawlish, and Teignmouth, and, with the memoir, should be of great service to visitors in this very varied region. The Havant map and memoir pleasantly continue the series devoted to the Downs and the Cainozoic synclines of south-eastern England. Scotland furnishes Memoir and Sheet 82, on Central Ross-shire, and Memoir and Sheet 92, on the Fannich Mountains and Strath Broom. The names of B. N. Peach and J. Horne appear among the authors of both these publications, which deal with wild districts of pre-Cambrian and Cambrian rocks. Despite their moderate price (2*s.* 3*d.* and 2*s.* 6*d.*), both works are illustrated with landscapes which are chosen with the eye of a geologist, but which will equally delight any lover of the highlands. The many students of thrust-structure and mountain-building will find new diagrams and new material in both these interesting memoirs.

"THE Oil Resources of the Empire" formed the subject of an address by Dr. F. M. Perkin, recently delivered before the Society of Arts, and published in the Journal of the society (vol. lxii., No. 3204). It is not generally realised how vast is the consumption of mineral oils in the United Kingdom, and how small a proportion is supplied from within the Empire itself. Out of a consumption of more than four million gallons only 2·67 per cent. was derived from British sources. It is hoped that by systematic surveys new sources of supply may be located, and valuable sources of oil may in future be found in the great shale beds of Tasmania. Much, too, remains to be done in increasing the supply of vegetable oils, more particularly of linseed oil, which might with advantage be produced extensively on British soil. One of the most striking features of recent years has been the rise of the soy oil industry, and in view of the fact that the crushing industry has now fallen largely into Japanese hands, it is suggested that attempts should be made to cultivate the soy plant in British territory.

AMONG recent American papers on the chemistry of soils the following may be noted. Mr. G. W. Wilson, in the *Biochemical Bulletin* (vol. ii., No. 10), reports a series of experiments on the effect of heating the soil on plant growth. It appears that heating the soil to a temperature of 95° C. caused slight acceleration of growth, but a higher temperature (135° to 175°) brought about a marked retardation; plants grown on the heated soil were more susceptible, however, to attack by parasitic fungi. In the same number of the *Biochemical Bulletin*, Mr. A. W. Thomas gives a convenient summary of the methods adopted by Schreiner and Shorey for isolating and detecting organic soil constituents, whilst in the *Journal of Agricultural Research* (vol. i., No. 5, p. 357) Mr. E. C. Shorey describes the isolation of certain derivatives of benzene from samples of sandy soil from Florida at present devoted to orange culture. These compounds were benzoic acid (350 lb. per acre foot), metahydroxytoluic acid (800 lb.), and vanillin (40 lb.), of which the latter at least appears to exist in the soil in the free state, probably being an unchanged residue of plant débris.

VOL. LXVII. of the *Annalen der Physik* contains an important series of four papers, one by Prof. Stark alone, and three by him in cooperation with others, on the effect of electric fields on spectrum lines. Since the discovery of the magnetic change of radiation frequency by Zeeman, various physicists have tried to discover an analogous electric effect. Prof. Stark has succeeded in affecting the spectrum lines emitted by canal rays in a vacuum tube by submitting them to an electric field, ingeniously arranged between a perforated kathode and an auxiliary electrode at a few millimetres' distance. The field intensity amounts to 30,000, and in some experiments even to 47,000, volts per cm. When the observation is made at right angles to the field, the spectrum lines are split up into polarised components under the action of the field, which proves to be rather homogeneous. The separation of the components is proportional to the field intensity. The hydrogen, helium, and lithium lines are studied in detail. For the line H_β (4861 Å.U.) the separation of the outer components, which vibrate parallel to the field, becomes about 8 Å.U. in a field of 28,500 volts per cm. In a direction parallel to the electric field the components of the resolved lines are unpolarised. The analogy between the Zeeman effect and the electric effect consists in the spectrum lines being resolved by both kinds of fields; but in all details there are great differences. The magnetic resolution is, with some limitations, the same for all lines belonging to the same spectrum series, and it decreases toward the violet end of the spectrum. The electric resolution is different for succeeding lines of a series, and the effect increases with decreasing wavelengths. Diffuse lines are most strongly affected by the electric field. The two yellow sodium lines show only a very small electric effect. The mechanism of the magnetic effect is certainly understood in its main features, but the exact meaning of the electric effect is still obscure.

LAST week's *Times Engineering Supplement* contains an excellently written article by Prof. J. A.

Fleming on recent scientific research in telephony. It is a description of the practical developments which have been the outcome of mathematical investigations (originated in the first place by Mr. Oliver Heaviside) into the effect of inductance in telephone circuits, followed much later by painstaking experiment and trials on a large scale. A quarter of a century ago, Heaviside's insistence that the solution of the problem of long-distance telephony lay in the distribution of inductance throughout the line met with a cold reception by the engineering department of the Post Office. Heaviside would do no more than expound his theory in his own way, and with his own mathematical notation, leaving its development to the "practicians"; but the practicians of those days were lacking either in the ability or the inclination to study his writings. It is one of the saddest things in the history of British science that Heaviside's work should then have been regarded as possessing no more than an academic value, and that his suggestions did not take practical effect in this country until they had been revived by an American many years later, and sent back to us as a new invention. Prof. Fleming clearly explains the present application of distributed inductance in enabling us to telephone over enormous distances; he describes the "phantom" circuit which permits two pairs of lines to be employed for three conversations simultaneously; he has remembered to mention the effect of reflection at junctions between overhead and underground lines, and concludes with a plea for further systematic investigation; but he has forgotten one thing: Oliver Heaviside's name does not appear once in the article.

THE June issue of the catalogue of Mr. Francis Edwards, 83 High Street, Marylebone, London, W., is concerned with miscellaneous literature, and gives a clearance list of second-hand books in a great variety of subjects. The sections dealing with alpine studies, birds, and general natural history are of special interest.

PROF. WALTER RIPPMANN, who has been for some time actively associated with the movement for spelling reform, asks us to state that though he could subscribe to most of what is said in the review of Mr. Archer Wilde's "Sounds and Signs," signed "W. R.," in NATURE of May 28, the review should not be attributed to him.

The following are among the forthcoming books of science announced by the *Cambridge University Press*:—The Royal Society's Catalogue of Scientific Papers, vol. xiii., covering the letters A and B; The Life, Letters, and Labours of Francis Galton, compiled by Prof. Karl Pearson, 2 vols; The Philosophy of Biology, by Dr. J. Johnstone; Ancient India, by Prof. E. J. Rapson; English Folk-Song and Dance, by F. Kidson and M. Neal; Perception, Physics, and Reality, by C. D. Broad; Philosophy: What is it? by Dr. F. B. Jevons; Mechanical Drawing, by J. H. Dales; Household Science, by C. W. Hale; The Place-Names of Sussex, by R. G. Roberts; Geography of the British Isles, by Dr. Mort; Pond Problems, by E. E. Unwin, and Bird Studies, by W. P. Westell; the *Oxford University Press* will publish shortly The Oxford Survey of the British Empire, in six 8vo volumes, edited by Prof. A. J. Herbertson and Mr. O. J. R. Howarth, in collaboration with seventy-three contributors; and *Messrs. Rivingtons* give notice of A Course of Geometry—Theoretical and Practical, by A. H. Bell, and a cheaper edition of Machine Drawing and Design, by Dr. W. Ripper.

OUR ASTRONOMICAL COLUMN.

ROTATING NEBULÆ.—In the *Daily Mail* of May 27 the following cablegram addressed to Prof. Lowell was published:—"Flagstaff, Arizona. Spectrograms show Virgo nebula rotating. Slipher." Up to the time of writing no further information is at hand, and it is not certain which is the nebula in question. The discovery is one of extreme importance, because, although the majority of nebulæ are of the spiral form, and such shape suggests a motion round a centre, a direct determination of the velocity of movement puts this question of movement beyond doubt. The observation is a most delicate one and requires all the resources of modern instrumental equipment and the best of observing conditions.

COLLATED LIST OF LUNAR FORMATIONS.—Selenographers will welcome the issue of the collated list of lunar formations, named or lettered in the maps of Neison, Schmidt, and Mädler, which has been compiled and annotated by Miss M. A. Blagg, under the direction of the late Mr. S. A. Saunder. It was due to Mr. Saunder's energy that a lunar nomenclature committee of the International Association of Academies was formed. Finding that lunar nomenclature was in an unsatisfactory state he desired to remedy the defect by having a nomenclature adopted once and for all by universal assent. This publication therefore forms the basis on which the names of the formations can be adopted. The preparation of an accurate map of the moon in mean libration was also undertaken by Messrs. Saunder and Franz, and it is hoped that this chart will soon be completed. Prof. Turner, in the introduction to the volume, directs attention to the severe losses by death of the committee, namely, Loewy, Newcomb, Saunder, and Franz, necessitating the nominal direction of it being placed in his hands.

THE LIGHT OF STARS.—The March number of *Le Radium*, which reached us a few days ago, contains a paper by Dr. A. H. Pfund, of Johns Hopkins University, in which he describes some preliminary tests he has made of a new apparatus for measuring the light of a star. The work was done at the Allegheny Observatory, the Keeler 30-in. reflector being used. In the focus of the telescope, either of two small blackened discs which formed the junctions of a thermo-circuit could be placed. The wires used for the thermo-element were alloys of bismuth and tin, and of antimony and bismuth respectively. They were enclosed in an evacuated capsule closed at one end by a plate of fluorite and substituted for the eyepiece of the telescope. The thermo-current was measured by a moving-coil galvanometer. The sensitiveness of the arrangement was such that a candle at a distance of eight miles would give a deflection of one millimetre. The deflections obtained from celestial objects were: Vega, 7·5; Jupiter, 3·0; Altair, 2·0 mm. The author hopes by using a more sensitive galvanometer and other materials for his thermo-elements, to increase the sensitiveness considerably, and in this way to open up a new field of astrophysical research.

THE SPECTRUM OF η CARINÆ (η ARGUS).—The study of the spectrum of the well-known variable η Carinæ, or as perhaps known better under the name of η Argus, has been undertaken by numerous workers, but the latest research on this star forms No. 252 of the Lick Observatory Bulletin, and is contributed by Messrs. J. H. Moore and R. F. Sanford. The spectrograms here described and studied were secured with the one-prism spectrograph of the D. O. Mills Expedition, at Santiago, Chili. The iron arc was used as a comparison spectrum, and the spectrograph was provided with a constant temperature case. The authors reproduce a plate showing the spectrum secured on March 28, 1913, and give tables of wave-length determinations, with comparisons with the chromosphere, laboratory spectra, and Nova Aurigæ. A brief summary of their results is as follows:—The spectrum is essentially a bright-line spectrum, a number of these lines being identified with the enhanced lines of iron, titanium, and chromium. The titanium and chromium lines show a greater displacement towards the violet than do the iron lines, the latter indicating a velocity of approach of 28 km. a second. The iron lines are in general the stronger lines, those of titanium and chromium being classed among the weaker lines. The origins of several strong lines are still unknown, and notable absentees are the lines of helium, the nebular lines, and 4481 A magnesium. Some evidence suggests the doubling of the hydrogen lines. The authors conclude that the spectrum of η Carinæ is closely associated with that of novæ at an early stage, and that possibly η Carinæ is a nova. Its position in a great nebula further supports this conclusion.

SCOTTISH FISHERY INVESTIGATIONS.[1]

"THE Fifth Report (Northern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters" is the last of a series of reports, issued by H.M. Stationery Office during recent years, which have contained the detailed accounts of work done in this country in connection with the international fishery investigations. The whole series appearing under the above general title comprises five Blue-books dealing with the northern area (Cd. 2612, 3358, 4350, 4893, and 6950), where the work has been carried out by the Fishery Board for Scotland, and five dealing with the southern area (Cd. 2670, 3837, 4641, 5546, and 6125), where the work was done by the Marine Biological Association of the United Kingdom. Other reports dealing with the English statistical side of the international work have been published by the Board of Agriculture and Fisheries (Cd. 4227, 4738, 5362, and 5686).

In the introductory statement to the volume under review the Scottish Fishery Board announces that the results of future investigations will find publication among the Board's ordinary scientific reports. As the southern work is now entirely conducted by the Board of Agriculture and Fisheries, it is to be presumed that the reports dealing with it will be issued in a similar way by that Board. It may therefore be hoped that this change in the mode of publication marks the establishment of the investigations upon a permanent footing instead of their being regarded as merely temporary as heretofore. From the commencement it has been obvious that such work could only accomplish its full purpose when continued over a long series of years, and the Scottish Fishery Board, and especially Prof. D'Arcy Thompson, its scientific member, under whose superintendence the northern investigations have been carried out, are to be congratulated not only upon the completion of the five volumes of the present series of reports, but still more upon the future prospects of the undertaking.

The first four volumes issued under the direction of the Scottish Board dealt chiefly with hydrographical and statistical researches. In this fifth report, in addition to these subjects, we have accounts of some of the results of the more biological investigations carried out by the research steamer *Goldseeker*. Prof. D'Arcy Thompson is responsible for the first memoir, in which he deals chiefly with the sizes and the distribution of plaice on the basis of the hauls of the research steamer and on the Aberdeen market statistics. A further report on the plaice and other flat fishes, by Dr. T. W. Fulton, based on special statistics of individual catches of Aberdeen trawlers extending over a period of ten years (1901–10) treats of the distribution and seasonal abundance of these fishes in the different areas of the North Sea fished by the trawlers. Dr. Fulton also divides the statistics into two periods of five years, 1901–5 and 1906–10, and contrasts the quantities of field yielded in a hundred hours' fishing in the first and second periods. It is shown that in the case of plaice the weight landed per unit of fishing is less in the second period than in the first, but that whilst this decrease is marked in the case of large and medium-sized fish, there is an actual increase in the weight of small plaice landed during the second period as compared with the first.

The same feature is also brought out by the Aberdeen market statistics for the years 1905–11, which show a progressive decrease in the average catch per voyage of large and medium plaice, but a progressive increase in the catch of small. In dealing with the question of the increased landing of very small plaice, Prof. D'Arcy Thompson expresses the opinion that their destruction is detrimental to the fishery, and that it yields no commensurate benefit to the trade, a view which supports the recommendation of Prof. Heincke, which will come under the consideration of the International Council, that an international size limit of 10 in. should be enforced for plaice.

A second memoir by Dr. Fulton deals with the plaice-marking experiments. Unfortunately the number of fish marked in Scottish waters has not been large; indeed, it has not been sufficiently large to give results of a very definite kind. There can be no doubt that such experiments, when carried out upon a sufficiently extensive scale, are capable of yielding information of quite exceptional value, and we are glad to learn from the Board's introductory statement that since the period covered by the experiments here dealt with, others have been conducted upon a much larger scale.

The volume concludes with a memoir by Dr. A. J. Robertson on the hydrographical investigations for 1909–10. No new features of a striking character were found during the two years dealt with, but the work has now been carried on over a sufficient period to show what is the ordinary, normal distribution of salinities and temperatures in the area dealt with, and a useful summary of these conditions is given.

E. J. A.

[1] Fishery Board for Scotland. Fifth Report (Northern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters, 1908–11. Cd. 6950.

THIRTEEN YEARS' MEASUREMENTS OF SOLAR RADIATION.

IN a paper entitled "Valeurs Pyrheliométriques et les sommes d'insolation à Varsovie," Dr. Ladislas Gorczynski discusses the measurements which he has made at Warsaw with actinometers and pyrheliometers during the thirteen years 1901–1913. The results are to some extent of a provisional character, and they have been published chiefly with a view of assisting the Commission on Solar Radiation in its

inquiry into the exceptional character of the latter half of the year 1912. During that period the intensity of solar radiation appeared generally to be considerably below the values previously found; the decrease was indeed so marked that it could be detected in the records from the Campbell-Stokes instrument which is designed primarily for the registration of duration of sunshine. The diminution has been attributed to the presence in the atmosphere of an exceptional amount of fine dust arising from the volcanic eruption of Katmai, in Alaska, at the end of June, 1912.

An ingenious explanation of the way in which the dust may stop the solar radiation without keeping in the earth's radiation to anything like the same degree has been put forward by Humphreys, in the Bulletin of the Mount Weather Observatory. The particles of dust have a diameter almost certainly greater than the wave-lengths of the most intense solar radiation, and smaller than the wave-lengths of terrestrial or atmospheric radiation, so that they would reflect the former but merely scatter the latter; and Humphrey's calculations show that the reflection would be much more effective than the scattering. Thus the effect on the temperature at the earth's surface is the reverse of that due to an increase in the *absorbing* power of the atmosphere, such as would be produced by increasing the water vapour or carbon dioxide in it. The theory is both novel and important; it indicates a method by which purely terrestrial agencies may profoundly affect the mean temperature of the globe, which may be sufficient justification for this digression.

The measurements at Warsaw bear out those found at other places; the intensity of radiation was slightly above the average for the earlier months of 1912, but from July to the end of the year it was nearly 20 per cent. below the average. The amount of the deficiency decreased in the first three months of 1913, and thenceforward the radiation appears to have been about normal. The latest values given are those for July, 1913.

The only other year in the period during which the records show a deficiency comparable with that for 1912 was 1903 (and the last two months of 1902), after the eruptions of Mont Pelée, Santa Maria, and Colima. It will be remembered that 1903 was a year remarkable in this country for its excessive rainfall and its disturbance of meteorological statistics and theories of periodicity.

The results of the whole series of measurements are discussed very fully for different altitudes of the sun, different times of day, and different conditions of the atmosphere, especially as regards humidity. The main text is in Polish, but the headings of the tables are given also in French, and there is a summary in French at the end of the paper.

E. GOLD.

AMERICAN RESEARCH ON CLAYS.[1]

A CONSIDERABLE amount of interesting work in connection with clays and the clay industries has been done in recent years in Germany and in America, and no one has worked more enthusiastically than Messrs. Ashley and Bleininger. In Germany, too, Drs. Rieke and Endell are doing really fine work. The untimely death of the writer of the first-named pamphlet—Mr. H. E. Ashley—was a sad loss which must have considerably retarded subsequent developments. The clay industries the world over owe the Bureau of Standards, etc., in the United States a debt of gratitude for having set aside such men as Messrs. Ashley and Bleininger to devote their whole time to this work, and the results must be a source of satisfaction to the authorities responsible for the innovation.

The posthumous pamphlet by Mr. Ashley, together with his "The Colloidal Matter of Clay and its Measurement" (1909), form a kind of monograph, or rather a brief advocating the colloidal theory as an explanation of the many curious properties of clays. Mr. Ashley was an extremist, and in consequence we have here probably the best possible statement of the theory without those doubts and difficulties which perplex and hamper less enthusiastic temperaments. For that reason, Mr. Ashley's brief is particularly valuable, even though it is certain that some of the applications of the colloidal theory will not be able to stand, in their present form, before adverse criticism.

The colloidal theory has been mainly directed to explaining the plasticity of clays. The argument appears to run somewhat as follows:—The plasticity of clays is determined by the contained colloidal matter (and also by the degree of fineness of the constituent particles of the clay). The greater the plasticity, the greater the proportion of colloids. Colloids are always present in clays in unknown quantities, and the proportion of colloids in clays of different plasticity varies in accord with theoretical requirements! The amount of colloidal matter in a clay is assumed to be proportional to the dye-absorptive power of the clay, and this, in turn, is stated to be proportional to the plasticity.

As a matter of fact, the real plasticity of a clay is not so easily measured. The potter's thumb is the ultimate test, and any process of measurement must express by number those complex sensations which the potter "feels" when he estimates the plasticity of a clay. If measurements of the dye-absorptive power and of the fineness of the grain of a clay will do this, then the problem is solved in a most simple and interesting manner. Unfortunately, the method breaks down completely in practice. Consequently, we cannot really go further than this: the known facts favour the colloidal theory as the best qualitative explanation of plasticity yet suggested, but no one has succeeded in satisfactorily demonstrating the theory quantitatively. Thus we return to the view held by a writer in the eighteenth century, who stated that "the plasticity is due to the presence of a greasy medium between the particles of the clay." It is difficult to see how the plasticity of clays can be measured unless it be treated as a mechanical problem; and to the present writer, Zschokke's analysis of plasticity is far and away the greatest advance that has yet been made.

The two other pamphlets seem to be an application to American clays of some ideas suggested by the present writer in several papers a few years ago: "On the Speed of Vitrification of Clays," etc. Clays are made up of a heterogeneous mixture of particles of different sizes and composition; when clay products—bricks, etc.—are being fired, the more refractory particles start dissolving in the matrix formed by those which melt first. In the extreme case, the whole would form a homogeneous vitreous mass. The firing is stopped before this condition is reached. The stage at which the process of vitrification is arrested is determined by the nature of the required products—porcelain, firebricks, etc.—and on the character of the particular clay "body" being used. Each clay has its own specific character, and this explains how a fireman with no sound principles to guide him—but a triumph of empiricism with one, or maybe two, types of clay—often fails ignominously when he is transferred from one district to another, using a different type of clay.

J. W. MELLOR.

[1] H. E. Ashley, Technical Control of the Colloidal Matter of Clays; G. H. Brown, The Function of Time in the Vitrification of Clays; A. V. Bleininger and E. T. Montgomery, Effect of Overfiring upon the Structure of Clays. Three Technological Papers of the Bureau of Standards. (Washington, D.C., U.S.A., 1913.)

FLUID MOTIONS.[1]

IT is apparent that in dealing with a large and interesting class of fluid motions we cannot go far without including fluid friction, or viscosity as it is generally called, in order to distinguish it from the very different sort of friction encountered by solids, unless well lubricated. In order to define it, we may consider the simplest case where fluid is included between two parallel walls, at unit distance apart, which move steadily, each in its own plane, with velocities which differ by unity. On the supposition that the fluid also moves in plane strata, the viscosity is measured by the tangential force per unit of area exercised by each stratum upon its neighbours. When we are concerned with internal motions only, we have to do rather with the so-called "kinematic viscosity," found by dividing the quantity above defined by the density of the fluid. On this system the viscosity of water is much *less* than that of air.

Viscosity varies with temperature; and it is well to remember that the viscosity of air increases while that of water decreases as the temperature rises. Also that the viscosity of water may be greatly increased by admixture with alcohol. I used these methods in 1879 during investigations respecting the influence of viscosity upon the behaviour of such fluid jets as are sensitive to sound and vibration.

Experimentally the simplest case of motion in which viscosity is paramount is the flow of fluid through capillary tubes. The laws of such motion are simple, and were well investigated by Poiseuille. This is the method employed in practice to determine viscosities. The apparatus before you is arranged to show the diminution of viscosity with rising temperature. In the cold the flow of water through the capillary tube is slow, and it requires sixty seconds to fill a small measuring vessel. When, however, the tube is heated by passing steam through the jacket surrounding it, the flow under the same head is much increased, and the measure is filled in twenty-six seconds. Another case of great practical importance, where viscosity is the leading consideration, relates to lubrication. In admirably conducted experiments Tower showed that the solid surfaces moving over one another should be separated by a complete film of oil, and that when this is attended to there is no wear. On this basis a fairly complete theory of lubrication has been developed, mainly by O. Reynolds. But the capillary nature of the fluid also enters to some extent, and it is not yet certain that the whole character of a lubricant can be expressed even in terms of both surface tension and viscosity.

It appears that in the extreme cases, when viscosity can be neglected and again when it is paramount, we are able to give a pretty good account of what passes. It is in the intermediate region, where both inertia and viscosity are of influence, that the difficulty is greatest. But even here we are not wholly without guidance. There is a general law, called the law of dynamical similarity, which is often of great service. In the past this law has been unaccountably neglected, and not only in the present field. It allows us to infer what will happen upon one scale of operations from what has been observed at another. On the present occasion I must limit myself to viscous fluids, for which the law of similarity was laid down in all its completeness by Stokes so long ago as 1850. It appears that similar motions may take place provided a certain condition be satisfied, viz., that the product of the linear dimension and the velocity, divided by the kinematic viscosity of the fluid, remain unchanged. Geometrical similarity is presupposed. An example will make this clearer. If we are dealing with a single fluid, say air under given conditions, the kinematic viscosity remains of course the same. When a solid sphere moves uniformly through air, the character of the motion of the fluid round it may depend upon the size of the sphere and upon the velocity with which it travels. But we may infer that the motions remain *similar*, if only the product of diameter and velocity be given. Thus, if we know the motion for a particular diameter and velocity of the sphere, we can infer what it will be when the velocity is halved and the diameter doubled. The fluid velocities also will everywhere be halved at the *corresponding* places. M. Eiffel found that for any sphere there is a velocity which may be regarded as critical, *i.e.* a velocity at which the law of resistance changes its character somewhat suddenly. It follows from the rule that these critical velocities should be inversely proportional to the diameters of the spheres, a conclusion in pretty good agreement with M. Eiffel's observations.[2] But the principle is at least equally important in effecting a comparison between different fluids. If we know what happens on a certain scale and at a certain velocity in *water*, we can infer what will happen in *air* on any other scale, provided the velocity is chosen suitably. It is assumed here that the compressibility of the air does not come into account, an assumption which is admissible so long as the velocities are small in comparison with that of sound.

But although the principle of similarity is well established on the theoretical side and has met with some confirmation in experiment, there has been much hesitation in applying it, due perhaps to certain discrepancies with observation which stand recorded. And there is another reason. It is rather difficult to understand how viscosity can play so large a part as it seems to do, especially when we introduce numbers, which make it appear that the viscosity of air, or water, is very small in relation to the other data occurring in practice. In order to remove these doubts it is very desirable to experiment with different viscosities, but this is not easy to do on a moderately large scale, as in the wind channels used for aeronautical purposes. I am therefore desirous of bringing before you some observations that I have recently made with very simple apparatus.

When liquid flows from one reservoir to another through a channel in which there is a contracted place, we can compare what we may call the *head* or driving pressure, *i.e.* the difference of the pressures in the two reservoirs, with the *suction*, *i.e.* the difference between the pressure in the recipient vessel and that lesser pressure to be found at the narrow place. The ratio of head to suction is a purely numerical quantity, and according to the principle of similarity it should for a given channel remain unchanged, provided the velocity be taken proportional to the kinematic viscosity of the fluid. The use of the same material channel throughout has the advantage that no question can arise as to geometrical similarity, which in principle should extend to any roughness upon the surface, while the necessary changes of velocity are easily attained by altering the head and those of viscosity by altering the temperature.

The apparatus consisted of two aspirator bottles (Fig. 1) containing water and connected below by a passage bored in a cylinder of lead, 7 cm. long, fitted water-tight with rubber corks. The form of channel actually employed is shown in Fig. 2. On the up-stream side it contracts pretty suddenly from full bore (8 mm.) to the narrowest place, where the diameter is 2·75 mm. On the down-stream side the

[1] From a discourse delivered at the Royal Institution on March 20 by the Right Hon. Lord Rayleigh, O.M., F.R.S.

[2] *Comptes rendus*, December 30, 1912, January 13, 1913.

expansion takes place in four or five steps, corresponding to the drills available. It had at first been intended to use a smooth curve, but preliminary trials showed that this was unnecessary, and the expansion by steps has the advantage of bringing before the mind the dragging action of the jets upon the thin layers of fluid between them and the walls. The three pressures concerned are indicated on manometer tubes as shown, and the two differences of level representing head and suction can be taken off

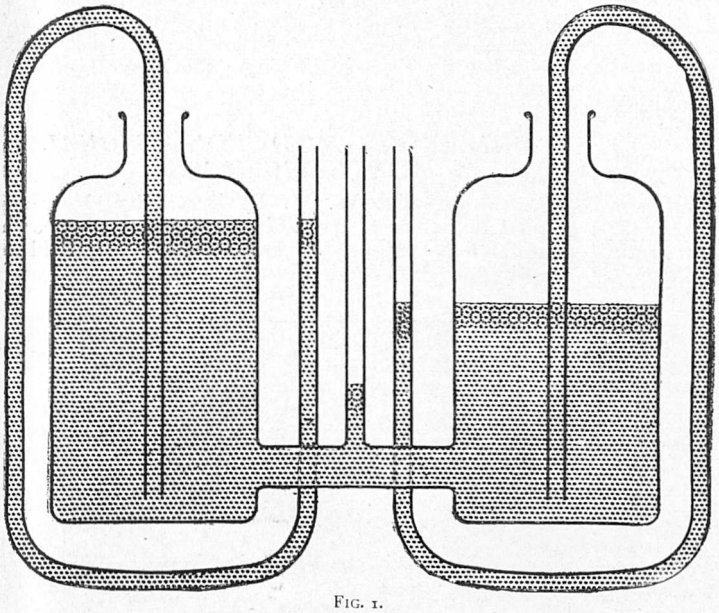


FIG. 1.

with compasses and referred to a millimetre scale. In starting an observation the water is drawn up in the discharge vessel, so far as may be required, with the aid of an air-pump. The rubber cork at the top of the discharge vessel necessary for this purpose is not shown.

As the head falls during the flow of the water, the ratio of head to suction increases. For most of the observations I contented myself with recording the head for which the ratio of head to suction was exactly 2 : 1, as indicated by proportional compasses. Thus on January 23, when the temperature of the water was 9° C., the 2 : 1 ratio occurred on four trials at 120, 130, 123, 126, mean 125 mm. head. The temperature was then raised with precaution by pouring in warm water with passages backwards and forwards. The occurrence of the 2 : 1 ratio was now much retarded, the mean head being only 35 mm., corresponding to a mean temperature of 37° C. The ratio of head to suction is thus dependent upon the head or velocity, but when the velocity is altered the original ratio may be recovered if at the same time we make a suitable alteration of viscosity.

And the required alteration of viscosity is about what might have been expected. From Landolt's tables I find that for 9° C. the viscosity of water is 0·01368, while for 37° C. it is 0·00704. The ratio of viscosities is accordingly 1·943. The ratio of heads is 125 : 35. The ratio of *velocities* is the square-root of this, or 1·890, in sufficiently good agreement with the ratio of viscosities.

In some other trials the ratio of velocities *exceeded* a little the ratio of viscosities. It is not pretended that the method would be an accurate one for the comparison of viscosities. The change in the ratio of head to suction is rather slow, and the measurement is usually somewhat prejudiced by unsteadiness in the suction manometer. Possibly better results would be obtained in more elaborate observations by several persons, the head and suction being recorded separately and referred to a time scale so as to facilitate interpolation. But as they stand the results suffice for my purpose, showing directly and conclusively the influence of viscosity as compensating a change in the velocity.

In conclusion, I must touch briefly upon a part of the subject where theory is still at fault, and I will limit myself to the simplest case of all—the uniform shearing motion of a viscous fluid between two parallel walls, one of which is at rest, while the other moves tangentially with uniform velocity. It is easy to prove that a uniform shearing motion of the fluid satisfies the dynamical equations, but the question remains : Is this motion stable? Does a small departure from the simple motion tend of itself to die out? In the case where the viscosity is relatively great, observation suggests an affirmative answer; and O. Reynolds, whose illness and comparatively early death were so great a loss to science, was able to deduce the same conclusion from theory. Reynolds's method has been improved, more especially by Prof. Orr of Dublin. The simple motion is thoroughly stable if the viscosity exceed a certain specified value relative to the velocity of the moving plane and the distance between the planes; while if the viscosity is less than this, it is possible to propose a kind of departure from the original motion which will increase *for a time*. It is on this side of the question that there is a deficiency. When the viscosity is very small, observation appears to show that the simple motion is unstable, and we ought to be able to derive this result from theory. But even if we omit viscosity altogether, it does not appear possible to prove instability *a priori*, at least so long as we regard the walls as mathematically plane. We must confess that at the present we are unable to give a satisfactory account of skin-friction, in order to overcome which millions of horse-power are expended in our ships. Even in the older subjects there are plenty of problems left!

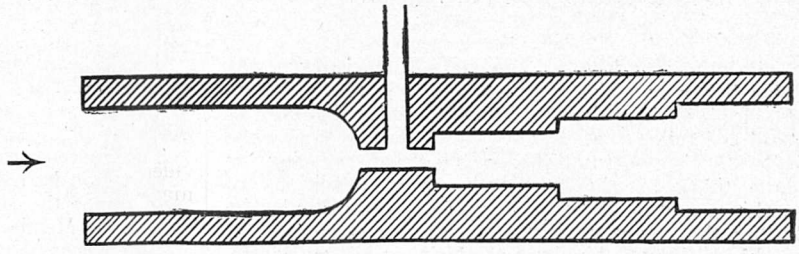
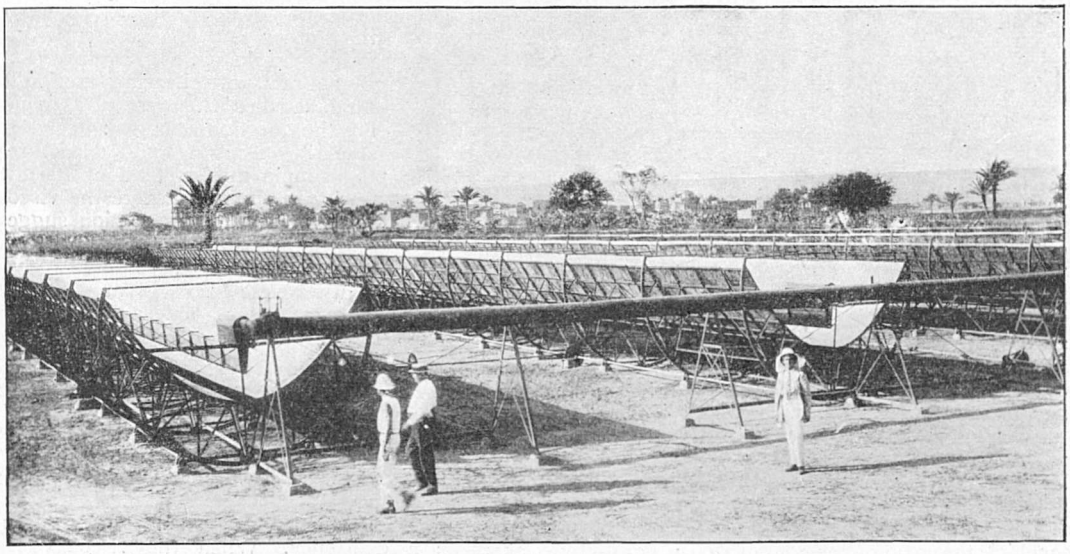


FIG. 2.

THE UTILISATION OF SOLAR ENERGY.[1]

AFTER naming the principal workers in this field, the author gives determinations of the solar constant and deals fully with the varying percentages of this quantity that are available throughout the day for power purposes. He then describes four types of Shuman sun heat absorbers and gives in great detail the results of his forty-eight trials of these absorbers, the latest pattern (that erected near Cairo, Egypt) of which gave a maximum thermal efficiency of no less than 40·7 per cent., and a maximum output of steam of 1442 lb. an hour at a pressure of 15·8 lb. per sq. in. abs. The results of these types of absorbers are compared by means of tables and curves, and from these the author has constructed a formula by means of which it is easy to calculate for a given type and size of absorber the total output of steam an hour if three things are known: (1) the time of day; (2) the humidity; and (3) the steam pressure. It has been known that humidity adversely affects the quantity of solar radiation arriving at the earth's solid surface, but this is the first time that its effect on solar steam production has been quantitatively determined.



The Meadi Absorber. Looking N.E. and showing the reflectors in the mid-day position. There are 5 reflectors each 205 ft. long, and 13 ft. 5 in. wide at the top.

The difference between the thermal efficiency of the solar boiler and the commercial value of the steam produced is ingeniously brought out, the author making it clear that in the case of such low-pressure boilers a high thermal efficiency is not necessarily the same thing as the most economical conditions of working, and he shows that, up to a certain limit, the higher the steam pressure, the more economical the working, though the thermal efficiency is then lower. Two of the types of absorber did not move with the sun, and one did. The greater constancy of output of steam in the case of the latter is very marked.

In order to utilise the low-pressure steam economically, Mr. Frank Shuman designed a special engine which has also gone through several stages. This engine is fully described with drawings, and the author gives the results of his fourteen trials of the several engines and compares their results with those of exhaust steam turbines and the low-pressure cylinders of compound- and triple-expansion engines, showing that the Shuman engine is the more economical. The steam consumption of one of these engines was only 22·1 lb. per B.H.P. hour, when the output was 94·5 B.H.P., and the steam pressure only 16·2 lb. per sq. in. abs. The thermal efficiency of the engine compared with an engine working on the Rankine cycle was 54·75 per cent. In the case of a Shuman high-pressure non-condensing engine with an output of 29 B.H.P., the steam consumption was 23·8 lb. per B.H.P. hour, and the relative thermal efficiency 71·7 per cent.

Finally the author gives the results of his trials of the complete sun power irrigation plant at Cairo, and describes his design of a special form of weir tank for measuring greatly differing quantities of water.

[1] Summary of a paper read before the Society of Engineers (Incorporated) on April 6, by Mr. A. S. E. Ackermann.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. W. H. R. Rivers has been appointed to represent the University at the nineteenth International Congress of Americanists to be held at Washington, U.S.A., in October next.

The Special Board for Biology and Geology has nominated Dr. Shipley as the representative of the University on the council of the Marine Biological Association.

The Sudbury Hardyman prize offered for an original dissertation by a graduate member of Emmanuel College under the standing of M.A., has been awarded to Mr. G. Matthai, for a treatise entitled "A Revision of the Recent Colonial Astræidæ Possessing Distinct Corallites."

OXFORD.—The Halley Lecture in 1915 will be delivered by Dr. F. W. Dyson, F.R.S., late fellow of Trinity College, Cambridge, Astronomer Royal.

The Hon. Bertrand A. W. Russell, F.R.S., late fellow of Trinity College, Cambridge, has been elected Herbert Spencer lecturer for the year 1914–15.

The Romanes Lecture, as previously announced, will be delivered by Sir J. J. Thomson, O.M., F.R.S., on June 10, at 3 o'clock. Subject, "The Atomic Theory."

DR. C. W. CHAMBERLAIN has been inaugurated presi-

dent of Denison University, Ohio. From 1901 to 1908 Dr. Chamberlain occupied the chair of physics in that institution. Since the latter date he has held the professorship of that subject in Vassar College.

DR. B. T. GALLOWAY has resigned his position as assistant secretary of the U.S. Department of Agriculture in order to accept the post of dean of the Agricultural College of Cornell University.

THE London County Council Education Committee has had under review the scheme for the reorganisation of the council's evening school system which was adopted last winter. The object of the reorganisation was to remedy certain serious defects of enrolment, attendance, and organisation, and to infuse freshness and attractiveness into the system. Among other arrangements made was a relief from fees as an award for good attendance, important changes in the *personnel* and duties of the inspectorate, and changes of a far-reaching character in the staffing, so as ultimately to obtain a separate staff for evening schools. Public attention was at the beginning of the session directed to the classes in many ways. Though a decrease of 30,000 pupils was anticipated in the total attendance, happily this was not realised. The committee is of opinion that in the main no change in the fundamental principles of the organisation appears to be advisable. Extension of the main features of the organisation are recommended, and some modifications of detail are suggested. It is proposed in a few instances to convert free schools into fee-paying under the ordinary conditions. The most important proposal, however, is to charge a registration fee of sixpence at all "free" institutes. It is felt that the immediate outlay of sixpence on joining an institute will be some guarantee that the student is serious, while it will not really interfere with the "free" character of the schools. The committee proposes to make provision for 120,000 students in these classes next year.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, May 19.—Mr. R. H. Burne, vice-president, in the chair.—Dr. C. H. **O'Donoghue**: The venous system of the dogfish. The general disposition of the main trunks in Scyllium is similar to that described in other Elasmobranchs, but the details differ considerably.—B. F. **Cummings**: Scent-organs in Trichoptera. An account of the remarkable development of the palpi of the first maxilla in a male caddis-fly, *Sericostoma personatum*. Instead of being 5-segmented, the palpus consists of a single swollen segment carrying an enormous tuft of long, silky hairs, at the bases of which unicellular scent-glands are situated.—H. A. **Baylis**: A new species of Cestode collected from an albatross (*Diomedea irrorata*) by Dr. H. O. Forbes in Peru.—D. M. S. **Watson**: The Deinocephalia, an order of mammal-like reptiles. The skull of a Tapinocephaloid is almost completely described. The fact that whilst in the skull Deinocephalia agree with the American Pelycosaurs, but in the post-cranial skeleton they resemble South African Therapsids, shows that the American forms must be included in the same great group, super-order, as the South African mammal-like reptiles.—Dr. R. C. L. **Perkins**: Species of the genus Paralastor and some other Hymenoptera of the family Eumenidæ. All the described species are enumerated therein, together with the descriptions of many new forms.—G. **Jennison**: Notes on colour-development in the Indian wood-stork (*Pseudotantalus leucocephalus*).—Dr. Ph. **Lehrs**: A new lizard from the Canary Islands, recently discovered by Dr. Cæsar Boettger on Hierro.

Physical Society, May 22.—Dr. A. Russell, vice-president, in the chair.—T. **Barratt** and A. B. **Wood**: Volatility of thorium active deposit. On heating thorium active deposit to accurately measured temperatures up to about 1250° C. it is found that B and C each commence to volatilise at 750° C., but the volatilisation is not complete until 1200° C. is reached. The C curve is peculiar, being similar to two of the B curves placed end to end, the inflexion occurring between 750° C. and 900° C., where about 35 per cent. of the α activity is removed. When measured by β radiation, C is not volatile until a temperature of 900° C. is reached. D commences to volatilise at 500° C. It is assumed that the part of C which produces β rays, viz., C_β, is a separate product, which is not so readily volatile as C_α.—H. P. **Walmsley** and Dr. W. **Makower**: The passage of α particles through photographic films. Kinoshita has shown that when an α particle strikes a grain of silver halide, that grain is subsequently capable of photographic development. It seemed probable that the path of an α particle projected tangentially to a photographic film should, after development, be visible under a microscope. This was shown to be the case, and photomicrographs showing the tracks of α particles through a photographic plate have been obtained.—S. **Butterworth**: A null method of testing vibration galvanometers. By extending the theory of the vibration galvanometer it is shown how the constants may be determined by methods which involve only the measurements of one deflection. The remaining measurements are carried out on an alternating-current bridge. The principle of the method depends on the fact that a vibration galvanometer behaves as a parallel combination of a conductance, a capacity and an inductance, in series with a resistance.—C. W. S. **Crawley** and Dr. S. W. J. **Smith**: Experiments with an incandescent lamp. The first experiment was due to Mr. Addenbrooke who, using a 100-volt lamp filled with paraffin oil as a high resistance in a 200-volt circuit, noticed that some of the bubbles forming on the filament behaved in a curious way. Instead of rising at once to the surface they ran down the legs of the filament, against gravity, and escaped at the leading-in wires. Dr. Smith, repeating the experiment, discovered another striking phenomenon. Placing the 100-volt lamp in a 100-volt circuit in series with a variable resistance it was found possible to obtain a single bubble upon the wire. Instead of escaping at either terminal, the bubble travels backwards and forwards between the two, "looping the loops" of the filament during every journey. A rapid fall of temperature from the wire through the liquid, in the region through which the bubble moves, is an essential condition of the phenomenon.

DUBLIN.

Royal Dublin Society, May 26.—Prof. W. Brown in the chair.—Prof. G. H. **Carpenter**: Injurious insects and other animals observed in Ireland during the year 1913. The more noteworthy records are larvæ of Bibionidæ feeding in potato tubers, and the presence of all three species of apple Aphis—*A. pomi*, *A. sorbi*, and *A. fitchi*—in Ireland. Observations and experiments by T. R. Hewitt on the infestation of narcissus bulbs by eelworms (Tylenchus) and their migration through the soil are described. Copper sulphate in weak solution (5–7½ per cent.) is safe and effective for soaking the bulbs. A mature larva of Hypoderma extracted from the back of a mare may be confidently

referred to the common *H. bovis*.—T. R. **Hewitt**: The larva and puparium of the frit-fly. The author describes the external features of this destructive larva in greater detail than has yet been attempted, directing attention to sensory organs in the head region, the mouth hooks, and the spiracles.—Prof. J. **Wilson**: Polygamous Mendelian factors. In papers on the colours of horses published in 1910 (Roy. Dublin Soc. Proc., vol. xii., p. 331) and 1912 (*ibid.*, vol. xiii., p. 184) it was observed that each of the colours was the result of a single factor which was polygamous. That is to say, the factor for one colour can mate with the factor for any of the others, one at a time. When the observation was made, however, it was not realised to be unusual or extraordinary, but was assumed to be a phenomenon which might occur frequently; consequently stress was not laid upon the observation. It was eventually seen, however, that the phenomenon is very unusual, and with the data collected, together with additional data to be found in Dr. Walther's "Beiträge zur Kenntniss der Vererbung der Pferdefarben," the phenomenon is now demonstrated. It would be inferred from Dr. Walther's data if the "absences" which his analysis requires were eliminated, and the conditions which they stand for substituted in their stead.

PARIS.

Academy of Sciences, May 18.—M. P. Appell in the chair.—Armand **Gautier** and P. **Clausmann**: Fluorine in freshwater. An application of the method previously described for determining traces of fluorine to the examination of water from rivers, glaciers, and springs. No potable waters examined contain more than 0·6 milligram of fluorine per litre. In Paris water the amount of fluorine taken a day per individual is about 0·12 mgr., or less than a quarter the amount daily excreted.—Charles **Moureu** and Georges **Mignonac**: A new class of nitrogen compounds, the ketisoketimines. This name is applied to substances of the type $R.CR' : N.CR : CH.R''$, obtained by the action of heat upon the ketimines.—L. **Maquenne** and E. **Demoussy**: The mobility of potash in plant tissues.—J. **Delauney**: The times of revolution of the satellites of a given system presenting certain relations between themselves.—W. **Goloubeff**: Functions with discontinuous singularities.—Marcel **Moulin**: The position of the centre of gravity of spiral springs furnished with theoretical terminal curves.—Albert **Turpain**: A photographic self-recording microammeter and the measurement which it furnishes. The apparatus described has given good records of messages from the Eiffel Tower at Poitiers, 300 km. distant. The instrument is of use in geodesic operations.—G. Gouré de **Villemontée**: The propagation of electricity through paraffin oil.—Léon and Eugène **Bloch**: The spark spectra of some elements in the extreme ultra-violet. Wave-lengths are given of the lines for arsenic, antimony, tin, bismuth, aluminium, and cadmium for the range 2134 to 1855.—R. **Marcelin**: The evaporation of slightly superheated liquids and solids. Results are given for nitrobenzene, naphthalene, and iodine.—Léo **Vignon**: The solvents of coal. Coals of different origin were extracted with alcohol, ether, benzene, toluene, aniline, nitrobenzene, pyridine, and quinoline. The soluble and insoluble portions of the coals were analysed. Bituminous coals gave a high aniline extract.—J. **Bougault**: The process of saponification of esters and of amides by strong sulphuric acid.—Georges **Tanret**: The constitution of galegine. This alkaloid was extracted from the seeds of *Galega officinalis*, and has the composition $C_6H_{13}N_3$. Its most important reaction is the formation of methyl-3-pyrrolidine and urea by hydrolysis with baryta water.—E. **Carrière**. The equilibrium at the ordinary temperature of the enol and aldehyde forms of ethyl formylsuccinate and ethyl formylethylsuccinate.—R. **Fosse**: The chemical activity of xanthydrol and its application to the estimation of urea.—Robert **Douin**: The development of the fruit-bearing apparatus of Marchantia.—M. **Marage**: The sensibility of the physiological ear for certain musical sounds.—A. **Moutier**: The interdependence of peripheral arterial hypotension and visceral arterial hypertension.—A. **Trillat** and M. **Fouassier**: The action of cooling on microbial droplets.—J. **Nageotte**: Some peculiarities of the nerve fibre of batrachians and on the so-called alterations of the myeline sheath, considered as causing changes of excitability of the nerves.—M. **Vasticar**: The nuclear formations of the internal auditive cell.—Mme. Marie **Phisalix**: Poisonous properties of the parotidian saliva of *Coronella austriaca*.—L. **Germain** and L. **Joubin**: The Chetognaths of the cruises of the Prince of Monaco.—Gabriel **Bertrand** and M. **Rosenblatt**: The thermo-regeneration of sucrase. A study of the changes in the hydrolysing power of sucrase from yeast produced by exposure to varying temperatures.—F. **Kerforne**: The presence of *Calymmene blumenbachi* in the Gothlandian of Brittany.—N. **Arabu**: The Trias of Ismid.—Léon **Bertrand** and Antonin **Lanquine**: New observations on the tectonic of the south-west slopes of the Maritime Alps.—E. A. **Martel**: The chasms of the Tertiary formations in the neighbourhood of Vertus (Marne).—Alphonse **Berget**: A piezometric sounder. Use is made of the compressibility of water contained in a tube silvered internally. The water is in contact with mercury, and the contraction of the water is measured by the amount of the silver removed as amalgam. The sensibility is practically constant at increasing depths, and gives an accuracy of 10 metres at a depth of about 6000 metres.—Ernest **Esclangon**: An instrument for recording the intensity of rainfalls.—Gabriel **Guilbert**: Weather prediction.

May 25.—M. P. Appell in the chair.—Fred. **Wallerant**: Contribution to the study of polymorphism. Experimental details concerning the polymorphism of malonic acid, monochlorocamphor, benzyl cinnamate, benzaldoxim, paratolylphenylketone and trinitrometacresol.—S. A. S. **Albert**, Prince of Monaco: The third campaign of *Hirondelle II.* (twenty-sixth of the complete series). In the course of bathypelagic work it has been found that certain organisms, more especially fishes, are only found during the daytime at a depth not less than 1000 metres, but are commonly obtained during the night at a depth of 200 metres. This corresponds to a change of pressure of 100 atmospheres.—M. Jacques **Loeb** was elected a correspondant for the section of anatomy and zoology in the place of the late Lord Avebury.—A. **Schaumasse**: Observations of the Zlatinsky comet (1914*b*) made with the equatorial at the Nice Observatory. Data given for May 18, 19, 20, 21, 22, 23. Changed from 6th magnitude on May 18 to 8·7 magnitude four days later.—Louis **Fabry**: The problem of the minor planets.—P. **Chofardet**: Observations of the new comet 1914*b* (Zlatinsky) made at the Observatory of Besançon. Four positions given for May 19–22. Was estimated to be of the 5th magnitude on May 19.—L. **Ballif**: The surfaces developed in two different manners by the motion of an indeformable curve.—W. de **Tannenberg**: A functional equation and curves of constant torsion.—T. H. **Gronwall**: Laplace's series.—R. W. **Wood** and L. **Dunoyer**: The optical resonance of sodium vapour under the stimulation of one only of the D lines. It has been proved that the resonance radiation excited by the line D_2 alone contains that radia-

tion only.—A. **Blanc**: A radiation accompanying the oxidation of phosphorus. The oxidation of phosphorus is accompanied by the production of an ionising radiation of very slight penetrating power, and resembling the γ rays of radio-active substances.—M. de **Broglie**: The spectroscopy of the secondary rays emitted outside Röntgen tubes and the absorption spectra.—L. **Bouchet**: A manometric arrangement for studying very small deformations of indiarubber.—Ch. **Fabry** and H. **Buisson**: The experimental verification of the Doppler-Fizeau principle.—R. **Swyngedauw**: The control of the insulation of a triphase network.—Ernest **Berger**: The oxidation of copper: the influence of temperature and pressure. The oxidation of copper by dry oxygen can be traced down to a temperature of 15° C. The velocity of oxidation is tripled for each 10° rise of temperature.—Jules **Roux**: Study of the limit of some reactions by means of the hydrostatic balance. Examples of the application of a quartz float to determine small changes of density.—Victor **Henri** and Venceslas **Moycho**: The action of monochromatic ultra-violet rays on the tissues. Measurement of the energy of radiation corresponding to sunstroke.—G. **Courtois**: Some organic uranium salts of the monoacids of the fatty series.—P. **Lebeau** and M. **Picon**: The hydrogenation of the cyclic hydrocarbons by sodammonium. The preparation of naphthalene tetrahydride. Naphthalene and powdered sodium are treated with liquid ammonia, naphthalene tetrahydride, and sodium amide are produced.—G. **André**: The development of the bud in a living plant (chestnut).—W. **Kopaczewski**: Researches on the composition of *Scilla maritima*. A toxic glucoside, not containing nitrogen, has been isolated from the scilla.—Raoul **Bayeux** and Paul **Chevallier**: Comparative researches on the concentration of the arterial blood and venous blood at Paris, Chamonix, and Mt. Blanc, by the refractometric study of the serum.—J. **Tissot**: Destruction of serum activity by heat.—Robert **Dollfus**: *Trochicola enterica*, a parasitic Eucopepod of the intestine of the Trochidæ.—M. **Herlant**: The existence of a periodic rhythm in the determination of the first phenomena of experimental parthenogenetic development in the sea-urchin (*Paracentrotus lividus*).—Ch. A. **Rolland**: Contribution to the study of the constitution of bovine vesicular bile and of its lipoid portion.—Maurice **Gignoux** and Paul **Combay**: The history of the last rhodanian glaciations in the Belley basin.—L. **Cayeux**: The existence of numerous traces of perforating algæ in French oolitic iron minerals.—H. **Fonzes-Diacon** and M. **Fabre**: The detection of boron in mineral waters.—Albert **Baldit**: A case of globular lightning.

BOOKS RECEIVED.

Western Australia. Geological Survey. Bulletin No. 44. A Geological Reconnaissance of a Portion of the South-West Division of Western Australia. By E. C. Saint-Smith. Pp. 80. Bulletin No. 49. Geology and Mineral Resources of the Yilgarn Goldfield. Part 1. Southern Cross. By E. C. Saint-Smith and R. A. Farquharson. Pp. 193+plates. (Perth, W.A.)

The Teaching of Mathematics in Australia. By Prof. H. S. Carslaw. Pp. 79. (Sydney: Angus and Robertson, Ltd.; London: Oxford University Press.)

The Call of the Stars. By Dr. J. R. Kippax. Pp. xviii+431+xliii plates. (New York and London: G. P. Putnam's Sons.) 10*s*. 6*d*. net.

Die Süsswasser-Flora Deutschlands, Oesterreichs und der Schweiz. Edited by Prof. A. Pascher. Heft 6. Chlorophyceæ, III. By W. Heering. Pp. iv+250. (Jena: G. Fischer.) 6 marks.

Chimie Physique Elémentaire. By E. Ariès. Tome Premier. Pp. xxx+212. (Paris: A. Hermann et Fils.) 4 francs.

Der Bau des Weltalls. By Prof. J. Scheiner. Vierte Auflage. Pp. iv+132. (Leipzig: B. G. Teubner.) 1.25 marks.

Vegetationsbilder. Edited by Drs. G. Karsten and H. Schenck. Zwölfte Reihe. Heft 2 and 3. Pp. iv+Tafel 7–18. (Jena: G. Fischer.) 8 marks.

I.K. Therapy, with Special Reference to Tuberculosis. By Dr. W. E. M. Armstrong. Pp. x+83. (London: H. K. Lewis.) 5*s*. net.

A Contribution to the Flora and Plant Formations of Mount Kinabalu and the Highlands of British North Borneo. By L. S. Gibbs. Pp. 240+plates 1–8. (London: Linnean Society.)

The Carnegie Foundation for the Advancement of Teaching. Eighth Annual Report of the President and of the Treasurer. Pp. vi+158. (New York City.)

Annual Report of the Meteorological Observatory of the Government General of Korea for the year 1912. Pp. iv+120+20. (Chemulpo.)

Manks Antiquities. By P. M. C. Kermode and Prof. W. A. Herdman. Second edition. Pp. 150. (Liverpool University Press.) 3*s*. net.

Memorabilia Mathematica, or the Philomath's Quotation-Book. By Prof. R. E. Moritz. Pp. x+410. (London: Macmillan and Co., Ltd.) 12*s*. 6*d*. net.

Twenty-sixth Annual Report of the Purdue University Agricultural Experiment Station, Lafayette, Indiana, for the Year Ending June 30, 1913. Pp. 88. (Lafayette, Ind.)

Aeronautics. Technical Report of the Advisory Committee for Aeronautics for the Year 1912–13 (with Appendices). Pp. 416. (London: H.M.S.O.; Wyman and Sons, Ltd.) 10*s*.

Spectrum Analysis Applied to Biology and Medicine. By the late Dr. C. A. MacMunn. Pp. xiv+112. (London: Longmans and Co.) 5*s*. net.

Problems of Science. By F. Enriques. Translated by K. Royce. Pp. xvi+392. (Chicago and London: Open Court Publishing Co.) 10*s*. net.

The Country Month by Month. By J. A. Owen and Prof. G. S. Boulger. New edition. Pp. x+492+plates. (London: Duckworth and Co.) 6*s*. net.

The Latest Light on Bible Lands. By P. S. P. Handcock. Second edition. Pp. xii+371. (London: S.P.C.K.) 6*s*. net.

Royal Society of London. Catalogue of Scientific Papers, 1800–1900. Subject Index. Vol. iii. Physics. Part ii. Electricity and Magnetism. Pp. xv+551–927+vii. (Cambridge University Press.) 15*s*. net.

Amulets Illustrated by the Egyptian Collection in University College, London. By Prof. W. M. Flinders Petrie. Pp. x+58+liv plates. (London: Constable and Co., Ltd.) 21*s*. net.

A Practical Treatise on Sub-Aqueous Foundations. By C. E. Fowler. Third edition. Pp. xliii+814. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 31*s*. 6*d*. net.

The Science of Knitting. By E. Tompkins. Pp. xiii+330. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 12*s*. 6*d*. net.

Chemical Examination of the Blood and its Technique. By Prof. A. Pappenheim. Translated by R. Donaldson. Pp. ix+87+ii plates. (Bristol: J. Wright and Sons.) 3*s*. 6*d*. net.

The Statesman's Year-Book. Edited by Dr. J. Scott Keltie, assisted by Dr. M. Epstein. Pp. lxxix+1500. (London: Macmillan and Co., Ltd.) 10*s.* 6*d.* net.

The Standard Cyclopedia of Horticulture. By L. H. Bailey. Pp. xx+602+xx plates. (London: Macmillan and Co., Ltd.) 25*s.* net.

The Institute of Chemistry of Great Britain and Ireland. Lectures on Explosives. By W. Macnab. Pp. 68. (London: 30 Bloomsbury Square.)

Twelfth Report of the Sarawak Museum, 1913. By J. C. Moulton. Pp. ii+47. (Sarawak.)

Poems of Human Progress. By J. H. West. Pp. xii+328. (Boston: The Tufts College Press.) 1.50 dollars net.

Preliminary Practical Science. By H. Stanley. Pp. viii+128. (London: Methuen and Co., Ltd.) 1*s.* 6*d.*

Gearing. By A. E. Ingham. Pp. xi+181. (London: Methuen and Co., Ltd.) 5*s.* net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—Faraday and the Foundations of Electrical Engineering: Prof. S. P. Thompson.

LINNEAN SOCIETY, at 8.—The Botanical Results of a Recent Expedition to Turkestan: Dr. B. Fedtschenko.—Darwin's Alternative Explanation of the Origin of Species *without* the Means of Natural Selection: Prof. G. Henslow.—A Collection of Land and Freshwater Gastropods from Madagascar, with Descriptions of a New Genus and New Species: G. C. Robson.—Sections showing the Entire Vertical Thickness of a Seam of Coal: J. Lomax.—Notes on the Morphology of Certain Structures concerned in Reproduction in the Genus Gnetum: Prof. H. H. W. Pearson.—Curculionidæ from the Indian Ocean. (Percy Sladen Expedition): G. C. Champion.—Deto, a Subantarctic Genus of Terrestrial Isopoda: Prof. C. Chilton.

FRIDAY, JUNE 5.

ROYAL INSTITUTION, at 9.—X-rays and Crystalline Structure: Prof. W. H. Bragg.

GEOLOGISTS' ASSOCIATION, at 8.—Prehistoric Problems in Geology: R. A. Smith.

SATURDAY, JUNE 6.

ROYAL INSTITUTION, at 3.—Studies on Expression in Art. I.: Origin and Development: Sigismund Goetze.

MONDAY, JUNE 8.

ARISTOTELIAN SOCIETY, at 8.—The Treatment of History by Philosophers: D. Morrison.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Dickson Centrifuge System of Sewage Treatment: E. H. Tripp.—Studies on the Reduction of Uranium Oxide: E. K. Rideal.—Contribution to the Discussion on Paper, Bleaching of Chemical Pulp, by Baker and Jennison, and Bleaching Efficiency considered in connection with Suggested Standard for Testing Bleaching Qualities of Chemical Wood Pulp: C. Beadle and H. P. Stevens.

INSTITUTE OF ACTUARIES, at 5.—Annual Meeting.

ROYAL GEOGRAPHICAL SOCIETY, at 8.45.—The Australian Antarctic Expedition: Dr. D. Mawson.

TUESDAY, JUNE 9.

ROYAL INSTITUTION, at 3.—Celestial Spectroscopy: Prof. A. Fowler.

ZOOLOGICAL SOCIETY, at 8.30.—A Report on the Fauna of the Monte Bello Islands: P. D. Montague.—Cephalopoda from the Monte Bello Islands: G. C. Robson.—Stalk-eyed Crustaceans collected at the Monte Bello Islands: Miss M. J. Rathburn.—Report on Mollusca collected at the Monte Bello Islands: T. Iredale.—Zoological Results of the Third Tanganyika Expedition conducted by Dr. W. A. Cunnington, 1904–1905. Report on the Parasitic Eucopepoda: Dr. W. A. Cunnington.—Contributions to the Anatomy and Systematic Arrangement of the Cestoidea. XIV. A New Species of Rhabdometra and on the Paruterine Organ in Otiditænia: Dr. F. E. Beddard.—The Marine Fauna of British East Africa, from Collections made by Cyril Crossland, in the Years 1901–1902: A. W. Waters.—(1) The Facial Vibrissæ of Mammals; (2) The Feet and other External Characters of the Ursidæ and Canidæ: R. I. Pocock.—*Procolophon trigoniceps*: a Cotylosaurian Reptile from South Africa: D. M. S. Watson.—A Second Collection of Batrachians and Reptiles made by Dr. H. G. F. Spurrell, in the Choco, Colombia: Dr. G. A. Boulenger.

RÖNTGEN SOCIETY, at 8.15.—Annual General Meeting.

WEDNESDAY, JUNE 10.

GEOLOGICAL SOCIETY, at 8.—The Geology and Glaciology of the Antarctic Regions: Dr. D. Mawson.—The Ballachulish Fold at the Head of Loch Creran (Argyllshire): E. B. Bailey.

THURSDAY, JUNE 11.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Bearing of Cytological Research on Heredity: Prof. E. B. Wilson.

ROYAL INSTITUTION, at 3.—Faraday and the Foundations of Electrical Engineering: Prof. S. P. Thompson.

FRIDAY, JUNE 12.

ROYAL INSTITUTION, at 9.—Some Aspects of the American Democracy: The Hon. W. H. Page.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—Note on the Connection between the Method of Least Squares and the Fourier Method of Calculating the Co-efficients of a Trigonometrical Series to Represent a Given Function or Series of Observations: Prof. C. H. Lees.—A Magnetograph for Measuring Variations in the Horizontal Intensity of the Earth's Magnetic Field: F. E. Smith.—The Atomic Weight of Copper by Electrolysis: A. G. Shrimpton.—Note on an Improvement in the Einthoven String Galvanometer: W. H. Apthorpe.

MALACOLOGICAL SOCIETY, at 8.—*Sulcobasis concisa*, Fer., and its Nearest Allies: C. R. Boettger.—Note on the radula and maxilla of *Orthalicus zebra*, Müller: Rev. E. W. Bowell.—(1) Invalid Molluscan Generic Names; (2) A New Cassid: T. Iredale.—The Relative Claim to Priority of the Names *Helix carduelis*, Schulze, and *Helix fruticum*, Müller: G. K. Gude.

SATURDAY, JUNE 13.

ROYAL INSTITUTION, at 3.—Studies on Expression in Art. II.: Right Expression in Modern Conditions: Sigismund Goetze.

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