THURSDAY, SEPTEMBER 29, 1904.

PETROLEUM.

The Oil Fields of Russia, and the Russian Petroleum Industry. By A. Beeby Thompson, A.M.I.M.E. Pp. xviii+504; plates and maps. (London: Crosby Lockwood and Son, 1904.) Price 31*l.* 3*s.* net.

THE aspect of this large and attractive, well printed, and freely illustrated addition to the enormous literature of the Russian oil fields (which extends to many hundreds of books and articles) excites hopes of a comprehensive summary of the principal facts dispersed through the unwieldy mass of record, and of a formulation of the laws of which those facts are the tangible expression. Such a summary is a great desideratum, for, apart from the polyglot condition of the recorded information, and the difficulty of access to the original sources in the files of Caucasian journals and unpublished records, the subject is one demanding the conjoint forces of the geologist, the chemist, and the physicist, whilst the past has shown that conclusions reached by the study of any of these branches separately may directly traverse those based on other categories of data.

The title-page sets forth the aim of the work as a practical handbook on the exploration, exploitation, and management of Russian oil properties, with collateral considerations on the origin of the petroleum and the modes of its utilisation as fuel. The statistics of production constitute Appendix A (pp. 399–432), and forty-five pages of official regulations form Appendix B, which is followed by some useful tables of physical and other data, and a few pages treating of the latest developments in exploration and utilisation.

The value of the work lies principally in its technical element, based on several years' practical experience in the region, whilst it merits attention, with or without acceptance, on the scientific side, which is dealt with somewhat too theoretically. In regard to geological matter the treatise is disappointing, as we have an excess of general lithological detail, but the scantiest stratigraphical information. Fuller indications in this respect, with less and better founded speculation as to primæval conditions of deposition, would have made the book of higher utility in regard to its first stated aim, that of assistance in exploration for oil. For this accurate details of composition and structure (including correlation from point to point) are essential, and such are regrettably absent from the work under consideration.

We must demur, at the outset, to the alleged conformability of the Aralo-Caspian surface-beds to the oil-bearing Oligocene and Lower Miocene strata, a view which is probably the cause of the author's rejection of the anticlinal structure as the predominant factor in concentrating the petroleum along the axes of flexure. The assumption (p. 60) of the existence of synclines equally rich with the anticlines is one not warranted by the results of operations in any oil field of known structure, and therefore where, as in the Baku fields, the structure of the petroliferous series is masked by an unconformable superincumbent mass, the flexures in which are discordant in strike with those of the subjacent rocks, positive evidence of productive synclinals may legitimately be demanded in place of mere hypothetical surmise of the existence of such beyond the depth accessible by the drill. The natural exudations, mud volcanoes, and gas discharges are all situated on anticlinal axes, exposed by denudation of the Quaternary cover.

We cannot, for the simplest of chronological reasons, accept the suggestion of the oleaginous quality of the sturgeon and other Caspian fish as having any bearing whatever on the origin of the Caucasian petroleum (p. 64), and no evidence is advanced of kinship of the Oligocene with the existing ichthyofauna. (It is not imagined, *per contra*, that caviare is a modified bitumen.)

Briefly reviewing various theories as to the origin of petroleum, and noting the possibility of its being of different source in separate areas, the author wholly rejects, on adequate geological grounds, the hypothesis of inorganic origin; whilst from the scarcity in the series of the remains either of fibrous vegetation or of diatoms, he doubts the contribution, from the vegetable kingdom, of much, if any, of the enormous bulk of Caucasian petroleum. The large percentage of carbonate and phosphate of lime in the rocks points, on the other hand, to abundant animal life, but the author, gratuitously assuming the æolian character of the oil sands, gives, we think, too much rein to imagination in invoking periodical sandstorms from hypothetical deserts to effect sudden extinction of these deep-sea organisms over limited areas, and their entombment in similarly limited patches of the deposited sand, now converted into "pockets" charged with the resulting petroleum. The belief in catastrophic hecatombs of this nature is some three generations out of date, and can only be regarded as a superstition. Not only is the abnormally lenticular structure of the oil sands hypothetical, the data obtained by boring being equally explicable by reference to faulting, but sandstorms that should, for a few score yards only, saturate a deep sea to the degree of suffocation of its denizens, must have been evoked by the Genius of Destruction from Arabian or other Oriental deserts, and the existence of such deserts in Oligocene times, when continuous sea united the Atlantic and Pacific Oceans in these latitudes, is more than doubtful.

In dealing with the Grosny field, and the isolated spots in Daghestan that have yielded evidence of oil, the author mentions the difference in lithological character between these and the Baku fields, but without the explanatory information that these northern fields are of a different geological series, the Lower Miocene, whereas most, if not all, the Baku oil comes from Oligocene beds, though traces of Miocene occur in the southern part of the province.

The term "excitement" is applied by the author in a new technical sense to designate the disturbance of the equilibrium of a region by the rapid discharge, through borings, of fluids and discrete solids previously under great pressure, and the effect of the sudden arrests and renewals of the flow owing to temporary chokings of the exit. The widespread vibrations pro-

duced necessarily afford partial relief or re-adjustment to somewhat remote and disconnected seats of pressure during the moments of oscillation. Similar causes in the American fields have led to the appearance of gas in wells that at first produced only oil or water, and *vice versâ*, and in some cases a renewal of commercial activity in an abandoned field has been the result of operations at some distance away.

Apart from the defects referred to, the work is worthy of praise, for the engineering details, which constitute the bulk, are given in a form convenient for reference, and it is only needful to warn technical readers against too implicit acceptance of the author's views on some still unsettled scientific problems.

CHEMISTRY OF ALKALOIDS.

The Vegetable Alkaloids, with Particular Reference to their Chemical Constitution. By Dr. Amé Pictet. From the second French edition. Rendered into English, revised and enlarged, with the author's sanction, by H. C. Biddle, Ph.D. Pp. i.–vii. and 1–505. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.)

THIS translation of the second edition of Pictet's "La Constitution chimique des Alcaloides végétaux," with the numerous additions made by the translator, will be welcomed by many readers, for nearly seven years have elapsed since the appearance of the original, and in the interval great advances have been made in our knowledge of the alkaloids. The book is in no sense a monograph, as references to the sources, modes of extraction and detection, and physiological properties of the alkaloids are of the briefest, attention being concentrated on their purely chemical behaviour, and the clues thus given to their constitution and synthesis. A brief survey of the history of this important group of compounds is followed by a section dealing with pyridine, quinoline, and their derivatives, including the carboxylic acids which have played so important a part in the elucidation of the molecular structure of the plant bases. The remainder of the book summarises what is known of the chemical behaviour of twenty-eight groups of alkaloids, and in a final chapter a list is given of forty-two alkaloids of unknown constitution. It should be added that numerous references to original papers are supplied in footnotes.

All attempts to define an alkaloid by reference to chemical constitution have proved to be unsatisfactory. Restriction of the term to derivatives of pyridine, as was proposed by Koenigs, would exclude morphine and the xanthine bases, such as caffeine, and its extension to cyclic bases found in plants, whilst including these alkaloids, would not embrace such substances as asparagine, choline, and trimethylamine. The author employs the term in its widest sense, and groups together as alkaloids all those substances which are directly obtained from plants and able to unite with acids to form salts.

The systematic chemical investigation of the alkaloids, dating from 1869, when the constitution of pyridine was made clear, has been pursued with a remarkable degree of success. Putting aside acyclic compounds, constitutional formulæ have been assigned to some twenty-five bases, including such well known substances as morphine, quinine, atropine, cocaine, nicotine, and caffeine; and although less is known of the molecular structure of the others, it is significant of the energy with which inquiry has been pressed in this direction, that more than one hundred alkaloids —about one-half of the number recognised as definite chemical substances—have been examined with at least some measure of success. Whether the formulæ now regarded as probable will survive in every case may be open to doubt; it is, however, a striking testimony to the success attending modern methods of unravelling molecular structure, that in the case of no fewer than twelve of the twenty-five formulæ just mentioned the constitution assigned on the basis of analytical evidence has been confirmed by the synthetical preparation of the alkaloid. Much of this work has been done since the appearance of the French edition, and reference in particular may be made to the syntheses of the belladonna and coca alkaloids, and of the xanthine bases, accounts of which have been supplied by the translator, and form, perhaps, the most interesting chapters in the book.

The translator has done his work successfully on the whole, but it is to be regretted that more attention has not been paid to the nomenclature of carbon compounds. The Chemical Society in this country—in the annual reprint of instructions to its staff of abstractors —and the Geneva Congress, have done much to associate definite suffixes with particular groups of compounds, and it may be hoped that, nowadays, no author of a chemical text-book in English on this side of the Atlantic would, for example, write "benzol" and "pyrrol" for benzene and pyrrole respectively. In a new edition the use of laboratory slang should be avoided. Expressions such as "nitrogen-methylated" (p. 135), "it does not react alkaline" (p. 143), "dimethylcytisine will add methyl iodide" (p. 180), and "as a starting substance" (p. 228) are not happily chosen; whilst curiosity is stimulated by the statement that "a decomposition similar to this [the elimination of methylamine from tropine] is effected by the destructive distillation of Hofmann" (p. 204), since details of the latter process have so far been withheld from publication. W. P. W.

NICKEL STEELS.

Les Applications des Aciers au Nickel, avec un Appendice sur la Théorie des Aciers au Nickel. By Ch. Ed. Guillaume. Pp. vii + 215. (Paris: Gauthier-Villars, 1904.) Price 3.50 francs.

A PROMINENT feature of the progress of steel during the last quarter of a century or so is the continued advance in the discovery and ever-widening practical application of what are known to the maker as "special" steels. "Ordinary" steels contain essentially certain well defined and usually small proportions of carbon, silicon, and manganese, varied to suit specific purposes, while sulphur, phosphorus, and even arsenic, though not desired, are seldom entirely

eliminated. "Special" steels contain other elements, or contain the ordinary elements in unusual proportions, as in the well known examples of Mushet's air-hardening tungsten steel, Hadfield's manganese steel, railway tyre chrome steels, nickel chrome armour plate steels, and so on, until at the present day, besides the elements just indicated, aluminium, copper, molybdenum, and even vanadium, which last is dearer than silver, are added to steels for commercial purposes, while other alloys are under experiment. It may well be imagined, then, with what eagerness the metallurgist turns to a monograph on any series of special steels, and particularly if it happens, as in the present case, to be written by a well known worker on the subject. Perhaps the title may mislead some general inquirers, for no doubt we are all looking for accounts of the experience of others in the innumerable applications, some experimental, some well established, of the steels of lower nickel content; but unless they were looking merely for guidance in the immediate work of manufacturing or using those steels, the feeling of disappointment would give way to one of great interest at the thorough manner in which certain properties of the steels of higher nickel content are discussed.

Practically the only steels seriously considered are those containing more than 26 per cent. of nickel. Within limits these are "reversible alloys," that is, "when they are brought to a determined temperature after having been run through any cycle of temperatures they retake sensibly the same properties." It is interesting to note that these alloys

"take a beautiful polish, lend themselves admirably to engraving, are sufficiently elastic when cold rolled to make passable springs though sensibly inferior to those of steel hardened and tempered. Resistance to oxidation varies with the nickel content and for well polished bars it is sufficient to go up to 36 per cent. nickel in order to be able without fear to leave them lying some hours or even days in water at ordinary temperatures. The reversible alloys work well in the lathe, in the planing machine, with the file or the drill on condition that the tool be strong and the attack slow. In general, working at too great a speed makes the alloys act in the same fashion as a grindstone and produces an extremely rapid wearing of the steel tool."

The work consists of four parts and an appendix. Part i. gives the dilatation and modulus of elasticity of the reversible alloys, and goes into great detail as to the amounts and variations of these under special conditions. These properties of the alloy of least dilatation containing about 36 per cent. of nickel, and the special annealing at temperatures less than 100° C. required to bring its wonderfully low dilatation practically to zero, and to bring almost to perfection its *invariability* under the greatest extremes of atmospheric temperature known, are most carefully described. Two new terms, widely accepted, should be noted here, *étuvage* for the low temperature annealing as distinct from *recuit*, high temperature annealing, and *invar*, an appropriate name for the alloy.

Part ii. is devoted to the application of these alloys, and particularly of invar, to the making of standards of length, and more especially for the measurement of bases in survey work (see NATURE, June 2, p. 104), with full details of the special wire standard. Part iii. treats of the uses and the limitations of the alloys in connection with chronometer pendulums, balances, and even springs. Part iv. takes sundry applications, some tried, some suggested, such as parts of levelling instruments, cathetometer and similar supports, bodies of astronomical telescopes, gravitation pendulums, balances, wires for operating signals, &c. Finally, the existence of invar, an alloy with a dilatation practically nil, suggests alloys of varying dilatations, hence special alloys (42 per cent. to 48 per cent.), with an expansion about equal to that of glass, for mounts of object glasses, incandescent lamps, Crookes's tubes, &c. In an appendix of twenty-seven pages the author gives his theory of the nickel steels. He abandons his former theory of compounds of iron and nickel, and, under the influence of MM. Osmond and Le Chatelier, works out an allotropic theory, of which space will not permit even a *résumé*.

This work is one that should be read not only by those particularly interested in the special matters with which it deals, but by all students of metals, as it forcibly drives home to the mind some of the characteristic properties of a remarkable series of alloys.

A. McW.

OUR BOOK SHELF.

Le Radium et la Radioactivité. By Paul Besson. With a preface by Dr. A. d'Arsonval. Pp. viii+170. (Paris: Gauthier-Villars, 1904.) Price 3.75 francs.

THIS little volume is undoubtedly one of the best summaries that has yet appeared of the investigations that have followed from Becquerel's discovery, in 1896, of the radio-activity of the salts of uranium. The author has been associated with Prof. and Madame Curie in working up on a large scale the uranium residues from Joachimsthal, from which the salts of radium were commercially prepared. His account of the discovery of the radio-active elements, of their separation from the inactive elements in the ores, and of the methods employed in detecting and estimating their radio-activity, is exceedingly lucid and simple, and will appeal strongly to those who wish for a simple account of the phenomena as they presented themselves to the pioneer workers in this field of investigation. In view of the large amount of speculation that these investigations have aroused, it is one of the merits of the book that, whilst seven chapters are devoted to the description of the preparation and properties of the radio-active salts, the theoretical considerations are brought forward only in the last chapter. The disintegration theory, which at the present time dominates almost all that is written on this subject, occupies only a secondary place in the author's discussion of the source of the energy of radio-active bodies. He appears to lean rather to the view advocated by Filippo Ré in a short paper published in the *Comptes rendus* in June of last year, to the effect that the radio-active elements act as sources of energy not because they are in an unstable or explosive condition, but rather because they are still in process of formation. This view, which is derived from analogy with the liberation of energy in the solar system, has much to recommend it, as it eliminates the difficulty of accounting for the relatively slow rate at which the elements in question release the vast stores of energy which they are supposed, by the advocates of the disintegration theory, to contain.

The physiological effects produced by the radium salts are described in considerable detail, and the author looks for important applications in this direction. Thus, whilst the book is addressed to all those who are likely to be interested in the subject, especial care has been taken to state in detail those observations that are of importance to students of medicine and surgery. The developments that have taken place in recent years in the application of physical methods to the cure of disease justify the argument, which forms the main part of Prof. d'Arsonval's preface, that the study of physics should occupy an important place in a medical curriculum.

Chemical Laboratories for Schools. By D. S. Macnair, Ph.D., B.Sc. Pp. 24. (London: George Bell and Sons, 1904.) Price 6*d*.

On the title-page of this little pamphlet are the words: "Hints to teachers as to the method of planning and fitting-up a school laboratory and of conducting a school course in chemistry." As the term "school laboratory" is extremely vague, each school or group of schools nowadays having a definite place in an organised system of education, some indication of the class of teacher to which the author wishes to appeal would have been advisable. Apparently the instruction is to be essentially of an elementary nature, and judging by the numerous suggestions regarding balances, weights, &c., weighing operations occupy an important place in the work.

The chief features and fittings of the laboratory are briefly dealt with in a simple manner. One notices that several dimensions, such as width of benches, height of bench-shelves, &c., are somewhat less than those usually adopted. More information might have been given regarding inexpensive materials suitable for pipes and other surfaces exposed to chemicals and fumes. For drain-pipes, fireclay or glass-lined iron is suggested; the former is seldom employed, as stoneware is found to be less porous, and on iron a coating of Dr. Angus Smith's mixture is generally preferred to a hard, brittle lining of glass.

A plan is given of a laboratory for twenty pupils: it is probably from an existing building, but to place 17-foot benches with one end against the wall is not an ideal arrangement, and another side-window appears desirable; continuous desks would be cheaper and more convenient than dual desks arranged *en bloc*.

Much admirable advice is given regarding the management of practical classes. Finally, considerable space is devoted to a carefully compiled list of the apparatus and chemicals required for a class of twenty pupils; each piece of apparatus is approximately priced, but the allowance for some items is liberal.

After all, the contents of this pamphlet seem more suitable to be included in the author's "Introduction to Chemistry" than for separate publication, even at the low price of sixpence.

Photo Printing. By Hector Maclean, F.R.P.S. Pp. 100. (London: L. Upcott Gill, 1904.) Price 1*s*. net.

This is a second and revised edition of the author's "Popular Photographic Printing Processes," and forms a practical guide to the use of the leading kinds of the so-called printing-out papers, as well as bromide papers, platinum papers, and carbon tissues. We notice that no reference is made to "ozotype," though this is a carbon process that has been growing in favour for some years, and the materials for its practice are supplied commercially. The volume is what it claims to be, namely, a practical guide to the use of commercial papers, and a condensed price-list of the goods of the principal makers is added to each chapter. It may be safely recommended to those who wish to print by the processes described, for the author is himself a practical worker, and has evidently bestowed considerable care on the collection of the information that he gives. Deviations from strictly practical directions are rare and generally unfortunate, if not unintelligible. These are a few details to which we would take exception. The expression "half the foregoing temperature" may convey the meaning intended, but it is incorrect. The use of "photo" in the title as a separate word instead of as a prefix is unnecessary and objectionable. The statement that "gelatino-chloride prints may be completely washed in ten minutes, provided" . . ., &c., is set down as a fact, though we think the evidence is rather against it so far as practical work is concerned. Much less are we prepared to accept the statement that three changes of water, allowing one ounce in each bath for each quarter-plate print, will serve to free the prints "as completely as possible from 'hypo.'" The classification of platinum printing as a "partly print out" process is an illustration of the purely "practical" character of the work.

Œuvres scientifiques de L. Lorenz. Edited and annotated by H. Valentiner. Vol. ii. Second Fascicule. Pp. xxii + 319–583; with portrait. (Copenhagen: Lehmann and Stage, 1904.)

This concluding fraction of the papers of Lorenz is prefaced with an interesting critical account of his life and works. We see the young Lorenz largely self-taught, preferring to work out problems independently, although the result was usually to find out that they had been solved long before. It was in this laborious way that his mathematical gifts were developed. Owing to indifference to the usual courses of instruction, there was little sympathy between him and his teachers, and he left the Copenhagen Polytechnic without distinction. Be that as it may, by the year 1887 he had become a Councillor of State, and had received the honorary degree of Doctor of Philosophy of the University of Upsala.

Lorenz's scientific works are, in the main, on mathematical physics—sometimes leaning to the mathematical side, sometimes to the physical side. The editor of the present collection is alive to the lack of lucidity which characterises many of these. This is especially so when no experiments are forthcoming by which the results obtained can be tested.

The best known of his papers have appeared in preceding fascicules. The present one contains those of more mathematical interest. Of these the most important is probably one on the development of arbitrary functions by means of given functions, these being the functions of Bessel. Other memoirs are on the compensation of errors of observation, and analytical researches on the number of prime numbers. Lorenz's genius was, however, essentially physical; and although many of his mathematical conclusions are valid, they have been reached by insight more than by the application of logic such as a mathematician demands.

A portrait is presented with this instalment of the collection.

Botany Rambles. Part iii. In the Autumn. By Ella Thomson. Pp. 253—377. (London: Horace Marshall and Son, 1904.) Price 1*s*.

This is the third of a series of simple books in which the parts and functions of common wild plants are described for young readers. The present book is concerned chiefly with seeds and the means by which they are dispersed. Children who read the pages will have their attention directed to many points commonly overlooked, and if they test the statements by personal observation and practical study—as they are advised to do—they will be given both knowledge and pleasure.

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.]*

Average Number of Kinsfolk in each Degree.

WHAT is the average number of brothers, sisters, uncles, nephews, nieces, first cousins, &c., that each person possesses? I had occasion to compute this for a particular collection of persons; the results were so far unexpected as to show that the question deserved a consideration which it has not yet received, so far as I am aware. The problem proved easy enough in the end, but not at first, for there are other ways of attacking it, in which I blundered and lost time.

The simplest conditions that will serve for a general theory are those of a supposed population (1) the numbers of which are statistically constant in successive generations; (2) the generations of which do not overlap; and (3) which are "completed" by having wholly passed into history; and again (4) where every person is taken into account, at whatever age he or she may have died. It will be a further great simplification if it be allowed (5) to suppose the males and females to be equal in number, and in all respects to admit of similar statistical treatment. This need be only a provisional way of looking at the problem, for it will be seen that corrections can easily be introduced if desired.

It will much facilitate matters to begin by dealing exclusively with either the male or the female half of the population, leaving the other half to follow suit. We will begin with the females.

Let d be the average number of female children born of each woman who is a mother, so if there be n mothers in the population the total number of females in the next generation will be nd. How many of these latter will prove fertile of female children? On the supposition of statistical constancy, the number of mothers in the two generations will be the same, therefore d out of the nd will be fertile of female children; conversely, the probability that any one of these female children will herself bear one or more female children $=1/d$. As a test of this, the average number of fertile daughters to each mother will be $d\times 1/d=1$, as it should be.

Next, as regards sisterhoods. Each mother bears on the average d female and d male children, or $2d$ individuals in all. Each of these will have $2d-1$ brothers and sisters, and half that number of sisters, namely, $d-\frac{1}{2}$.

The syllable *si* will be used to express "sisters" without regard to age or fertility, and *si'* to express "sisters who are fertile of female children"; similarly *da* and *da'* for daughters.

The number therefore of *si* is $d-\frac{1}{2}$, of *si'* it is $(d-\frac{1}{2})/d$, of *da* it is d, of *da'* it is 1. The number of *me'*, or of mothers to a child, is, of course, 1, and there is no occasion for using *me*, as a mother must be fertile.

A few examples of results are given in the following table; it could have been extended indefinitely, but these are quite sufficient for drawing conclusions:—

Specific kinships.		Average number in each	
ANCESTRY—			
me'	(mother)	1	1
me' me'	(mother's mother)	1×1	1
me' me' me'		$1\times 1\times 1$	1
COLLATERALS—			
si	(sisters)	$(d-\frac{1}{2})$	$d-\frac{1}{2}$
me' si	(mother's sisters)	$1\times(d-\frac{1}{2})$	$d-\frac{1}{2}$
me' me' si		$1\times 1\times(d-\frac{1}{2})$	$d-\frac{1}{2}$
si' da	(sister's daughters)	$(d-\frac{1}{2})/d\times d$	$d-\frac{1}{2}$
me' si' da		$1\times(d-\frac{1}{2})/d\times d$	$d-\frac{1}{2}$
si' da' da		$(d-\frac{1}{2})/d\times 1\times 1/d$	$d-\frac{1}{2}$
DESCENDANTS—			
da	(daughters)	d	d
da' da	(daughter's daughters)	$1\times d$	d
da' da' da		$1\times 1\times d$	d

The foregoing remarks and table are equally applicable to males if *bro* (brother) is substituted for *si*, *son* for *da*, *fa* (father) for *me*.

It will, then, be understood that each mother, father, or fertile couple has, on the average, d sons and d daughters, or $2d$ children altogether, of whom 1 is a fertile son, 1 a fertile daughter, and that the others die without issue. In the collection mentioned above, the value of d was about $2\frac{1}{2}$, that is to say, an average family consisted of about 5 children, which is a usual estimate.

It is unnecessary to prolong these remarks by considering the minor corrections to be supplied on account of the hypotheses not being strictly accordant with observation. The two most important of these relate to populations that are not stationary, and to the allowance to be made for inequality in number of the sexes. There are others hardly worth even the trouble of describing, being utterly insensible in rough work.

The general results are that kinships fall into three distinct groups:—(1) direct ancestry, (2) collaterals of all kinds, (3) direct descendants, and that the number of individuals in each *specific* kinship in these classes is respectively 1, $d-\frac{1}{2}$, and d. Also that $d=2\frac{1}{2}$ may be accepted as a reasonable and not infrequent value. To determine the number of individuals in each *general* kinship, the appropriate tabular number must be multiplied by the number of *species* that the *genus* contains; thus there are two species of aunts, *me si* and *fa si* (mother's sisters and father's sisters), each of which has the tabular number of $d-\frac{1}{2}$; therefore the average number of aunts is twice that amount, or $2d-1$, which, in the above case of $d=5$, is equal to 4.

FRANCIS GALTON.

The Mendelian Quarter.

A FEW weeks ago we heard in Section D at the Cambridge meeting of the British Association a paper by Mr. A. D. Darbishire on the bearing of his experiments in crossing Japanese waltzing and albino mice on Mendelian theory. He told us that on that theory we should expect a quarter of the offspring of the hybrids to be albinos—and we found them albinos—and a quarter of the offspring of the hybrids to waltz—and they did waltz. Somebody protested *sotto voce*, and Mr. Darbishire added "a rough quarter." Since that meeting I have been looking up the matter, for the point seems to me of great interest, and this is what I find in a recent paper by Mr. Darbishire in the *Manchester Memoirs*, "On the Bearing of Mendelian Principles of Heredity on Current Theories of the Origin of Species," vol. xlviii. p. 13:—"Let us consider the offspring of hybrids . . . . Secondly with regard to their progression, we should expect to find 25 per cent. waltzing mice: this is very roughly what happens; . . . Now let us look at the offspring of hybrids from *both* points of view at the same time: one mouse in every four is an albino; one in every four is a waltzer, so we should expect one in every sixteen to be an *albino waltzer*. Now these albino waltzers are new things . . .," and then Mr. Darbishire tells us that he has been unable to get offspring from them.

Here, from a quarter, we have got to a quarter "very roughly," but still "one mouse in every four is a waltzer." I must confess that Mr. Darbishire's "rough quarter" excited me to look further, and these are the words I find describing some actual experiments on these mice:—"*Waltzing* occurs in only 97 out of the 555 individuals resulting from the union of hybrids. When we compare this with the number of pink eyed individuals (131–134) or of albinos (137) we see that the proportion of waltzing individuals *cannot be regarded as a possible quarter*. The probable error of the expectation that a quarter of the individuals will waltz is, on the Mendelian hypothesis, $0.6745\sqrt{\frac{1}{4}\times\frac{3}{4}\times 555}=6.88$ only, and the observed deviation is $138.75-97=41.75$, the odds against so great a deviation being rather more than 50,000 to 1. As the result here obtained differs from Mendelian expectation in the same direction as that already obtained by von Guaita and to an extent consistent with the agreement of both, *the evidence that the waltzing character does not segregate in Mendelian proportions is very strong*."

The sentences in italics are not in italics in the original,

but I want to emphasise them. The words quoted are from an article on the "Result of Crossing Japanese Waltzing with Albino Mice" in *Biometrika*, vol. iii. p. 20. The writer appears to be a Mr. A. D. Darbishire of Oxford, *not* of Manchester. The one Mr. Darbishire considers that the proportions cannot be regarded as a possible quarter, the other that a rough quarter, or "one mouse in every four," is waltzing. Mr. Darbishire of Manchester expects that one in every sixteen of the offspring of the hybrids will be an albino waltzer, and then proceeds to state that he has so far been unable to breed from these albino waltzers. Reading his paper, I presumed he would have told us had he *not* found albino waltzers to be 1 in 16. Consulting, however, Mr. Darbishire of Oxford, I find he had 20 instead of 35 albino waltzers among his 555 offspring. I presume that 20=35 is a "rough" sixteenth to our Manchester author, while he of Oxford would doubtless have been able to tell us that the odds against such an underestimate were two or three hundred to one! Which writer shall a member of the inquiring general public trust? Or, if the two writers should be the same, must we assume that in Oxford, under the influence of some recessive biometer, Mr. Darbishire failed to see that 97 in 555 was a reasonable quarter, or 20 in 555 a reasonable sixteenth, but that he has learnt in Manchester, or perhaps in Cambridge from some dominant anæsthetist, that these things really are so?

But if 97 be not even roughly 139, or 20 approximately 35, would it not be well at once to admit that the waltzing habit corresponds to a compound allelomorph, one element of which, the *chorophore*, may be credited to any mouse, but only becomes patent when combined with the *chorogen* to form the true waltzing habit? I am not sure this will work, but perhaps Mr. Darbishire will give it a trial. Should this in turn fail, a metaphysician might help him out of these procrustean difficulties by analysing straightforward advance into right-handed and left-handed elements, each with its own chorophore and chorogen—but I must not anticipate the details of such a remarkable progression at present.

KARL PEARSON.

The *n*-Rays.

THE inability of a large number of skilful experimental physicists to obtain any evidence whatever of the existence of the *n*-rays, and the continued publication of papers announcing new and still more remarkable properties of the rays, prompted me to pay a visit to one of the laboratories in which the apparently peculiar conditions necessary for the manifestation of this most elusive form of radiation appear to exist. I went, I must confess, in a doubting frame of mind, but with the hope that I might be convinced of the reality of the phenomena, the accounts of which have been read with so much scepticism.

After spending three hours or more in witnessing various experiments, I am not only unable to report a single observation which appeared to indicate the existence of the rays, but left with a very firm conviction that the few experimenters who have obtained positive results have been in some way deluded.

A somewhat detailed report of the experiments which were shown to me, together with my own observations, may be of interest to the many physicists who have spent days and weeks in fruitless efforts to repeat the remarkable experiments which have been described in the scientific journals of the past year.

The first experiment which it was my privilege to witness was the supposed brightening of a small electric spark when the *n*-rays were concentrated on it by means of an aluminium lens. The spark was placed behind a small screen of ground glass to diffuse the light, the luminosity of which was supposed to change when the hand was interposed between the spark and the source of the *n*-rays.

It was claimed that this was most distinctly noticeable, yet I was unable to detect the slightest change. This was explained as due to a lack of sensitiveness of my eyes, and to test the matter I suggested that the attempt be made to announce the exact moments *at which I introduced my hand* into the path of the rays, by observing the screen. In no case was a correct answer given, the screen being announced as bright and dark in alternation when my hand was held motionless in the path of the rays, while the fluctuations observed when I moved my hand bore no relation whatever to its movements.

I was shown a number of photographs which showed the brightening of the image, and a plate was exposed in my presence, but they were made, it seems to me, under conditions which admit of many sources of error. In the first place, the brilliancy of the spark fluctuates all the time by an amount which I estimated at 25 per cent., which alone would make accurate work impossible.

Secondly, the two images (with *n*-rays and without) are built of "instalment exposures" of five seconds each, the plate holder being shifted back and forth by hand every five seconds. It appears to me that it is quite possible that the difference in the brilliancy of the images is due to a cumulative favouring of the exposure of one of the images, which may be quite unconscious, but may be governed by the previous knowledge of the disposition of the apparatus. The claim is made that all accidents of this nature are made impossible by changing the conditions, *i.e.* by shifting the positions of the screens; but it must be remembered that the experimenter is aware of the change, and may be unconsciously influenced to hold the plate holder a fraction of a second longer on one side than on the other. I feel very sure that if a series of experiments were made jointly in this laboratory by the originator of the photographic experiments and Profs. Rubens and Lummer, whose failure to repeat them is well known, the source of the error would be found.

I was next shown the experiment of the deviation of the rays by an aluminium prism. The aluminium lens was removed, and a screen of wet cardboard furnished with a vertical slit about 3 mm. wide put in its place. In front of the slit stood the prism, which was supposed not only to bend the sheet of rays, but to spread it out into a spectrum. The positions of the deviated rays were located by a narrow vertical line of phosphorescent paint, perhaps 0·5 mm. wide, on a piece of dry cardboard, which was moved along by means of a small dividing engine. It was claimed that a movement of the screw corresponding to a motion of less than 0·1 of a millimetre was sufficient to cause the phosphorescent line to change in luminosity when it was moved across the *n*-ray spectrum, and this with a slit 2 or 3 mm. wide. I expressed surprise that a ray bundle 3 mm. in width could be split up into a spectrum with maxima and minima less than 0·1 of a millimetre apart, and was told that this was one of the inexplicable and astounding properties of the rays. I was unable to see any change whatever in the brilliancy of the phosphorescent line as I moved it along, and I subsequently found that the removal of the prism (we were in a dark room) did not seem to interfere in any way with the location of the maxima and minima in the deviated (!) ray bundle.

I then suggested that an attempt be made to determine by means of the phosphorescent screen whether I had placed the prism with its refracting edge to the right or the left, but neither the experimenter nor his assistant determined the position correctly in a single case (three trials were made). This failure was attributed to fatigue.

I was next shown an experiment of a different nature. A small screen on which a number of circles had been painted with luminous paint was placed on the table in the dark room. The approach of a large steel file was supposed to alter the appearance of the spots, causing them to appear more distinct and less nebulous. I could see no change myself, though the phenomenon was described as open to no question, the change being *very* marked. Holding the file behind my back, I moved my arm slightly towards and away from the screen. The same changes were described by my colleague. A clock face in a dimly lighted room was believed to become much more distinct and brighter when the file was held before the eyes, owing to some peculiar effect which the rays emitted by the file exerted on the retina. I was unable to see the slightest change, though my colleague said that he could see the hands distinctly when he held the file near his eyes, while they were quite invisible when the file was removed. The room was dimly lighted by a gas jet turned down low, which made blank experiments impossible. My colleague could see the change just as well when I held the file before his face, and the substitution of a piece of wood of the same size and

shape as the file in no way interfered with the experiment. The substitution was of course unknown to the observer.

I am obliged to confess that I left the laboratory with a distinct feeling of depression, not only having failed to see a single experiment of a convincing nature, but with the almost certain conviction that all the changes in the luminosity or distinctness of sparks and phosphorescent screens (which furnish the only evidence of *n*-rays) are purely imaginary. It seems strange that after a year's work on the subject not a single experiment has been devised which can in any way convince a critical observer that the rays exist at all. To be sure the photographs are offered as an objective proof of the effect of the rays upon the luminosity of the spark. The spark, however, varies greatly in intensity from moment to moment, and the manner in which the exposures are made appears to me to be especially favourable to the introduction of errors in the total time of exposure which each image receives. I am unwilling also to believe that a change of intensity which the average eye cannot detect when the *n*-rays are flashed "on" and "off" will be brought out as distinctly in photographs as is the case on the plates exhibited.

Experiments could be easily devised which would settle the matter beyond all doubt; for example, the following:—Let two screens be prepared, one composed of two sheets of thin aluminium with a few sheets of wet paper between, the whole hermetically sealed with wax along the edges. The other screen to be exactly similar, containing, however, dry paper.

Let a dozen or more photographs be taken with the two screens, the person exposing the plates being ignorant of which screen was used in each case. One of the screens being opaque to the *n*-rays, the other transparent, the resulting photographs would tell the story. Two observers would be required, one to change the screens and keep a record of the one used in each case, the other to expose the plates.

The same screen should be used for two or three successive exposures, in one or more cases, and it should be made impossible for the person exposing the plates to know in any way whether a change had been made or not.

I feel very sure that a day spent on some such experiment as this would show that the variations in the density on the photographic plate had no connection with the screen used.

Why cannot the experimenters who obtain results with *n*-rays and those who do not try a series of experiments together, as was done only last year by Cremieu and Pender, when doubt had been expressed about the reality of the Rowland effect? R. W. WOOD.

Brussels, September 22.

Porpita in the Indian Seas.

DURING five voyages to and from the East, I have been interested in watching for (and not always seeing) a species of Porpita common in the Red Sea, on the coasts of India, Ceylon, and the Malay Peninsula. From the deck of a steamer the colony, only the flat disc of which is visible, appears like a floating counter of bone or ivory. When examined at close quarters it has a greyish metallic lustre, and is seen to be surrounded with an aureole of azure tentacles, the tips of which are green. So long ago as 1579 [1] Thomas Stevens appears to have remarked upon this animal (though he did not recognise its animal nature) as being one of the signs by which the vicinity of land might be known on the Indian coasts. During the monsoon, even in comparatively fine weather, this Porpita, so far as my observations go, completely disappears from the surface. It would seem to follow that the colony is an annual growth, as it has no power of sinking, and very feeble, if any, means of independent progression. This is borne out by an observation I was able to make on the shore at Colombo on July 15 last. On that date, when the monsoon had already been in progress for some weeks, the beach along the Galle face, which is open to the full force of the monsoon, was covered with biscuit-like discs, which I had no difficulty in recognising, from the sculpturing on their surface and the characteristic appearance in cross-section, as those of Porpita. They had quite lost their silvery appearance, and were very brittle; no trace of the living tissues of the animal remained. There were, however, large numbers of other Siphonophora, too decomposed for even partial identification (but obviously belonging to a different section of the group), mingled with the discs. My friend Dr. J. H. Ashworth tells me that he has observed much the same thing in the Mediterranean with regard to Velella, and it appears that Agassiz records having seen a broad blue band of Velella along the shores of Florida, but I have not the reference at hand. NELSON ANNANDALE.

Indian Museum, Calcutta, August 22.

[1] See Beazley's "Voyages and Travels," 1903, p. 158.

On van 't Hoff's Law of Osmotic Pressure.

VAN 'T HOFF imagines that a substance dissolved in a fluid medium behaves as if it were in a vacuum, and so exerts on the walls of the containing vessel a pressure which is precisely that which it would exert were the solvent imagined removed and the dissolved substance imagined present in a gaseous form.

The pressure thus exerted on the walls of the vessel is called the "osmotic pressure." Many authors of great mathematical repute have seriously questioned the correctness of van 't Hoff's views, and they find it exceedingly difficult to see how a dissolved substance *can* be present in the solvent in a state similar to the gaseous state.

For example, Prof. O. E. Meyer ("Kinetic Theory of Gases," p. 367, Eng. trans., 1896) remarks:—"... osmotic pressure is not one of the phenomena which the kinetic theory of gases has to explain. I will also not conceal that I do not think van 't Hoff's views of the kinetic nature of osmotic pressure to be correct. For osmose does not arise from the kinetic pressure of the dissolved substance, but from quite different forces which cannot be neglected."

I think, however, these authors have neglected an important factor which would tend to make the dissolved molecules behave as if in a vacuum, and so would tend to give physical reality to van 't Hoff's views.

The factor I allude to is the fact that different kinds of molecules attract each other with enormously different forces. For example, the molecules of carbon exert on each other an enormous attractive force, as is shown by the remarkable hardness and involatility of certain forms of carbon. Oxygen, hydrogen, helium, and other molecules have in comparison but a feeble molecular attraction.

Consider a molecule A in the midst of a swarm of other molecules; for example, a molecule in the interior of a homogeneous liquid. Then if the molecule A be of the same nature as the other molecules, each will exert the same intensity of attractive force on the other, and so the molecules will all be on an average symmetrically arranged about A. The liquid will, in fact, have at every point a symmetrical structure. If, however, the molecule A be different in nature from the neighbouring molecules (as occurs in the case of solution), two cases in general occur:—

(1) The molecules of the liquid attract each other more strongly than they attract the molecule A.

(2) The molecules of the liquid attract each other *less* strongly than they attract the molecule A.

(1) In this case it is easy to see that under the influence of the molecular forces the molecules of the *liquid* would be *drawn* away from the molecule A (in precisely the same way, and for a similar reason, that the molecules of quicksilver are drawn away from glass), and so form about A a sort of *vacuum bubble*; and as A moves forward in the liquid the molecules surrounding it would be drawn away, and leave a free passage for A, which would thus behave very much as if it were actually in a vacuum. Here, then, van 't Hoff's conception becomes readily intelligible.

(2) In this case molecules of the liquid would combine with the molecule A to form an unstable compound, traces of which are so often met with in solution; and the combination would proceed until the compound thus formed exerted an attractive force on the neighbouring molecules equal to or *less* than the force which the neighbouring molecules exert on each other.

When this occurs the case would resolve itself into case (1) previously considered, the unit, however, being now not the molecule A, but the molecular compound of which it forms a part.

In this connection it should be observed that it is a general rule that when a molecule adds on atoms to itself, the resultant aggregate of atoms usually exerts an *intensity* of molecular attraction *less* than that of the original molecule. For example, high-grade types of combination are nearly always more volatile than lower types of combination of the same molecular weight. Saturated compounds are more volatile than unsaturated compounds of the same molecular weight. Chemically unstable compounds are invariably more volatile than stable compounds of the same molecular weight, and the addition of atoms to a molecule decreases its stability.

The point is discussed fully in a paper which appeared in the *Chemical News* some time ago (vol. lxxxix. p. 241).

We should therefore expect to find that when a substance A in a liquid combines with molecules of the liquid, the *intensity* of the molecular attraction which the new compound exerts would diminish as the number of molecules of the liquid added on to the molecule A increases.

When this is not the case, van 't Hoff's law cannot be obeyed at all closely by the dissolved substance.

Kiel, September 6. GEOFFREY MARTIN.

THE ROYAL PHOTOGRAPHIC SOCIETY'S ANNUAL EXHIBITION.

THIS exhibition will remain open until October 29. Although the scientific and technical section is disappointing, for, taken as a whole, it is below the standard of the last few years, there are several exhibits that are well worth attention. We are glad to notice an improvement in the arrangement, each department being kept more distinct than heretofore.

Zoological work is better represented than any other. Captain F. D. S. Fayrer shows several photographs of the daboia (a venomous viper), in one of which venom can be distinctly seen hanging from the fangs. As an example of photographic difficulties successfully overcome, the "Flying Sea Gull" of Mr. B. H. Bentley should be noticed. There are several sets of prints illustrating progressive changes. The one that will probably be considered the most notable is "A comparison of a jump of one foot in height as executed by a dog and a cat respectively." There are sixteen photographs of each animal showing as many stages of the jump, and they demonstrate that both animals judge with remarkable nicety the rise necessary to clear the obstacle, and that the movement of the legs is the same in both cases. "The Embryology of a Chicken," by Mr. W. M. Martin, is a series of seventy photographs, one by Röntgen rays, some by transmitted light, and some by a combination of transmitted and reflected light. It is clever and useful work which must have needed considerable patience for its execution. The Zoological Photographic Club has contributed a number of very interesting and meritorious photographs, including one by Mr. Douglas English of the Orkney vole, the last discovered British mammal.

Mr. R. H. Baskett shows how, by means of a simple original such as a piece of lace or a sprig of forget-me-not or bramble, many designs may be obtained by the use of mirrors as in a kaleidoscope, if the multiplied image is photographed. He says that millions of designs may be obtained for the cost of the plates. A truly amateur's view of the matter in neglecting the cost of the apparatus and the time of the worker!

Colour photography is but poorly represented. A basket of fruit by Mr. S. R. Brewerton, done by the Sanger-Shepherd imbibition process, is a notable example, but such fine work has been done by this method that we cannot pass over the background, which if not unfortunate in its tint has not been reproduced with the perfection that we expect. Of the specimens of commercial colour work there is little to be said. What is wanted for exhibition is the original with its reproduction, produced without any fine etching or other hand work; then we shall be able to see what colour photography pure and simple is capable of, and to judge of its progress. If the trichromatic prints produced by Dr. Jumeaux's process fairly show the capabilities of that process, we can only say that it is a long way behind other processes. Photographers should notice the "three-colour carbon print" by Mr. J. Gilbert Jackson, as for obvious reasons they are not likely often to have the opportunity of seeing prints produced in this way. The carbon tissue is triply coated, so that the high lights show blue, the half tones, ochre, and the low tones, green. Of course, the colour in the print is in no way dependent on the colour of the object. The interest of the exhibit lies only in the fact that the method has been seriously proposed for practical work.

A telephotograph of St. Paul's showing a direct magnification of twenty-four diameters demonstrates excellently the usefulness of this kind of work. A number of photomicrographs, some Playertype enlargements, some star maps, and a few other items are all worth examination; but the most notable of the remaining exhibits is a series of radiographs showing bone diseases by Mr. C. Thurstan Holland. The amount of detail obtained in difficult circumstances is remarkable, and the exhibit is further praiseworthy as forming a connected whole instead of, as we often see, a heterogeneous collection of examples that have happened to turn out well. We regret to notice that there is no apparatus whatever in this section of the exhibition. Probably the presence of the trade exhibits in the central court is the reason for the disappearance of what used to be one of the main sections, but general exhibits by the trade do not take the place of a classified selection of new apparatus. In the central court will be found new cameras, or modifications of old ones, by several makers, and some new sensitometric apparatus and a recording chronograph by Messrs. Sanger-Shepherd and Co., besides, of course, a large selection of the various specialities of the exhibitors.

Of lantern slides there is a fair number, and they appear to be of more than usual interest. A series by Dr. G. H. Rodman showing how by the use of Röntgen rays the structure of molluscan shells can be shown, and a series of studies in the biology of flowers by Mr. B. H. Bentley, are the most conspicuous. But we cannot discover when these can be seen properly displayed, for a slide is not made to be looked at, but to furnish an enlarged image on a sheet. It appears that at the lantern lectures, which are given at intervals, other slides are shown.

PROF. N. R. FINSEN.

THERE are many records of patient heroism in the history of scientific investigation, but there are few careers in which strenuous work for the alleviation of human suffering has been carried on at greater disadvantage than that of the late Prof. Finsen, of Copenhagen.

Twenty years ago, he was the victim of a severe attack of rheumatism, which left the heart seriously damaged, and this was followed by disease of the liver and dropsy. By the greatest self-denial, and the most careful regulation of his dietary, Finsen

lived on, in spite of his terrible affliction, devoted to his work, developing his theories, and putting them to practical use in the treatment of disease. For some time past he had been confined to his house, and could only direct the labours of others in the great Light Institute at Copenhagen. His death occurred on Saturday, September 24, at the early age of forty-three.

Niels R. Finsen was born in the Færoë Isles, and spent some of his earlier years in Iceland. After eight years' study at the University of Copenhagen, he was appointed lecturer on anatomy. But his attention was soon directed to the investigation of the influence of light on living organisms.

Starting from Widmark's observations on the inflammation of the skin caused by the ultra-violet rays of light, he developed in 1893 the red-light treatment of small-pox. The exclusion of the chemical rays by red curtains modifies the course of this disease, and diminishes scarring. A prolonged series of observations was then made on the influence of light upon various animals, proving that the chemical rays produce irritative and deleterious effects.

Later, Finsen investigated in a masterly manner the bactericidal power of the ultra-violet rays, a development of the work of Downes and Blunt. The practical application of these experimental researches was the treatment of lupus by light, an advance in therapeutics which has placed in the hands of the medical profession a means of combating this intractable and most disfiguring disease.

Fortunately, Finsen's work was not allowed to languish for want of financial support. His friends helped him, and then the State aided him with a loan, free of interest, and the Light Institute was built. Since it was opened, 2000 patients have been treated.

The interest taken by Queen Alexandra in the work of her countryman led to the introduction of the light treatment into this country, and her gift of the apparatus to the London Hospital was followed by generous assistance from private donors enabling that institution to carry out the Finsen treatment with remarkable success.

Finsen was a man of noble qualities, of high scientific attainments, and of a remarkably inventive mind. The construction of his apparatus is sufficient to indicate this. It was no chance discovery, but was laboriously built up by the adaptation of scientific principles. His modesty, quiet humour, and total absence of self-seeking brought him the esteem and affection of all who knew him.

Always a poor man, Finsen could with difficulty be persuaded to retain for the use of his family any part of the Nobel prize of 100,000 crowns which was awarded him. He wanted to give all to his institute, but eventually agreed that half should be placed at interest for his family, to revert subsequently to his great work. This institute and its beneficial cures are a fitting memorial of a splendid life of quiet heroism in the cause of science.

NOTES.

A CAREER of high promise was cut short by a lamentable accident at the "Devil's Kitchen," near Bethesda, North Wales, on September 20. Mr. Ronald William Henry Turnbull Hudson, lecturer in mathematics at the University of Liverpool, who, with Mr. J. F. Cameron, lecturer of Caius College, Cambridge, was climbing a difficult *couloir*, dislodged a mass of rock, and, falling with it, was instantly killed. Mr. Hudson, who was just twenty-eight years of age, was the son of Prof. W. H. H. Hudson, of King's College, London, and the brother of two sisters who recently distinguished themselves in mathematics at Newnham College. He was educated at St. Paul's School and St. John's College, Cambridge. He gained every college award that was open to him, and graduated as senior wrangler in 1898, his friend Mr. Cameron being second wrangler. The two comrades were alone in the first division of the first class in part ii. of the tripos in 1899, and in the following year each was a Smith's prizeman. In 1900 Mr. Hudson was elected a fellow of his college, and engaged with success in teaching and research. He graduated M.A. in 1902, and was appointed lecturer at Liverpool, where his powers rapidly matured. He published a number of papers, chiefly on analytical and geometrical subjects, which manifested much freshness and skill, as well as width of interest and of knowledge. He was unusually well read in classical and modern literature, and in experimental science. In athletic pursuits he was also keenly interested, and more than once steered his college boat to victory. It was confidently expected that ere long he would be promoted to a professorial chair, for which his gifts and acquirements specially fitted him. The news of his untimely death was received in Cambridge with the deepest regret, and with sincere sympathy for his family and college.

THE fifth annual Huxley memorial lecture of the Anthropological Institute will be delivered on Friday, October 7, in the theatre of the Civil Service Commission, Burlington Gardens, when Dr. J. Deniker, of Paris, will lecture on the different racial elements in the present population of Europe.

THE King has conferred the title "Royal" upon the Edinburgh Museum of Science and Art, and approved its designation being altered to "The Royal Scottish Museum."

EXTENSIONS made to Millport Marine Biological Station, including new laboratory, research rooms, tank-room, and library, all the gift of Mr. James Coats, jun., of Paisley, were opened on Tuesday by Sir John Primrose, Lord Provost of Glasgow.

THE Liverpool School of Tropical Medicine proposes to dispatch a second expedition to the Amazon in view of the necessity of further investigation of yellow fever. The expedition will probably start at the end of this year.

THE National Association for the Feeble-minded and the National Union of Special School Teachers have arranged a conference to be held at the Guildhall on October 13 and 14 to discuss various aspects of physically, mentally, and morally defective children.

REUTER'S correspondent at Naples states that the Vesuvius Observatory has issued the following notice:—"The activity of Vesuvius is very great. The walls of the crater, which have collapsed, tend to obstruct the bottom of the crater, whence proceed immense explosions and volcanic dust. The torrent of lava in the valley of Atrio del Cavallo is forming small volcanoes, the explosions from which attain a height of 150 metres. Large fissures have occurred in the great cone, the rupture of which is considered possible." The eruption of Mount Vesuvius on September 23 is said to have been the greatest within the last ten years. On September 25 explosions were frequent, and masses of igneous matter were hurled to great heights. Parts of the neighbouring woods have been burned, the funicular railway has been damaged, and the guides' quarters have been destroyed.

THE following papers will be read at the autumn meeting of the Iron and Steel Institute to be held in New York on October 24 and 26:—Iron and steel at the St. Louis Exposition: Prof. H. Bauerman; a West African smelting-house: C. V. Bellamy and F. W. Harbord; the influence of carbon and phosphorus upon the strength of iron and steel: H. H. Campbell; the Rateau low-pressure turbine at steel-works and collieries: E. Demenge; a dry air blast apparatus: J. Gayley; high-speed tool-steels: J. M. Gledhill; the determination of carbon and phosphorus in steel: Baron H. Jüptner von Jonstorff, A. A. Blair, G. Dillner, and J. E. Stead, F.R.S.; acid open hearth manipulation: Andrew McWilliam and W. H. Hatfield; a power gas plant for Johannesburg: P. J. Mallmann.

THE fourth general meeting of the International Fire Service Council was recently held at Budapest on the occasion of the International Fire Congress, which was organised under its auspices. The meeting was presided over by M. G. de Marie, of Luxemburg. All the European countries were represented, with the exception of Portugal, Turkey, and the Balkan States. It was decided that the seat of the council remain at Luxemburg for the next four years. Mr. Edwin O. Sachs, chairman of the British Fire Prevention Committee, was re-elected vice-president for the impending four years. The work of the council for this period will deal to a considerable extent with technical questions, with statistical questions in respect to fire losses, and with the preparation of a fire technical dictionary in the German, French, and English languages. The next general meeting of the council will be held at Milan in 1906. Among the resolutions adopted by the recent conference at Budapest were the following:—(1) That it is absolutely essential that all stage scenery and properties be rendered non-inflammable in a trustworthy and permanent manner, and that all the constructional parts of a stage be of a fire-resisting character. (2) That the greatest attention should be accorded to the chemistry of fire protection in the interests of fire prevention.

THE twelfth annual report of the Sonnblick Society for the year 1903 contains a very interesting description by Dr. O. Szlavik, an assistant at the Vienna Meteorological Office, of a winter passed by two observers and himself on the summit of that mountain, at an altitude of 10,190 feet above the sea. For various reasons, including the want of educated companions and the difficulties of locomotion, Dr. Szlavik considers that a winter passed at such a station compares unfavourably with the privations endured at a Polar station. The meteorological summary for 1903 shows that the mean monthly temperature only rose above the freezing point in the month of August. The maximum (46°·8) occurred in September, and the minimum (−14°·4) in February. Snow or rain fell on 205 days. The pamphlet also contains an illustrated article on optical phenomena observed at the station, the results of observations at several high-level stations in the neighbourhood of the Sonnblick, and other useful information relating to mountain meteorology. We are glad to learn that the society has decided to combine the results of the last twelve years in one handy volume.

THE *Journal* of the Sanitary Institute for August (xxv., part ii.) contains the addresses delivered to the congress of the Sanitary Institute at Glasgow, and Sir Douglas Powell's lecture to the congress on "The Prevention of Consumption."

WE have received the September number of *Our Hospitals and Charities*, an illustrated monthly journal which gives interesting particulars of the various London and provincial hospitals, convalescent homes, and other charitable institutions.

SEVERAL papers have recently been published on the morphology and occurrence of the Leishman-Donovan body or parasite (see NATURE, lxix. pp. 167 and 495, and lxx. p. 85). This parasite occurs in certain cases of irregular tropical fever of long duration, associated with enlarged spleen and marked cachexia. Major Donovan, I.M.S., in the *Lancet* (September 10, p. 744) describes fully the cases in which he has detected the parasite, and gives a number of coloured drawings of the latter. In the *British Medical Journal* (September 17, p. 642) the discussion on this parasite at the meeting of the British Medical Association is reported. Major Leishman, R.A.M.C., in opening it, stated that he had expressed the opinion that this parasite was a stage in the life-cycle of a flagellate protozoon, probably a trypanosome. Prof. Leonard Rogers described experiments he had performed on the cultivation of the organism, and stated that undoubted trypanosomes had appeared in two of his cultures.

THE report of the departmental committee appointed to investigate experimentally and to report upon certain questions connected with the dipping and treatment of sheep has recently been issued. The composition of efficient dips, their method of use, and their effects upon the animals, the wool, and the parasites for which they are employed, and the life-history of the sheep-scab acarus and other parasites, are some of the subjects dealt with, and a series of recommendations is given for the periodical dipping of sheep. All the dips tested proved efficient; they consisted of arsenic and alkali, arsenic and sulphur, preparations of tar, tobacco and sulphur, and carbolic acid. The tobacco and sulphur preparations seemed to be the most active, rapidly killing the parasites, and having no injurious action on the wool; they are, however, somewhat costly. The arsenical preparations have to be used with care, or the animals may suffer. Some of the tar preparations had a deleterious action on the wool.

IN the *Bulletin* of the Johns Hopkins Hospital for July (xv., Nos. 160–161), Dr. Harvey Cushing surveys the sensory distribution of the fifth cranial nerve, Dr. Percy Dawson continues his biography of the Rev. Stephen Hales, and Dr. Schmoll discusses the chemical origin of leucocytes. In the last named the question is discussed whether the organism is able to synthesise the nuclein of its tissue cells, or is obliged to build them out of the cell material contained in its food. From a study of cases of leucæmia, and the influence on the leucocytes of ordinary mixed diet and of a purin-free diet, the conclusion is arrived at that, while the organism prefers to draw upon preformed nuclein material, it is perfectly able to synthesise this if necessary.

DRAGON-FLY "nymphs" form the subject of a paper by Mr. J. G. Needham published in the *Proceedings* of the U.S. National Museum (No. 1371). The examination of a large series of the immature stages of these insects has tended to throw light on the mutual relationships of the forms to which they severally belong.

CONSIDERABLE interest attaches to an article by Messrs. Castellani and Willey in the August issue of *Spolia Zeylanica* on the parasites found in the blood of vertebrates in Ceylon. The only trypanosome detected by the authors in the island is *Trypanosoma lewisi*, which infests at least 25 per cent. of the rats in millions, but without doing any appreciable harm to its hosts. Although the trypanosome

of cattle disease can be readily transmitted by inoculation into rats, the rat-parasite will only develop in its proper hosts. Some curious problems in development are presented by the life-history of a gregarine found in the blood of a water-snake.

IN the September issue of the *American Journal of Science* Mr. E. H. Sellards continues his account of the Palæozoic cockroaches, with descriptions of several new Coal-measure types. Another article, by Mr. G. R. Wieland, is devoted to the structure of the turtles of the genus Lytoloma, as exemplified by specimens from the Upper Cretaceous of New Jersey. These turtles, it may be mentioned, are characterised by the backward position of the inner nostrils and the great length of the mandibular symphysis. The author considers that they were specialised for the purpose of feeding on shell-fish, and confirms Mr. Lydekker's reference of the English Eocene *Chelone planimentum* to the American genus

DRS. B. L. ROBINSON and J. M. Greenman continue to publish the results of their examination of Mexican and Central American plants in the first number of the current volume of the *Proceedings* of the American Academy of Arts and Sciences. Mr. M. L. Fernald presents a synopsis of species of Alnus, and describes a number of new species from the same countries.

IT is tolerably well known that contact with certain plants, notably species of Rhus and Primula, often causes inflammation. This may be described as a form of eczema, or in some cases would be more correctly called dermatitis. Mr. J. H. Maiden has made these plants the subject of a short paper which he laid before the Therapeutical Society in March, 1903.

SINCE the first description with figures of Melocanna by Roxburgh in 1819, it was known that this genus of bamboos growing in eastern Bengal and Burmah was characterised by the production of a succulent fruit about the size of a pear, and containing one large oval seed; later it was observed that germination started before the fruit was shed. Only recently has a complete description been forthcoming in the paper which Dr. O. Stapf communicated to the Linnean Society, and which is published in the *Transactions* (June). The fruit of Melocanna differs from that of ordinary grasses in other respects, because the ripe seed contains no endosperm, the food being stored up in the pericarp, and the collapsed endosperm cells act as a diaphragm. One of the most striking features of the plant is that it forms large jungles or forests, in which after many years of vegetative growth all the plants produce their flowers and fruits simultaneously.

IN view of the discussion of electrical units by the International Electrical Congress at St. Louis, the Physikalisch-Technische Reichsanstalt publishes in part xxxi. of the *Elektrotechnische Zeitschrift* a protest against defining the unit of electromotive force by reference to a standard cell. It is maintained that sufficiently large differences exist in the E.M.F. of any one type of cell with differences in constructional detail to prevent the adoption of such a unit from giving satisfaction. With our present knowledge of standard cells, it is contended, the unit of resistance should be the mercury unit, and current should be defined by reference to the silver voltameter; the unit of E.M.F. is then the derived unit obtained by assuming Ohm's law.

WE have received from the author a reprint of a paper read before the German Physical Society by Mr. L. Austin on the alteration in length during magnetisation of Heusler's magnetic alloys of manganese, aluminium, and copper. It contains a description of a very simple apparatus for measuring minute changes in length, in which the magnifying principle adopted is the reflection of a beam of light from a plane mirror. Besides showing that the alloys increase in length during magnetisation proportionally to the magnetic force, the author describes a peculiar contraction which they subsequently undergo when exposed to a magnetic field of constant strength. The contraction seems to be roughly proportional to the square of the magnetic intensity.

IN No. 18 of the *Physikalische Zeitschrift* Prof. F. Paschen publishes an experimental investigation of the γ rays emitted by radium. These extremely penetrating radiations have hitherto been regarded as most closely allied to the Röntgen rays, but as they carry with them a negative charge which they are capable of imparting to substances that they encounter, it appears more justifiable to regard them as a species of kathode rays. All attempts, however, to deflect the γ radiations in the same way as the β rays by means of an intense magnetic field were unsuccessful. Even in a field of 30,000 C.G.S. units a perceptible deviation from a straight line path could not be detected. By carefully measuring the thermal effect of the γ radiations, the surprising result was obtained that the energy of a γ electron must be at least 3200 times greater than that of a β electron. That the γ rays cannot be the Röntgen effect of the β or kathode rays of radium is shown by the fact that their total energy is to that of the β rays in the ratio 74 : 1. It is concluded, indeed, that the γ rays carry with them the greater proportion of the energy of radium.

AN improved means of observing the beautiful scintillations exhibited by a sensitive screen under the action of Alpha rays has been devised by Mr. F. H. Glew, 156 Clapham Road, S.W. The little instrument, which is called the "Scintilloscope," consists of a simple magnifier of adjustable focus, as in the spinthariscope, but instead of the fixed screen and particle of radio-active substance a small double plate of glass is used. One of these pieces of glass is coated with a radio-active salt, and the other is a radio-sensitive screen. Upon looking at a combination of this kind with the lens the sparkling appearance is very clearly seen. The advantage of this method of observing the effect is that different combinations of radio-active substances and screens can be used. For instance, a sensitive screen placed upon a piece of pitchblende ground flat and polished shows the scintillations very well. Mr. Glew's device provides an effective way of exhibiting the brilliant display produced by radio-activity on sensitive screens.

IN the *Proceedings* of the American Philosophical Society (vol. xliii. p. 123) Messrs. Edgar F. Smith and F. F. Exner give an account of an elaborate investigation of the atomic weight of tungsten. The authors, on the basis of a critical examination of previous determinations, consider it doubtful whether pure substances have been employed. The mean atomic weight calculated from concordant data obtained by converting the hexachloride into the oxide is 184·04, and by oxidation of the metal 184·065.

SOME interesting results have been obtained by F. Garelli and F. Gorni in a study of the isomorphism of organic substances by the cryoscopic method. They are described in the August number of the *Gazzetta*. Substances may apparently differ very considerably in constitution, and yet crystallise together so as to form a solid solution. Thus, for example, phenyl benzoate, phenyl salicylate, and salicylhydroquinone, which differ by the

important hydroxyl group, readily form mixed crystals. That a definite law does not hold in such cases is shown by the fact that phenol and hydroquinone, which bear the same relation to each other as phenyl salicylate and salicylhydroquinone, are not perceptibly isomorphous. The results are of importance as indicating a limitation of the cryoscopic method of determining molecular weights.

SOME experiments which are of importance from the standpoint of the theory of dyeing are described in the *Proceedings* of the Vienna Academy of Sciences (No. 15) by Prof. W. Suida. On exposing several finely divided natural silicates to the action of coal-tar dyes, it was found that those silicates which were of an acid nature, containing free hydroxyl groups, were permanently dyed by the basic dyes of this series, whilst acid dyes were without action. Similarly, hydrated silicic acid readily absorbs the same colours, whilst silicic anhydride has no affinity for them. When kaolin is used, the different colour-bases combine with it in equivalent proportions, probably to form colour-salts, the original acid in the dye becoming attached to constituents of the clay. Similar results were obtained with potato-starch, and the general conclusion is drawn that the process of dyeing with basic colours is far more chemical than physical in its nature.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN OCTOBER :—

Oct. 1. 7h. Mercury at greatest elongation, 17° 54′ W.
5. 7h. 45m. to 9h. 7m. Transit of Jupiter's Sat. III.
7. 15h. Moon in conjunction with Mercury. Mercury 1° 1′ N.
12. 11h. 0m. to 12h. 24m. Transit of Jupiter's Sat. III.
15. Venus. Illuminated portion of disc=0·897, of Mars=0·956.
18. 11h. 0m. Jupiter in opposition to the Sun.
19. 14h. 13m. to 15h. 42m. Transit of Jupiter's Sat. III.
19–21. Epoch of October meteors (Radiant 92°+15°).
19. 10h. 8m. Minimum of Algol (β Persei).
22. 6h. 57m. Minimum of Algol (β Persei).
23. 10h. 0m. Moon in conjunction with Jupiter. Jupiter 1° 34′ N.
25. 6h. 37m. Jupiter's Sat. IV. in superior geocentric conjunction.
26. 16h. 48m. to 17h. 25m. Moon occults γ Tauri (mag. 3·9).

EXPLANATION OF THE MARTIAN AND LUNAR CANALS.—Prof. W. H. Pickering, writing to No. 7, vol. xii., of *Popular Astronomy*, offers an explanation of the formation and variation of the Martian canals which is based on their analogy to the similar features seen on the lunar surface. Whilst accepting the vegetal origin so ably supported by Mr. Lowell, Prof. Pickering finds the theory of artificial pumping suggested by that observer difficult to realise.

Instead of this, he supposes that the lunar canals, and hence, by analogy, those observed on Mars, are simply lines of volcanic action on the surface where the crust is weakened, and therefore is easily cracked by the internal stresses put upon it by the action of the heated interior.

This theory is supported by his observations that the canals, and also the lakes from which they appear to radiate, are dotted by small craterlets and are so symmetrically arranged about the craterlets as to suggest a causal relation between the two phenomena. Analogous formations are common in terrestrial volcanic districts; for example, in the 2000 mile stretch of volcanoes which occurs in the Andes.

This theory does not require the transference of water and carbon dioxide along the canals, but supposes that they issue directly from the interior along the whole length of each fissure, and in conjunction with sunlight promote the growth of vegetation. Owing to the rarity of the atmosphere, Prof. Pickering suggests that the vapours would not ascend on their emergence, but would quietly roll down the slopes of the craterlets, or "lakes," and canals, thereby sufficiently irrigating the immediate vicinity to produce the vegetation.

FURTHER OBSERVATIONS OF THE RECENT PERSEID SHOWER.—Communications from American observers confirm the comparative richness of the recent display of Perseids.

At Wilmington (N.C.) Mr. E. S. Martin saw between 25 and 30 Perseids per hour between 9 p.m. and 12 p.m. (local M.T.) on the nights of August 10 and 11, although very few were seen on August 12 and 13, and none on August 14.

At Barre (N.Y.) Mr. W. Wetherbee saw 154 meteors, of which 116 were Perseids, in less than three hours on the eve of August 11. He remarked that many of the Perseids appeared in pairs the components of which travelled in parallel paths and had equal magnitudes. According to this observer, the radiant has moved westward, and appeared to be near to the star ι Persei. One extraordinarily bright Perseid appeared in Aquila, and left a trail 10° long which lasted for about four minutes (*Popular Astronomy*, No. 7, vol. xii.).

POSITION OF SATURN'S NINTH SATELLITE.—A telegram from Prof. E. C. Pickering, published in No. 3969 of the *Astronomische Nachrichten*, announces that Prof. Barnard observed Phœbe, Saturn's ninth satellite, on September 12·6916 (G.M.T.). The apparent position at that time was as follows :—

$$\alpha = 21\text{h. } 12\text{m. } 29{\cdot}5\text{s.}, \quad \delta = -17^\circ\ 25'\ 55''.$$

The motion of the satellite was south-west, whilst the magnitude was 16·7.

DISTRIBUTION OF NEBULÆ IN RELATION TO THE GALAXY.—In No. 3969 of the *Astronomische Nachrichten* Dr. C. Easton discusses the distribution of the nebulæ in regard to the galactic system.

Commencing with the usually accepted statement that the nebulæ not only occur some distance from the Milky Way, but that they actually tend to congregate about the galactic poles, he confirms this, from observational data, for the northern hemisphere, but questions its truth for the southern hemisphere. He further states that the accepted notion that it is simply the lack of observations which accounts for the apparent scarcity of nebulæ in the southern hemisphere is not founded on fact. If it were true, then that part of the northern galactic zone which lies south of the equator should apparently contain fewer nebulæ than that part which is above, because it has not been so well observed. The following figures show that although this is true for the faint nebulæ, which with the planetary nebulæ are placed in the category of "green nebulæ," in the case of the bright (*i.e.* "white") nebulæ the inverse is true :—

Northern Galactic Zone.

	A S. of the equator	B N. of the equator
Faint nebulæ	754	1043
Bright nebulæ	152	71

This leads to the conclusion that the nebulæ in the southern hemisphere are not arranged in the same manner as those in the northern.

Several other interesting points are developed by Dr. Easton in his paper, and are supported by the tabulated observational results which he gives. One other important conclusion at which he arrives is that the faint nebulæ are allied, as regards their phase of development, to the stellar conglomerations of the galaxy and occur in the same regions, whilst the bright (*i.e.* "true") nebulæ are similarly allied to the sparsely distributed non-galactic stars.

ASTRONOMY AND COSMICAL PHYSICS AT THE BRITISH ASSOCIATION.

GREAT vitality was shown in this subsection, and three mornings and one afternoon were hardly sufficient to get through the rather large programme. The meetings were well attended, and were of particular interest, since many distinguished foreigners were present, several of whom attended at Cambridge in consequence of the meeting there of the subcommittee of the International Meteorological Committee which was appointed at Southport last

year to discuss the means of advancing our knowledge of the relation between solar and terrestrial changes.

Sir John Eliot's address has already appeared in these columns, so that attention here will be restricted to the subsequent proceedings of the subsection.

With Sir John Eliot in the chair, the first paper on Friday was by Father Cortie, who summed up the results of all the observations of sun-spot spectra made at Stonyhurst during the period 1883–1901. One of the chief points of the paper was to show the great importance of the elements vanadium and titanium, the lines of these elements being more frequently widened than those of any other. Reference was also made to widened-line crossings and to oxygen in the spectra of sun-spots.

Sir Norman Lockyer then followed with a short summary of his work on the classification of stars according to their temperature since he gave the Rede lecture in 1871. The chief feature of the paper was to show that by paying special attention to the results obtained with a small camera having calcite and quartz to replace the glass lens and prism used in his earlier work, he was enabled to bring a more efficient check on the classification from the point of view of the extension of the spectrum in the ultra-violet than he could with the glass optical parts. The result of this inquiry confirmed the chemical classification in every respect.

The extension in the ultra-violet part of the spectrum as a criterion of stellar temperatures was the subject of a paper by Mr. H. F. Newall, who was inclined to question this criterion based upon the ultra-violet extension. He referred to observational evidence, which displayed sometimes perplexing discrepancies between the relative intensities of the blue and the red ends of the spectrum in different stars. The point raised was, how far was the present criterion of stellar temperature based upon the observed behaviour of gaseous radiation as opposed to the radiation of solid bodies? He said, in conclusion, that it was not impossible that we should be forced to regard extension in the ultra-violet regions as a sign of differences and not of high temperature.

The paper on the short-period barometric see-saw and its relation to rainfall, by the present writer, was an extension of a paper which has previously been printed in this Journal (vol. lxx. p. 177). The chief point was to show how very closely rainfall curves were associated with curves representing the inverted barometric changes. The regularity of the barometric see-saw mentioned above suggested that there may possibly be found to exist a method here of forecasting wet and dry years over a large portion of the earth's surface.

After a brief interval for lunch, the meeting was continued, Dr. Shaw taking the chair in the absence of Sir John Eliot.

Prof. Birkeland (Christiania) spoke about the relationship between sun-spots and auroræ. The chief feature was to indicate that "stream lines" from the sun could only reach the earth's atmosphere between very narrow limits, and these in high latitudes, and further that only spots on a restricted portion of the solar disc in relation to the position of the earth would have any terrestrial effect. In this way he suggested a means of explaining the narrow curtain-like form of the aurora and its occurrence chiefly in high latitudes.

A short paper by M. Angot (Paris) described a result which he had derived from an examination of Wolf's sun-spot numbers. He found that, by taking the relative number at a sun-spot minimum and also about a sun-spot maximum, small relative numbers at a minimum are followed by small numbers at a maximum, and large numbers at a minimum by large numbers at a maximum. As the last minimum (1901·7) was small, the next maximum, he suggested, will be small also. As another investigation points to the next maximum being comparatively large, it will be interesting to see which occurs.

The results of an investigation of the upper air over the Mediterranean by means of flying kites from a steamer were described by M. Teisserenc de Bort. He showed that although on the average greater elevation meant greater wind velocity, there were alternately strata of large and small velocities. This fact explains why sometimes attempts at getting kites to fly above certain elevations have failed. Both Mr. Rotch and Dr. Shaw spoke on this interesting question.

Commander Hepworth described the relation between pressure, temperature, and air circulation in the South Atlantic Ocean, the result of a large piece of research work in which 3300 ships' logs had been utilised. In the absence of Prof. K. Ångström, his two papers, on the ultra-violet absorption spectrum of ozone and the existence of that gas in the atmosphere, and an instrument for the measurement of the radiation from the earth, were taken as read, and the meeting closed for the day.

On Monday, the second day on which this subsection met, Sir J. Eliot being in the chair, the reports of the seismological and kites committees were briefly summarised by Dr. Milne and Dr. Shaw respectively.

Mr. A. L. Rotch (U.S.A.) described the results of the experiments he has been making with kites at the Blue Hill Observatory in order to determine the temperature of the air in cyclones and anticyclones. Sir David Gill spoke about an attempt he had made to state the problems in practical astronomy which press for solution. Among these he mentioned the apparent discordance between the value of the constant of aberration as derived from direct observation (20″·52) and that obtained by combining the measured value of the sun's parallax (8″·80) with the known velocity of light, which gives a value of the aberration constant (20″·48). The discussion in the paper confined itself to the means to be adopted for perfecting the determinations of the solar parallax, the constant of aberration, and the mass of the moon. Reference was also made to the variation of latitude, to the Lœwy-Comstock method for determining the aberration constant, to recent improvements in methods of meridian observation, and to the value of old series of observations.

Dr. W. N. Shaw opened the discussion on a memorandum adopted by the committee of the council on the suggested uniformity of units for meteorological observations and measurements. Several speakers gave their views on the subject, but no definite conclusion was arrived at. The general opinion seems to be that either to alter or put additional scales to the barometers and thermometers would, from a practical point of view, be detrimental to the observations themselves. It was suggested that such units might be adopted in the discussion of meteorological problems, the conversions to the new scales being made after the observations had been collected at the central office. From the physical standpoint the subject was not discussed.

In a paper on the masses of stars, Dr. H. N. Russell pointed out that the average mass of fifty-five binary stars is about three times that of the sun. Groups of stars with very different spectra, magnitudes, and proper motions have almost the same average mass. Thus it was concluded that stars vary much less in mass than in other characteristics.

The third and last meeting of this subsection took place on Wednesday, Sir John Eliot being in the chair. The first two items on the programme were the reports of committees on the Falmouth Observatory and on observations of Ben Nevis. In the absence of Prof. O. Backlund (St. Petersburg), his paper on some results of researches on the comet Encke was taken as read.

The writer described briefly the spectroheliograph recently erected at the Solar Physics Observatory, South Kensington. This instrument, which is now in fair adjustment, is used for photographing the sun in monochromatic light. The numerous photographs shown gave an idea of the efficiency of the instrument, and they are now being daily secured, weather permitting. Composite pictures in "K" light were shown, the "limb" and "disc" of the sun being taken on one plate. Many of the photographs showed rapid solar changes, one enormous prominence 192,000 miles in length increasing to 216,000 miles in five hours, its height changing from 55,000 miles to 60,000 miles simultaneously.

In a paper on the unsymmetrical distribution of rainfall about the path of a barometric depression, Dr. H. R. Mill showed that, for the British Isles, the area of heavy rainfall, in nine cases out of ten, lay on the left of the cyclone's path, and in advance of the centre. This relationship suggests that a more definite basis for forecasting heavy rains becomes available if it be possible to ascertain previously the path of the cyclone's centre.

Miss Hardcastle read Miss F. E. Cave's paper, which contained some further results she has obtained relative to

the application to meteorology of the theory of correlation. The two stations taken were Wilmington (North Carolina) and Halifax (Nova Scotia), distant from one another about 1000 miles. Allowing different intervals between the corresponding barometric observations, the magnitude of the correlation was found to vary with these intervals, being greatest when Halifax is taken one day later than Wilmington. It was suggested that for selected places further apart the discovery of correlations of sufficient magnitude might be of use in the practical work of prediction.

Major B. Baden-Powell described briefly the development of the aëroplane, and gave an account of the experiments that he has been recently carrying on. Chief among these were his gliding experiments made at the Crystal Palace, in which he is seeking to find out how a man-carrying machine behaves while travelling in the air.

After a paper by Prof. D'Arcy W. Thompson on Plato's theory of the planets, the business of the subsection came to a conclusion, the following papers being taken as read :—Report of Committee on Underground Temperatures; Dr. F. Hirtel, Zur Flugfrage; Rev. J. M. Bacon, upper air currents and their relation to the audibility of sound; Prof. Lemström (Helsingfors), on the effect of electric air-currents; J. Hopkinson, the rainfall of the midland and eastern counties of England, and the rainfall of England, 1861–1900. WILLIAM J. S. LOCKYER.

ZOOLOGY AT THE BRITISH ASSOCIATION.

THE meetings of Section D were held in the new Sedgwick Museum of Geology. On Thursday morning, August 18, Mr. W. Bateson, F.R.S., delivered to a large audience his presidential address (see NATURE, August 25), the vote of thanks for which was moved by Prof. Poulton and seconded by Prof. Max Weber. In the afternoon Prof. F. W. Keeble gave an address, illustrated with diagrams and lantern slides, on the coloration of marine Crustacea, embodying results of the researches carried on by Dr. Gamble and himself during the last seven years. He described the prawn-like *Hippolyte varians* which lives among the seaweeds around our coasts, and matches their colour with marvellous precision. Its colours range through green, yellow, and brown to red. When given a choice between different coloured weeds, this animal invariably picks out for its abiding place that weed which is in harmony with its own coloration, a faculty to be ascribed not to the possession of a colour sense by the animal, but rather to an extreme sensitiveness to light. Only in one position, namely, on weed of its own colour, is it in a position of light equilibrium, and then it rests. The coloration of the animal is produced by the manipulation of its three colour pigments, red, yellow, and blue. The common shrimp and prawn were shown to possess the same mechanism, although they make little use of it. Transparent young Hippolytes placed on weed of a certain colour develop the pigment necessary to approximate the animals to that colour in forty-eight hours or less; older animals take almost a week for the same process, and adults a fortnight, but even then the result is imperfect. Though the adults have lost, to a large extent, this power of sympathetic colour change, the pigments react rapidly to changes of light. This reaction is most marked not when the intensity of light changes, but when the background on which the animal rests is changed from white to black, *i.e.* from one which scatters to one which absorbs light. In the daytime the pigments are expanded; at night they are contracted, except the blue, so that the animal has then a transparent azure colour. This is a true periodic change; it has become a habit, and endures for days even though the animals be kept in darkness.

Prof. W. B. Scott, of Princeton, U.S.A., then delivered an address (with lantern illustrations) on the Miocene ungulates of Patagonia The animals described were collected by the Princeton Expedition from the Santa Cruz beds, the Miocene age of which seems to be now established. Prof. Scott pointed out that while these South American ungulates are singularly different (especially in the structure of the periotic region) from those of the northern hemisphere, it is not unlikely that they have a common origin, as Ameghino has described a number of genera from pre-Patagonian formations which, though incompletely known, appear to be referable to the Condylarthra—the parent stock of the northern ungulates. Very probably an early Eocene or late Mesozoic migration carried the Condylarthra into South America, and there, in almost complete isolation, they gradually gave rise to the various peculiar orders of the Noto-Ungulata. The possibility of such a migration is shown by the discovery of an armadillo in the Middle Eocene of North America.

The section was occupied practically the whole of Friday, August 10, with papers and discussions on heredity, Prof. Hickson, F.R.S., in the chair.

The first paper was by Miss E. R. Saunders on heredity in stocks. She said that since the re-discovery of Mendel's work, experimental evidence of the purity of the germ cells has been found in a rapidly increasing number of examples. Much of this evidence has been derived from cases like those studied by Mendel where the differentiating characters are related to each other as dominant and recessive. In such cases the individuals of the (F_1) first generation (DR) show the dominant character, and those of the second (F_2) generation the two parental characters in the ratios 3 D : 1 R or 1 D : 1 R, according as they result from DR×DR or DR×R. In other cases the results are complicated by reversion, gametic coupling of distinct characters, &c., and they require careful analysis, and several generations may be required to elucidate them. As a surface character hoariness is dominant, glabrousness recessive. Experiments in the form DR×DR or DR×R, where D is the white-flowered form of *Matthiola incana* and R a glabrous ten-week strain, give normal Mendelian ratios in F_2. In other cases the result, as regards hoariness and glabrousness, is more complex, owing to the different behaviour of various glabrous strains, which, as far as can be seen, differ only in *flower colour*. As to flower colour, various combinations of colours give reversionary purple in the first generation (F_1). Purple F_1 may also be produced by two white parents if they belong to strains differentiated by the leaf surface. Such purple cross-breeds may give a simple Mendelian result in F_2, or a variety of new colour forms may appear, this latter being commonly seen when cream is one of the parental colours. For example, in a cross of a glabrous white with a glabrous cream, at least nine colour forms were produced in F_2. Whether the appearance of these new forms indicates disintegration or simply re-combination of preexisting characters is uncertain. Creams breed pure at once. Some whites are pure, others are heterozygotes with cream. The number of extracted recessive types resulting from a given union and their specific behaviours are not yet known.

Mr. A. D. Darbishire gave some account of his experiments on the breeding of mice. The Japanese waltzing mice show the well known restless and spinning movements; they have a piebald yellow and white coat and pink eyes. When an albino is crossed with a Japanese waltzing mouse the majority of the offspring are on first inspection indistinguishable from the common house mouse, and they invariably (in all the 300 cases bred) have black eyes. Hybrids never exhibit waltzing movements, and they are never albinos. When such hybrids are bred together they produce offspring which, considered from the point of view of colour, fall into three categories :—(1) those (half the number) with black eyes and coloured coat, and therefore resembling their parents; (2) those (one-fourth) with pink eyes and coloured coat, therefore presenting the same features of eye- and coat-colour as Japanese waltzers; (3) those (one-fourth) with pink eye and uncoloured coat, *i.e.* albinos. About one-quarter of these hybrids waltz, but the rest are normal in their progression, and the waltzing habit may be associated with any of the three colour categories. The albinos (group three) breed true, the pink-eyed mice with coloured coats breed nearly true, and the black-eyed mice with coloured coats produce, when paired together, albinos, pink-eyed mice with coloured coats, and black-eyed mice with coloured coats (proportions of each not yet determined). Some of the facts seem to confirm the Mendelian interpretation, while others may be described in terms of either Galton's or Pearson's formulæ of ancestral inheritance.

Mr. C. C. Hurst described some experiments on heredity in rabbits. An inbred pair of albino Angoras was crossed

reciprocally with an inbred pair of Belgian hares (F_1), and the hybrid progeny were bred with one another for two generations (F_2 and F_3). In F_1 the Angora coat was always recessive to the normal coat, and the albino character recessive to the normal character, while in F_2 and F_3 both these features followed the ordinary Mendelian rules. As to coat colour, in F_1 the first cross of brown and albino gave offspring all of which had wild grey coats. In F_2 the hybrid greys bred together gave a ratio of 9 grey : 3 black : 4 albino, which, when worked out in detail, is in accordance with the Mendelian expectation. Experiments on F_3 proved that the black factor was not introduced by the original brown parent, but by the albino, which, though gametically pure as regards simple albinism, was at the same time carrying the distinct factor for black coat colour.

Prof. Weldon, in opening the discussion, referred to one of Mendel's experiments in which he took a pea of a race producing only seeds with green cotyledons and crossed it with one of another race producing only seeds with yellow cotyledons. The resulting seeds produced plants a quarter of which bore green seeds only, a quarter yellow seeds only, and each of these sets was said to breed true. The remaining half produced seeds with the hybrid properties of their immediate cross-bred parents. Considering how reversion has been found by Mr. Galton in other cases, we might regard the hybrids which made up half the segregation generation as reverting directly to their parents, and the remaining half as reverting to the various green-seeded or yellow-seeded ancestors in various proportions, so that every generation of ancestry was represented to a greater or less extent, the nearer ancestors more frequently, the remoter more rarely. In Mr. Bateson's translation Mendel says that the yellow-seeded individuals reproduce the character of the yellow-seeded "parent form," but we do not know whether Mendel meant the race or one individual of the race. Mr. Bateson and others have adopted the view that, so far as colour is concerned, the green-seeded and the apparently true-breeding yellow-seeded forms were not merely like, but identical with the pure individuals of the green- or yellow-seeded races used in making the original cross. The view attributed to Mendel paid attention to the last two only of the pure-bred ancestors, while that of Galton and others considered that all the ancestors contributed in various proportions to the characters of the subsequent generations. The description of the seed colours is not accurate enough to enable one to decide between these two hypotheses. Because each human being, his parents and grandparents, have seven cervical vertebræ, we have no right to say that we are exactly like our fathers, and that our grandfathers have no share in determining our characters. Again, each of the species included as *Lychnis dioica* has a hairy and glabrous form, the plants resulting from a cross of which are hairy, and the offspring of such hybrids are hairy or glabrous in Mendelian proportions. But we are not told how hairy either plant is. Prof. Weldon counted the hairs on pure-bred hairy plants, and found them to vary from about a dozen to 1300 per sq. cm. of leaf surface. Now if one with 1300 hairs per sq. cm. were crossed with a glabrous plant, and if the offspring had on an average 500 hairs per sq. cm., were they "hairy" like their hairy parent or completely intermediate between the two parents? Questions of this kind required finer methods of observation and description. Again, the frequent existence of reversions to the characters of fairly remote ancestors was inconsistent with the idea that the characters of hybrids might be regarded as due to the combination of "pure" determinants derived from their immediate parents. It had been said that the numerical conclusions drawn from the Mendelian hypothesis agreed so closely with the observed distribution of the descendants of hybrid individuals that these alone justified the conception of gametic purity. It was easy with a small series of results to devise several hypotheses which would fit the results. For example, crossing albino and yellow mice of known ancestry, Cuénot obtained 81 albino, 34 yellow, 20 black, and 16 grey mice, and the remarkable modification of Mendel's theory which he had put forward to describe this result led him to predict the numbers 76, 38, 19, and 19. This was not so good as Prof. Pearson's prediction—82·5, 31, 20·5, 17. In conclusion, he argued that until further experiments and more careful descriptions of results were available, it was better to use the purely descriptive statements of Galton and Pearson than to invoke the cumbrous and undemonstrable gametic mechanism on which Mendel's hypothesis rested.

In the afternoon of August 19 Mr. Punnett, on behalf of Mr. Bateson, described the effects of crossing in fowls, and Prof. Minot added some observations on his experiments upon guinea-pigs.

Mr. Bateson then replied in some detail to Prof. Weldon's criticisms, and maintained that by the Mendelian hypothesis alone was it possible to draw together the vast number of observed facts which had seemed utterly incoherent. The Ancestrians, however, asserted that the laws based on ancestry could cope with the same facts. Prof. Weldon had passed very lightly over the critical fact which finally settled the question—the purity of the characters of the segregated types. None of the various schemes of the Ancestrians had contemplated such purity, and all were totally unable to deal with it. The last attempt to explain away the fact of purity of type was that enunciated to-day by Prof. Weldon, who regarded it as "reversion." But if the "reversion" were so complete as to include even the purity of the parental type, such reversion was Mendelian segregation by another name. The second fact with which the Ancestrians could not deal was the condition of those hybrids or heterozygotes which, though again and again crossed back with pure types, had always the same gametic constitution undiluted. He illustrated this from the work of Mr. R. H. Lock on maize, in which it was shown that, using mongrel materials, as regards yellow and white grains, the inheritance was of a normal Mendelian order. Sweet peas provided further illustrations of the applicability of Mendelian principles to complex cases. It was shown that, in one example, at least eight kinds of purple individuals occur in the second generation, each having distinct powers of transmission, though outwardly indistinguishable. Only minute experiment could distinguish these fundamental differences, which the biometrical system entirely disregarded. The evidence also included one significant case in which sterility of the anthers behaved as a Mendelian character, and made it possible to discriminate two types of extracted whites almost certainly dissimilar in their powers of transmitting colour-factors. Prof. Weldon had asked whether the extracted types showed parental characters unchanged. Frequently the extracted types were identical with the pure, but the question must be answered case by case, according to the special sort of segregation which took place in each case. The Mendelian theory had begun to coordinate the facts of heredity, until then utterly incoherent and contradictory. The advance made in five years had been enormous, and he had no doubt of the result.

Prof. Karl Pearson said that the great revolution which Mr. Francis Galton introduced into biological study was purely a difference of method. The introduction of methods of precision had nothing to do with Mendelism or ancestral law. He had seen the Mendelians produce figures without making any attempt to show that the figures were consonant with the theory they were supposed to illustrate. He believed he had elaborated the most complete Mendelian system ever yet worked out, but this led to general principles which were singularly like those proposed by Galton from observation. He asked from the Mendelians some definite theory which could be worked out, and for further work, for the controversy could only be settled by investigation, not by disputation.

After some remarks by Prof. Hubrecht and Rev. T. R. R. Stebbing, who said that interest in this important inquiry was greatly quickened by the controversy, and hoped it would continue, as from it the world could only gain the light, Prof. Hickson (from the chair) closed the discussion by saying that the subject in dispute was of the greatest importance, and the debate had been of much value to those biologists who were still "sitting on the fence."

In the zoological laboratory there were numerous exhibits of the specimens used in these various experiments on heredity.

At the invitation of His Grace the Duke of Bedford, a party of twenty-five zoologists visited Woburn Abbey on Saturday morning, August 20. The party was met by two representatives of the Duke of Bedford, and driven over the estate to see the splendid collection of animals there maintained in such excellent condition. Numerous species of

deer, the nilgai, gnu, eland, buffaloes and European bison, giraffes, and a fine series of Prjevalsky's horse were greatly admired. Mr. R. Lydekker (the leader of the party) and Prof. Ewart pointed out the interesting features of the rarer forms. The party was afterwards entertained to lunch, and conducted through the picture galleries of the abbey.

On Monday morning, August 22, Dr. C. W. Andrews gave an address on Egyptian Eocene vertebrates and their relationships, particularly with regard to the geographical distribution of allied forms.

Prof. Keibel, of Freiburg, exhibited some "Normentafeln" of the development of Vertebrata, and also some original drawings of embryos of apes. He stated that although there is a close resemblance between these and human embryos in a similar stage (as Selenka has shown), there are found on further examination various differences—apart from the tail—not only between human and Simian embryos, but also between those of different species of apes, so that the species may be determined without difficulty in embryos from the fourth to the fifth weeks.

Then followed communications by Mr. A. E. Shipley, F.R.S. (on behalf of Dr. Elliot Smith), on Looss's researches on *Ankylostoma duodenale* (miner's worm); by Prof. G. N. Calkins on *Cytoryctes variolae*, Guarnieri, the organism of small-pox; and by Dr. J. A. Murray on the biological significance of certain aspects of the general pathology of cancer (for abstracts see NATURE, September 22, p. 519).

Dr. T. H. Bryce demonstrated a series of slides illustrating the histogenesis of the blood of the larva of Lepidosiren.

Mr. J. W. Jenkinson gave an account of the origin of the cleavage centrosomes in the egg of Axolotl. The middle piece of the spermatozoon, after forming the centre of the sperm-sphere and sperm-aster, completely disappears. At a later stage a centrosome is formed from the sperm-nucleus, and this divides to give rise to the cleavage centrosomes. A watery substance collects in vacuoles in the centre of the sperm-sphere, which suggests that the sperm introduces into the ovum a hygroscopic substance.

Four papers from the Irish Fisheries Laboratory were then read by Mr. Tattersall.

Messrs. E. W. L. Holt and W. M. Tattersall described some new and rare Schizopoda from the Atlantic slope on the west of Ireland, Mr. Tattersall some Isopoda, and Mr. G. P. Farran some Copepoda from the same region. Many of the Isopoda and Copepoda collected appear to be identical with, or closely allied to, Norwegian forms. Mr. Tattersall also gave a brief account of a new species of Dolichoglossus. It was found in Ballmakill Harbour, co. Galway, in coarse sand and mud at extreme low water spring tides, eight to twelve inches below the surface, in tubes of sand cemented by mucus. A nearly complete specimen measured 12·5 cm. Its chief points of interest are two proboscis pores, complete and continuous lumen of stomochord, and the great size of the pericardium.

The proceedings on Tuesday morning, August 23, were opened by Prof. Graham Kerr's account of the work of the late Mr. J. S. Budgett on the development of Polypterus. A series of lantern slides, most of which had been prepared from Mr. Budgett's drawings, showed that as regards external characters the development was very like that of an amphibian. There is a pair of true external gills and a pair of cement organs. Dr. Harmer and Prof. Bashford Dean spoke in appreciative terms of Mr. Budgett's work.

Mr. E. J. Bles contributed some notes on the development of *Phyllomedusa hypochondrialis*, Cope. The material described was obtained by Mr. Budgett in South America. Just before hatching paired cement organs are present as vestigial structures, but soon disappear without having become functional. This indicates that Phyllomedusa is probably descended from a form which, like our European Hyla, was hatched as a heavily yolked larva which hung from its cement organ until the yolk was absorbed. The amount of yolk in the egg of Phyllomedusa (which is now large) has probably only comparatively recently increased. There is also a glandular frontal organ in Phyllomedusa probably of use in assisting the embryo to escape from the egg-membranes. The thyroid gland in Phyllomedusa differs from that of other tadpoles, and is more like the early thyroid of Ammocœtes, as it reaches along the whole length of the floor of the buccal cavity. The subnotochordal rod is also conspicuous. The pectoral lymph-hearts in this, as in other tadpoles, appear not at the metamorphosis, but when the tadpole has still a solid intestine and the yolk has almost disappeared from all the other tissues. The wall of the lymph-heart appears to be derived from an outgrowth of the posterior cardinal vein, and before the valves are formed the lumen of the lymph-heart contains blood corpuscles.

Prof. C. S. Minot then communicated three papers. In the first he presented the theory of cellular rejuvenation, which he claimed must be defined as the increase of the nuclear substance in proportion to the amount of the protoplasm. This increase occurs during the period of segmentation of the ovum, is the immediate result of impregnation, and results in the production of rejuvenated cells, *i.e.* cells with a very small amount of protoplasm around their nuclei. These cells and their descendants then enter upon a career of cellular senescence. In an experiment with telegony Prof. Minot used females of a known race the virgin does of which were allowed to breed with a male of entirely different strain, about half the offspring having the paternal colour. The same does were afterwards allowed to breed with bucks of their own race, and in no case was there any trace of the colour of the telegonous father in the offspring. Prof. Minot gave an account of the Harvard embryological collection, which comprises more than 800 series of sections of vertebrate embryos, and pointed out its value in aiding research.

Dr. G. H. F. Nuttall, F.R.S., gave a paper on the precipitin tests in the study of animal relationships. He briefly described the methods of testing by means of precipitating antisera, and pointed out two practical applications of the test—in legal medicine for the identification of blood stains, and in the study of animal relationships. For example, this method has demonstrated a close relationship between Hominidæ and Simiidæ, a more distant one between these and Cercopithecidæ, a slight bond connecting all of these with the New World monkeys. The lemurs do not appear to be connected with the Primates any more than do other mammals. The test appears to connect the Cetacea with the Ungulata, and the Reptilia with the Aves.

In reply to a question by Prof. Poulton, Dr. Nuttall stated that tests of the blood of Echidna do not indicate any relationship between this animal and other mammals.

Prof. E. B. Poulton, F.R.S., gave a paper on the mimetic resemblance of Diptera to Hymenoptera, to which Lord Avebury, Mr. Bateson, and Mr. O. Latter added further observations.

In the afternoon of August 23 three addresses dealing with the evolution of the horse were delivered by Profs. Osborn, Ewart, and Ridgeway (for abstracts see NATURE, September 22, p. 520).

On Wednesday morning, August 24, Mr. J. W. Jenkinson gave an account of the effects produced by growing frog-embryos in salt and other solutions. The object of the experiments was to discover whether the distortion of development produced by growing the eggs of the frog in a 0·625 per cent. solution of sodium chloride is due to the physical (increased osmotic pressure) or chemical properties of the solution or both. The monstrosity consists of (1) failure of the blastopore to close, so that a large persistent yolk-plug is produced, and (2) the failure, total or partial, of the medullary folds to close. Solutions of chlorides or bromides of barium, calcium, &c., cause death of the egg at an early stage, possibly due to the formation of insoluble carbonates in the cells. When kept in chlorides or bromides of potassium, lithium, &c., the egg loses its power of elongating in the direction of the long axis of the embryo, but differentiation of the germ-layers and organs proceeds; ultimately degeneration and disintegration of the tissues set in. In sodium or magnesium chlorides or nitrates the embryo is able to elongate, but development is abnormal. In solutions of urea or sodium sulphate development is nearly or quite normal, especially in the latter solution, in which the tadpoles will live for weeks. Mr. Jenkinson thinks the various phenomena are to be attributed to the poisonous properties of the substances employed.

Prof. M. M. Hartog showed lantern slides of magnetic models of cellular fields of force. He remarked that there is in the dividing cell a dumb-bell-shaped structure recalling the figure of the "field of force" manifested by sprinkling

a sheet of paper, overlying two poles of a magnet, with magnetic dust. He showed photographs of various "fields" obtained by a combination of electromagnets, and pointed out that all the cellular phenomena could be reproduced by the action of a polar or dual force such as statical electricity or magnetism, and that the apparent anomalies were due to the peculiar conditions of the protoplasm in which the field was formed. He also showed some beautiful sections of the embryos of Rhynchelmis, lent by Prof. Vejdowsky, of Prague, in which the dumb-bell-shaped figure is of exceptional size.

GEOGRAPHY AT THE BRITISH ASSOCIATION.

AS the exploration of the higher mountain areas has been mainly the work of university men, it was very appropriate that Mr. Douglas Freshfield, one of the pioneers of Alpine exploration, should be president of the geographical section at Cambridge. No one was better qualified than he to deal with mountains and mankind, which formed the subject of his address, which has already appeared in NATURE (September 1).

Several other communications dealt with the "culminating area" of the globe, as Hermann Wagner calls it. Mr. Maurice de Déchy contributed a full account of the glaciers of the Caucasus, which at one time were supposed to be of very small dimensions. He gave statistics of the altitude of the snow-level in different parts of the system, showing how it rose towards the Caspian, and of the dimensions of the principal glaciers, including the depth to which their tongues descended below the snow-level. He then surveyed the variations of ice movements during the past half century, and pointed out how they corresponded with those which have been observed in the Alps. Finally, he referred to the evidences of the former great extension of the glaciers. Mr. Charles Rabot, secretary of the Paris Geographical Society and of the French Glacial Commission, discussed the importance of glacier-bursts in shaping the topography of glaciated areas. These bursts are due to the creation and subsequent sudden discharge of a reservoir of water, by a glacier dam due to the ice stopping the exit from a valley and the consequent accumulation of water, or to water gathering above, below, or in the glacier itself. The violence of the outburst is proportional to the volume of the water and the slope of the ground. In 1878 the Märjelensee discharged 7,700,000 cubic metres in nine hours, and the Gietroz outburst of 1818 attained a volume of 530,000,000 cubic feet. Twenty-five such outbursts are known to have taken place in the Alps, and they have been reported from all glaciated mountain areas. Their effects are necessarily confined to modifying the contours of the valley, by enormous erosion above, and by the deposition of vast masses of waste below. In discussing glacial phenomena, sufficient importance has probably not been given to these torrential outbursts, which must have been commoner in Pleistocene times. Mr. A. W. Andrews showed a number of excellent maps and views of passes of the Alps in order to prove that in teaching a well chosen set of lantern slides could be used to bring out their characteristic natural features, and to indicate their relation to routes, &c.

There was no tale of startling adventure recounted, but a number of excellent travel papers was read. Mr. Bruce's account of the Scottish National Antarctic Expedition, while barren in hair-breadth escapes, was one of steady scientific investigation under very difficult conditions in perhaps the most interesting area of the Antarctic. Notable though the discovery of the northern Atlantic margin of Antarctica and the depths of the ocean to the north are, the oceanographic, biological, and more particularly the meteorological work of the expedition are likely to yield results of the greatest value. It is a matter of congratulation that Mr. Mossman, probably one of the best living meteorological observers, remains in the south with the cooperation of the Argentine Government, for there the study of meteorological conditions is more important than elsewhere in high southern latitudes in view of the dangers attending the rounding of Cape Horn, and the importance of an investigation of the centres of atmospheric activity controlling its meteorology.

The papers dealing with distant lands described the lowlying Malabar coasts, the savana lands of northern Nigeria, the fertile Cyrenaica, and the puna of the Andine plateau. Mr. R. S. Lepper gave a comprehensive account of the climate, products, and peoples of the Malabar coast, illustrated by excellent views. He pointed out the great progress which had been made during the past half century, and insisted on the economic value of the region. Major J. A. Burdon, Resident of the Sokoto Province, described the Fulani Emirates of northern Nigeria in a communication which it would be difficult to over-rate. The impressive contrasts between the conditions in this laterite plateau dissected by broad flat valleys, leaving monotonous table-topped hills covered with open brush, and the dense forests of southern Nigeria were admirably shown, and the resulting effects traced—Paganism and degenerate peoples in the forest belt, Islam and a well developed social organisation in the north. The effects of the nomad Fulani conquest of the region were traced, and form an interesting contribution of the evidence which goes to prove that a definite type of social organisation is connected with nomadic pastoral peoples all the world over, and that a fairly constant series of events follows the thorough conquest of a settled people by such nomadic tribes. The present British administration is fortunately inspired by the scientific spirit of constructive action based on existing institutions.

In 1903 Mr. Arthur Hill made a journey to Lake Titicaca. The uniformity of the vegetation at altitudes from 12,500 to 16,500 feet was striking; the plants growing in rosettes have long tap-roots by which they reach the warmer soil at some distance below the surface, and their leaves are linear and hairy, and suited to the dry air subjected to temperature variations of as much as 70° F. within a few hours.

Mr. D. G. Hogarth spent nearly a week in Cyrenaica in April, 1904, and was able to note certain geographical facts which explain some of the peculiarities of Cyrenaic history. He pointed out that changes of coastal level must have taken place since ancient times. This point is of considerable importance, as Mr. R. S. Günther showed by a series of maps and photographs of the Neapolitan region. In a paper descriptive of these he summarised the results of his investigations on the Bay of Naples,[1] where he found a mediæval land level 12 to 23 feet below the present one, and a Græco-Roman land level some 16 feet above the existing level, and therefore in places 40 feet above the mediæval one. Round Genoa the coasts were also lower in the thirteenth and fourteenth centuries, and the Nile delta has been shown to be higher in classical times. The old shore lines are not horizontal, and Mr. Günther considers that land oscillations have been the cause of the changes of level. In the discussion which followed Messrs. R. D. Oldham and J. Y. Buchanan both pointed out other changes which had been observed in the level of the Mediterranean. A special committee to investigate the evidence was appointed by the general committee. The two afternoon lectures arranged by this section had reference to the Mediterranean basin; and Dr. Tempest Anderson's views and description of the Lipari Islands reminded his hearers of the obvious unstable condition of part of it at the present day. Mr. Silva White's admirable account of the Nile Valley emphasised its organic unity, its physical and political insularity, which has resulted in the political control of Egypt since the time of Alexander the Great by the Power possessing command of the sea. He also showed some views, and gave an eloquent description of the desert barrier which surrounds it.

Coming to our own country, the papers dealt with problems within the sphere of influence of Cambridge. Mr. H. Yule Oldham, reader in geography at Cambridge, discussed the changes in the fen district since the seventeenth century, when the tides came up the Ouse and nearly reached Cambridge. By the cutting of the new Bedford River and the building of the sluice at Denver, the tidal waters were diverted up the new river, and this permitted the drainage of the fens. The old course of the Ouse was indicated in modern maps by the irregular boundary between Cambridgeshire and Norfolk, which followed it. Mr. R. H. Yapp dealt with the vegetation of the fen region, and by a series of excellent slides showed the characteristic forms found in different edaphic conditions. The Rev. Alfred Hunt claimed the hamlet of

[1] The full report is published in the *Geographical Journal* for August and September, 1903; and in *Archaeologia*, lviii.

Burnham, in the parish of Thornton Curtis, in north Lincolnshire, four miles from the Humber, where entrenchments have been found, as the site of the battle of Brunanburh, when, under Athelstane, the south of England obtained the dominance over the north.

Dr. Mill exhibited and described a map showing the names of the physical features of England and Wales to which the Royal Geographical Society's council had given its imprimatur. Mr. Whitaker protested against the use made of the term weald, the new name given to Ashdown Forest, and other points. It is to be hoped that after a thorough discussion by all interested a general agreement will be come to as to the use of topographical terms. The majority of those on the map will be accepted by all.

Three papers dealt with map-making. The Rev. H. S. Cronin described what he believed to be the way in which Ptolemy constructed his map of Asia Minor, and pointed out how wrong conclusions were certain to arise from treating it as if it were a modern map, or his geography as modern geography. Mr. C. R. Beazley contributed an account of the Portolani of the early fourteenth century, the first true maps of the Mediterranean. Major C. F. Close discussed the methods of topographical surveying suitable for different countries, choosing the United Kingdom, India, the Gold Coast, where "long traverses" are necessary owing to the dense forest making the cost of triangulation prohibitive, South Africa, already triangulated and ready for plane tabling, which can be carried out in the open country under very favourable conditions, and Canada, for which a scheme has recently been drawn up by Major Hills. In Canada, in very special circumstances, photographic surveying has been carried out, but Major Close considered that ordinary methods under ordinary conditions were better as regards accuracy, rapidity, and cost. This was queried in the subsequent discussion. Sir David Gill dealt with the condition of the South African survey, which owes so much to him.

FIG. 1.—A Roll Wave leaping the Outfall of the Grünnbach Conduit.

The report by Dr. Cornish of the committee on terrestrial surface waves and wave-like surfaces was read. It contained a description of roll waves, a term used to describe waves resembling a bore travelling down stream more rapidly than the current in such open paved conduits as the lower courses of the Guntenbach and Grünnbach, which flow into the Lake of Thun (see Fig. 1). The phenomenon has been noticed on the Tees. The committee was re-appointed.

The geographical section combined with the zoological one to recommend the appointment of a committee to carry on physical and biological investigations in the western Indian Ocean under the leadership of Mr. Stanley Gardiner. This was duly appointed, and a grant of 150*l.* assigned to it.

Another important committee was nominated on the joint recommendation of geologists and geographers to collect information and report on the meaning and distribution of local terms given to topographical and geological features.

CONFERENCE OF DELEGATES OF LOCAL SCIENTIFIC SOCIETIES.

TWENTY years have passed since the local scientific societies of this country first had the opportunity of coming into official relation with the British Association. Although it is believed that this relationship has been, in various ways, of much benefit to many of the societies, it must be admitted that the results, viewed as a whole, have hardly equalled the expectations which were originally entertained when the scheme of affiliation was projected. This view was prominently brought forward at the conference of delegates from the corresponding societies recently held at Cambridge.

The chairman of the conference, Principal E. H. Griffiths, F.R.S., of Cardiff, pointed out the desirability of binding together all the scientific societies of this kingdom, so that they could move, in matters of national importance, as one body. He pictured them, at present, as a scattered heap of iron filings, waiting for the British Association to act as a magnet in their midst, so as to "transform the confused assemblage into a field of symmetry and beauty."

The work of the local societies may be said, broadly speaking, to be of two kinds, *educational* and *technical*, the latter including observational and investigational work. Of these branches, the chairman was disposed, in the present state of things, to regard the former as the more important. "The work is educational not only in arousing intelligent interest in the facts of natural science and quickening in the individual the power of observation, but also in promoting the missionary spirit which will enable the members to excite the interest and sympathy of their neighbours."

In order to extend the influence of the British Association, Principal Griffiths suggested some relaxation in the rules which now regulate the admission of societies. At present no society can be brought into union unless it publishes the results of original investigations. But, said he, "it is very doubtful if publication *is* the best test of merit"; and he added that if we exclude those societies which "refrain from adding to the mass of literature under which there is danger of our being smothered, it is possible that we are excluding the very bodies whose sympathy and interest we should most wish to encourage."

Principal Griffiths was accordingly led to advocate the recognition of two classes of corresponding societies, one to be called affiliated societies, conforming to the existing regulations, the other to be called associated societies, including any local society which has existed for a period of, say, three years, and numbers not fewer than fifty members. "Surely," said the chairman, "we desire to throw our doors as wide open as possible, surely we wish to give every encouragement to all scientific societies, but more especially to those working under difficulties, to strengthen the hands of their promoters, and to ask their aid and assistance in our deliberations. Moreover, it is precisely those societies with narrow means, and whose members are possibly drawn from working classes, that can be of the greatest use to us. They are missionaries situated where we most want them, and preaching to the unconverted. This yearly meeting of single delegates from a few of the leading societies, although an admirable nucleus, is not sufficient to produce crystallisation of the scientific interests in solution in the population of this kingdom."

As a means of inter-communication between the societies, and with the view of uniting them "in common action for

the attainment of some purpose of national or scientific importance," Principal Griffiths advocated the publication of a *Journal of Corresponding Societies*, towards the expenses of which the various societies should contribute according to the respective numbers of their members.

The chairman's views were received with much favour by the delegates and others attending the meeting. Sir Norman Lockyer referred to his presidential address of last year, in which he suggested that the organisation of the corresponding societies might become a potent and valuable machine for influencing public opinion on matters relating to science throughout the country. He regarded the corresponding societies as having before them an important and undeveloped field of work. With regard to the Corresponding Societies Committee, he advocated more frequent meetings and a closer union with the central organisation of the British Association. Mr. W. Whitaker agreed with the chairman that the time was come when it seemed desirable to reconsider, and possibly revise, the old conditions regulating the affiliation of local societies. He considered that the maintenance of a good museum might be as much a ground for union as the publication of a volume of proceedings. The Rev. W. Stallworthy advised the appointment of a small number of competent members as inspectors, who should visit the various local societies and report upon their work to the authorities at headquarters. Prof. Ewing advocated the admission of the smaller societies in outlying districts, where publication was not to be regarded as the test of usefulness. Dr. G. Abbott supported the views of the chairman, and enlarged on the advantage of uniting societies in local groups. Many societies in the south-east of England had been strengthened by such a union. He thought that the British Association should get into touch with as many societies as possible, and that no barrier should be raised, such as that of publication. The Rev. T. R. R. Stebbing deprecated publication being used as a test of the usefulness of a society. If the paper were important, it ought to go to a central society, and not be published locally; if it were unimportant, it were better not published at all.

Ultimately a committee was appointed to consider the present relation between the British Association and the local scientific societies, and to make suggestions to the council with a view to the greater utilisation of this relationship, and the extension of affiliation to societies now excluded.

The subject of museums, which has often been discussed at the annual conference of delegates, was brought forward by the Rev. W. Johnson, of York, who read a paper on the utilisation of local museums, with special reference to schools. He believed that provincial museums have often failed in developing the scientific habit in visitors, because they have given too much prominence to rarities, whereas the beginner needs illustrations of common objects, such as he is likely to find in his own study in the field. A large amount of material now lies buried in our museums needing judicious display and description to render it available to the young student. Mr. Johnson held that every museum should have attached to it a demonstration room, fitted with lanterns and other lecture-room appliances, and he considered that demonstrations by competent persons might well be paid for by the State, in consideration of their value in assisting the higher science teaching in our schools. The excellent work of Mr. Crowther, the curator at Leeds, in giving demonstrations to children from the local schools, was referred to with warm approval. Mr. Johnson recommended that during the winter-holidays museum-lectures should be given on elementary meteorology, explaining the nature and use of the various instruments which are used at most museums for obtaining weather records.

In discussing the paper, Mr. Rudler referred to the difficulties incidental to museum demonstrations, and advocated the delivery of the lecturette in a separate room, followed by adjournment to the museum. The interest of the delegates in the museum question centred in the point of contact between the local museum and the local society, and he referred to some of the ways in which the society might assist the museum, such as the frequent display of fresh specimens of wild flowers with instructive labels. Whilst admitting the importance of taking children to the museum, he held that it was equally desirable to take the museum to the children, and he consequently favoured the practice of circulating educational cabinets of specimens among the local schools.

At the second meeting of the delegates, Mr. J. Hopkinson, of the Hertfordshire Natural History Society, brought forward a very practical subject relating to the publications of scientific bodies. He denounced the insufficiency of the title given in certain papers, and the absence of an index, a table of contents, or a list of plates in the publications of many societies. The date of publication of each part or number of a volume of proceedings should always be given, and in the case of reprints of papers, the original pagination should be preserved, whilst the date and volume of the publication from which they are extracted should invariably be stated. Dr. Tempest Anderson, who presided at the second meeting of the delegates, spoke strongly in favour of securing uniformity in the size of the publications of scientific societies.

In the discussion on the aid which local societies could give to the work of the committees of various sections of the British Association, Dr. H. R. Mill, as a delegate from Section A, pleaded for increased interest in meteorology, and urged the local societies to take regular and systematic observations. Mr. Whitaker, on behalf of Section C, solicited the aid of the societies in seeking the derivation and precise significance of local terms relating to geological and geographical subjects—an appeal which was supported by Dr. Herbertson, representing Section E. The Rev. T. R. R. Stebbing, speaking for Section D, suggested, as additional work for local societies, the study of overland lines of migration of birds, and the collection of slugs from all parts of the British Isles. Miss Sargent solicited information with regard to certain points in the growth of British orchids. The conference was not favoured with suggestions from any of the other sections.

EOCENE WHALES.

A MOST important contribution to our knowledge of the extent and affinities of that group of Eocene marine mammals known as Archæoceti has recently been made by Prof. E. Fraas, of Stuttgart, in an illustrated memoir entitled "Neue Zeuglodonten aus dem unteren Mitteleocän vom Mokattam bei Cairo," published in Koken's *Geologische und Palaeontologische Abhandlungen*. The Archæoceti, or zeuglodonts, which have hitherto been definitely known only by various species of the typical genus Zeuglodon, have been regarded by many zoologists as the direct ancestors of the modern whales and dolphins, and if this view be accepted, it has for some time been evident (although this was not the opinion of the late Sir William Flower) that the toothed whales, at any rate, are probably the descendants of carnivorous mammals, as it seemed impossible that the zeuglodonts could be derived from a herbivorous type.

The carnivorous descent of the zeuglodonts is now fully demonstrated by Prof. Fraas, who describes two new generic representatives of the group—Protocetus and Mesocetus—from the well known Middle Eocene nummulitic rocks of the Mokattam range near Cairo. Of the former genus the author figures a nearly complete skull, together with many of the bones of the skeleton. In both genera the teeth are of the typical mammalian number, and divisible into incisors, canines, premolars, and molars, the latter, in Protocetus at any rate, being quite unlike the corresponding teeth of Zeuglodon, and approximating to those of the primitive Eocene Carnivora of the group Creodontia. The skull, moreover, although much more elongated than in any of the land forms, presents all the distinctive characteristics of the latter group, and there can be little hesitation in accepting Prof. Fraas's view that Protocetus and Mesocetus form connecting links between the terrestrial creodont carnivores on the one hand and the marine zeuglodonts on the other. They are, in fact, terrestrial animals in course of modification into purely aquatic ones. Prof. Fraas does not, however, by any means stop at this, but proceeds to argue that the Archæoceti are entirely unconnected with either the whalebone or the toothed whales, and merely form a marine group of Creodontia which died out without leaving any descendants. As he rightly observes,

we have evidence that members of several distinct groups of reptiles—the ichthyosaurs, the plesiosaurs, the marine crocodiles, and the mosasaurs—were independently modified for a marine existence, and there is no reason why a similar state of affairs should not have occurred among mammals.

This is doubtless true; but it has to be borne in mind that, so far as we can see, the new discoveries in no wise affect the alleged relationship of Zeuglodon to the Cetacea, which, if well founded previously, apparently still remains so. Moreover, if we remember rightly, Dr. Elliot Smith, in a recent paper on the brain of the Archæoceti, has pointed out very definite cetacean resemblances, which it would be difficult to explain as due solely to parallelism. Again, if we remove the Archæoceti from the cetacean line, there are no possible ancestors for the whales to which we can point, and, in the present comparatively advanced position of the palæontological record, it would be strange indeed if the past history of the Cetacea (with the exception of forms belonging to the existing groups) were an absolute and complete blank.

While according therefore to Prof. Fraas full credit for having brought the zeuglodonts into phylogenetic relationship with the creodont carnivores, we may be permitted, perhaps, to reserve our judgment as to whether he has succeeded in demonstrating the absence of relationship between the former group and modern whales.

R. L.

FORTHCOMING BOOKS OF SCIENCE.

MR. GEORGE ALLEN directs attention to:—"The Glamour of the Earth," by G. A. B. Dewar, illustrated; "A Volume on Bird Life," by E. Selous, illustrated; and "Recent Discoveries and Excavations in the Forum, 1898 to 1904," by St. Clair Baddeley, illustrated.

Mr. Edward Arnold announces:—"The Becquerel Rays and the Properties of Radio-active Substances," by the Hon. R. J. Strutt; "The Chemical Synthesis of Vital Products and the Inter-relations between Organic Compounds," by Prof. R. Meldola, F.R.S.; "Experimental Researches with the Electric Furnace," by Prof. H. Moissan, translated by Dr. A. T. de Mouilpied; "Physical Chemistry in Biology and Medicine," by Prof. B. Moore; "Astronomical Discovery," by Prof. H. H. Turner, F.R.S.; "The Theory of Optics," by Prof. A. Schuster, F.R.S.; "Preliminary Practical Mathematics," by S. G. Starling and F. C. Clarke; "The Evolution Theory," by Prof. A. Weismann, translated by Prof. J. A. Thomson, two volumes, illustrated; "Nature Study in the House, Garden, and Field," by Prof. L. C. Miall, F.R.S.; "Lectures on Diseases of Children," by Dr. R. Hutchison; "A Manual of Pharmacology for Students," by Dr. W. E. Dixon; "Recent Advances in Chemical Physiology," by Drs. A. P. Beddard, L. Hill, F.R.S., J. J. R. Macleod, B. Moore, and M. S. Pembrey; "Exercises in Arithmetic," oral and written, by C. M. Taylor, part iii.; "The Elements of Trigonometry," by Dr. R. Lachlan and W. C. Fletcher; "A Second Geometry Book," by J. G. Hamilton and F. Kettle; and new editions of "Electrical Traction," by Prof. E. Wilson; and "Human Embryology and Morphology," by Dr. A. Keith, illustrated.

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In Mr. Murray's list are to be found:—"Recent Development in Biological Science," by W. B. Hardy, F.R.S.; "Bacteriology and the Public Health," by Dr. G. Newman; "The Culture of Fruit Trees in Pots," by J. Brace, illustrated; "River, Road, and Rail, some Engineering Reminiscences of Undertakings in Various Parts of the World, including the St. Gothard Tunnel and the Zambesi Falls Bridge," by F. Fox, illustrated; "Hints on the Horse, for Artist and Buyer," by Captain C. N. Conne, R.A., illustrated; "The Moon, a Summary of the Existing Knowledge of our Satellite, with a Complete Photographic Atlas," by Prof. W. H. Pickering, illustrated; "Artillery and Explosives, Essays and Lectures Written and Delivered at Various Times," by Sir A. Noble, K.C.B., F.R.S., illustrated; in the "Progressive Science" Series:—"Earthquakes, in the Light of the New Seismology," by Major C. E. Dutton, illustrated; and "Heredity," by Prof. J. A. Thomson, illustrated; also "Growth and Spread of Culture," by Prof. E. B. Tylor, F.R.S., illustrated; "A Second Course of Practical Science," by J. H. Leonard and W. H. Salmon; "A Primer of Botany," by Prof. J. B. Farmer, F.R.S.; "The Vegetable Garden, or the Edible Vegetables, Salads, and Herbs Cultivated in Europe and America," by W. Robinson; and a new edition of "Marine Boilers, their Construction and Working, Dealing more Especially with Tubulous Boilers," based on the first edition of the work by M. L. E. Bertin, brought up to date, edited by L. S. Robertson.

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Mr. D. Nutt announces:—"Folk-lore of the Musquakie Indians of North America and Catalogue of Musquakie Beadwork, and other Objects in the Collection of the Folk-lore Society," by M. A. Owen, illustrated.

Messrs. G. P. Putnam's Sons' announcements include:—"The Heart of the Orient: Saunterings through Georgia, Armenia, Persia, Turkomania, and Turkestan, to the Vale of Paradise," by M. M. Shoemaker, illustrated; "Strabismus, or Squint, Latent and Fixed, a Supplement to 'Errors of Refraction,'" by Dr. F. Valk; "Field Book of Wild Birds and their Music, being a Description of the Songs and Colouring of Wild Birds intended to Assist in the Identification of Species Common in the Eastern United States," by F. S. Mathews, illustrated; "An Introduction to Vertebrate Embryology Based on the Study of the Frog and the Chick," by Dr. A. M. Reese; "Bog Trotting for Orchids," by G. G. Niles, illustrated; "The Mystic Mid-Region, the Deserts of the South-west," by A. J. Burdick, illustrated; "The Trees of North-eastern America," with introduction by N. L. Britton; and new editions of "Landscape Gardening," by S. Parsons, jun.; and "The Shrubs of North-eastern America," by C. S. Newhall, two vols. in one, illustrated.

The Walter Scott Publishing Co., Ltd., give notice of:—"A Study of Recent Earthquakes," by Dr. C. Davison; "Science and Hypothesis," by Prof. H. Poincaré, translated by W. J. Greenstreet; and a new edition of "Electricity in Modern Life," by G. W. de Tunzelmann, illustrated.

The announcements of Messrs. Swan Sonnenschein and Co., Ltd., include:—"Physiological Psychology," by Prof. W. Wundt, a translation of the fifth and wholly rewritten (1902–3) German edition by Prof. E. B. Tichener, in three vols., vol. i., illustrated; an abridged edition of Erdmann's "History of Philosophy," based on the fifth German edition, revised by Dr. B. Erdmann, translated and edited by W. S. Hough; "A Philosophical Introduction to Ethics," by W. B. B. Gibson; "Thoughts and Things: a Genetic Study of Logical Process," by Prof. M. Baldwin; "Student's Text-book of Zoology," by A. Sedgwick, F.R.S., vol. ii., illustrated; and new editions of "Handbook of Systematic Botany," by Dr. E. Warming, translated and edited by Prof. M. C. Potter, illustrated; "Introduction to the Study of Organic Chemistry," by J. Wade, illustrated; and "Sanatoria for Consumptives in Various Parts of the World," by Dr. F. R. Walters, illustrated.

Mr. E. Stanford announces:—"The Sea Fishing Industry of England and Wales, a Popular Account of the Sea Fisheries and Fishing Ports of those Countries," by F. G. Aflalo, illustrated; "Stanford's Compendium of Geography and Travel" (supplementary volume), "Glossary of Geographical and Topographical Terms, and of Words of Frequent Occurrence in the Composition of such Terms and of Place Names," by A. Knox; "Stanford's Geological Atlas of Great Britain (based on Reynold's Geological Atlas), with Plates of Characteristic Fossils, Preceded by a Description of the Geological Structure of Great Britain and its Counties, and of the Features Observable along the Principal Lines of Railway," by H. B. Woodward, F.R.S., illustrated; and a new edition of "Stanford's Compendium of Geography and Travel"—"Africa, vol. ii., South Africa," by Dr. A. H. Keane, illustrated.

Messrs. W. Thacker and Co. promise:—"The Exploration of Tibet," by G. Sandberg; "The Birds of Calcutta," by F. Finn; "Indian Electricity Act, 1903," by J. W. Meares; and new editions of "Game, Shore, and Water Birds of India," by Colonel Lemessurier; and "Astronomy without a Telescope," by E. W. Maunder.

The University of Chicago Press (Chicago) will publish:—"Studies in General Physiology," by Dr. J. Loeb, two vols.; and "Lectures on the Calculus of Variations," by Prof. O. Bolza.

Mr. Fisher Unwin announces:—"Travel, Exploration and Climbing in Siberia," by S. Turner, illustrated; "The Land of the Horn," by W. S. Barclay, illustrated;

"Through Town and Jungle: Fourteen Thousand Miles Awheel among the Temples and People of the Indian Plain," by W. H. and F. B. Workman, illustrated; "British Bird Life," by W. P. Westell, illustrated; and "Gardening for the Million," by A. Pink.

Messrs. Whittaker and Co.'s announcements are as follow:—"Insulation of Dynamo Electric Machinery," by H. W. Turner and H. M. Hobart; "Armature Construction," by H. M. Hobart; "Steam Turbines," by H. M. Hobart and T. Stevens; "Concrete-Steel," by W. Noble Twelvetrees; "Practical Wireless Telegraphy," by Prof. Mazzotto, translated from the Italian by S. Bottone; "Percentage Tables for Elementary Analysis," by L. F. Guttmann; and new editions of "The Alternating Current Circuit and Motor," by W. P. Maycock; "Electricity in its Application to Telegraphy," by T. E. Herbert; "Central Station Electricity Supply," by A. Gay and C. H. Yeaman; "The Management of Accumulators," by Sir D. Salomons; and "The Optics of Photography and Photographic Lenses," by J. T. Taylor, revised by P. F. Everitt.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. GEORGE H. CARPENTER, of the Science and Art Museum, Dublin, has been appointed professor of zoology in the Royal College of Science for Ireland.

AT the inaugural ceremony in connection with the University of Leeds on Thursday, October 6, the following honorary degrees, among others, will be conferred:—D.Sc., Lord Rosse, Lord Kelvin, Sir Isaac Lowthian Bell, Sir James Kitson, M.P., Sir William Henry Broadbent, Sir Arthur W. Rücker, Dr. Thorpe, C.B., Dr. C. G. Wheelhouse, Mr. Jonathan Hutchinson, Mr. J. P. Teal, Dr. H. Jackson, Prof. Miall, Dr. Tempest Anderson, and Prof. A. W. Mayo Robson.

THE inaugural lecture of the new session of the London School of Economics and Political Science will be given by the director, Mr. H. J. Mackinder, on Monday, October 3, on "The Need of Scientific Method in Affairs." The arrangements for the session include courses of lectures on all branches of economics, sociology, and cognate subjects of decided value in the development of a scientific spirit in commerce and industry. Among the lecturers are Mr. A. L. Bowley, Dr. E. Cannan, Mr. H. S. Foxwell, Prof. A. C. Haddon, Mr. A. W. Pollard, and Dr. E. A. Westermarck.

THE Department of Agriculture and Technical Instruction for Ireland proposes to establish for the year 1904–5 a limited number of commercial scholarships, tenable for one year only (value 100*l.* each), at such schools as the department may approve; also one scholarship for persons engaged in the woollen industry, and one for those engaged in the leather and tanning industries. These scholarships will be tenable at some higher institution, to be approved by the department, in which these industries are taught. They will be of the value of 80*l.* each, and may be renewable for second and third years at the discretion of the department. Candidates for the scholarships must apply for forms, which should be returned to the department duly filled in not later than October 5.

IT is announced in the *British Medical Journal* that Lord Strathcona and Mount Royal, the Chancellor of McGill University, Montreal, has presented the sum of 10,000*l.* to the medical faculty. This is in addition to a gift of 20,000*l.* which Lord Strathcona made to the medical faculty about two and a half years ago. The whole of that sum was expended in alterations and extensions of the buildings of the faculty; these were so extensive that they practically amounted to rebuilding. Two new lecture rooms, and three laboratories for chemistry, physics, and hygiene respectively were erected, and other alterations and additions made which greatly increased the working power of the faculty. These buildings, which were opened by the Prince of Wales about two years ago, cost some 7500*l.* more than was expected. The further sum now given by Lord Strathcona is intended to cover the deficit and to assist the general work of the medical school.

AT University College, London, on October 3, Prof. Norman Collie will give a public introductory lecture to the faculty of medicine on "The Bearing of Chemistry on Medicine." On October 18 Sir William Ramsay will commence a course on the chemical aspects of the recent discoveries connected with radio-active matter. A course of lectures on spectroscopy and spectrum photography, by Mr. E. C. C. Baly, will be given twice during the session, beginning in November and February.

A LIST of courses of lectures and practical work at Herold's Institute—the London Technical School of Leather Manufacture—has been received. The school is a monotechnic equipped with every appliance requisite for the practical manufacture, currying, dyeing, and finishing of all kinds of leather. Students are urged to go through courses of study of two or three years' duration, and every possible facility is afforded to those who desire to carry out original researches.

THE syllabus of classes at the Sir John Cass Technical Institute, Aldgate, shows that much care has been devoted to the organisation of the work of the institute, which is now an educational centre for industrial classes, men and women, of east London. The institute has now completed its first two sessions, and a fairly definite line has been taken in the science teaching, which is chiefly concerned with physics, chemistry, and metallurgy, whilst these departments are correlated to the department of arts and crafts in respect to the teaching of art metal work, jewelry, and enamelling. Metallurgy is one of the more special departments of the institute, and we notice that a course is announced on metallography.

AT St. Thomas's Hospital Medical School the entrance scholarship in natural science, of the value of 150*l.*, has been awarded to Mr. Ernest W. Withey, and the university scholarship, of the value of 50*l.*, to Mr. Charles E. Whitehead, of Caius College, Cambridge.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, July 26.—"On the Production of a Specific Gastrotoxic Serum.—Preliminary Communication." By Dr. Charles **Bolton.** Communicated by Prof. Sidney Martin, F.R.S.

This communication deals with the production of a gastrotoxic serum by the injection of the mucous membrane of the stomach (1) of the guinea-pig into the rabbit, (2) of the rabbit into the rabbit, and (3) of the guinea-pig into the guinea-pig.

In each case the blood of the injected animal becomes toxic; in the first case for the guinea-pig, in the second case for the guinea-pig, and in the third case for the rabbit.

The lesions produced by injection of the serum are in all three cases the same. They consist of circumscribed areas of necrosis in the mucous membrane of the stomach associated with hæmorrhage, the latter being secondary to the necrosis, and to some extent also of hæmolytic origin. At a later stage definite ulcers of the stomach are produced, and in this process of ulceration the gastric juice is considered to play a prominent part. The remaining portions of the alimentary canal are found to be normal. The gastrotoxic serum does not produce any visible change in the stomach cells which are exposed to its action *in vitro*.

An inquiry into the nature of the gastrotoxin has shown that it consists of an "immune body," which is newly formed in the blood and resists the action of heat, and a "complement" which is contained in the normal blood and is destroyed by heat.

The specificity of the gastrotoxin was tested by mixing various cells (such as liver, blood) with it previous to its injection in order to determine whether guinea-pig's stomach cells alone, or whether any other cells, could extract the "immune body." As the result of this, it was found that guinea-pig's stomach cells alone in the first two cases were able completely to extract the "immune body" and thus

render the serum inactive. It was, however, found, on immunisation of a rabbit against guinea-pig's stomach cells washed quite free from blood, that the hæmolytic power of the rabbit's serum for guinea-pig's red blood corpuscles was much increased, and therefore that the gastric cells possess receptors to some extent in common with red blood corpuscles. The gastrotoxin is thus shown to consist of two factors:—(1) gastrotoxic, (2) hæmolytic.

The hæmolytic factor is by no means the more important, because the lesions produced were in the hitherto observed cases limited to the stomach, the hæmolytic factor could be extracted from the serum leaving the gastrotoxic factor, and in many cases no evidence of hæmolysis could be found on microscopic examination of the lesions.

In the case of the gastrotoxic serum produced by injection of the stomach cells of the rabbit into the rabbit, it was found that although the rabbit's stomach cells possessed an affinity for the gastrotoxin, yet they completely failed to extract the "immune body" when exposed to the action of the serum *in vitro*. It is therefore concluded that probably this phenomenon, together with absence of autolysis, may be explained by the presence of an "anti-immune body" which is concomitantly formed by the rabbit to protect itself from the effects of the poison which it is manufacturing.

This opens up a hitherto unexplored field in the pathology of human gastric ulcer.

PARIS.

Academy of Sciences, September 19.—M. Mascart in the chair.—On the production of sugar in the kidney of a dog to which phloridzin has been administered: R. **Lépine** and M. **Boulud.** It is shown that the sugar obtained in experiments in glass does not give an exact measure of the sugar actually present in the blood in the veins.—On the depth of field and focal length of photographic objectives: J. **Thovert.** Regarding the object of photography as the reproduction of an object as seen by the eye, the limit of angular definition of a photographic image should be about 1/3000. It is shown that this ideal cannot be attained for lenses of short focal length.—On the chemical composition and formula of adrenalin: Gabriel **Bertrand.** Three formulæ have been proposed for adrenalin, the active substance in the extract of suprarenal capsules. Starting with 118 kilograms of the fresh organs, from 4000 horses, 125 grams of crystallised adrenalin were obtained, and this was submitted to an elaborate fractional precipitation. The figures obtained by combustion analyses of the various fractions were very concordant, and show that crystallised adrenalin extracted from the suprarenal capsules of the horse is a distinct substance and not a mixture. The molecular weight was fixed by the lowering of the freezing point of glacial acetic acid, and the formula of the substance fixed as $C_9H_{13}NO_3$, this agreeing with the views of Aldrich.—The nomenclature of the rosanilines: Jules **Schmidlin.**—Tetraoxycyclohexane-rosanilines: a new class of colourless derivatives: Jules **Schmidlin.** The formation of this new class of compounds depends on a simple hydrolysis which rosaniline salts undergo in acid solution. The conclusion is drawn from these experiments that the salts of rosanilines contain four double linkages of the fatty type.—Ultramicroscopic observations on solutions of pure glycogen: Wilhelm **Biltz** and Madame Z. **Gatin-Gruzewska.** Two sets of experiments are described. The first set, agreeing with the results of Raehlmann, show that an aqueous solution of glycogen contains particles of different diameters, varying with the condition of the solutions. In the second set, the effect on the size of the particles by precipitation with gradually increasing quantities of precipitants was studied.

NEW SOUTH WALES.

Royal Society, August 3.—Mr. C. O. Burge, president, in the chair.—On Eucalyptus kinos, their value for tinctures, and the non-gelatinisation of the product of certain species: H. G. **Smith.** In this paper, which is the second of the series dealing with Eucalyptus kinos, the author shows that the tannins in the exudations from the various Eucalypts vary largely in character, and that while some kinos gelatinise in tinctures, others do not. There is a remarkable regularity in the action of kinos from allied species, and the marked differences in the tannins themselves appear to be the reason why they act so differently as regards gelatinisation. There are three tannins at least in Eucalyptus kinos, and all are determinable by reagents.—On some hydrographical data in relation to ocean currents: H. A. **Lenehan.** A paper dealing with ocean drifts, principally in the southern hemisphere. It contains a tabulated statement of 182 records, the most important of which travelled a distance of 11,350 miles between June 19, 1901, and March 5, 1904, at a daily rate of 11½ miles. There are also eleven other drifts more than 3000 miles long. Two charts accompany the paper, showing the positions where the records were cast adrift and the places where found.

GÖTTINGEN.

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

July 9.—W. **Nernst**: On the formation of nitrogen dioxide at high temperatures. H. **Gerdien**: Measurements of atmospheric electricity during two balloon ascents. Wilhelm **Biltz**: Ultra-microscopic observations, i. The precipitation of sulphur from thiosulphuric acid and of selenium from selenious acid.

June 25.—H. **Minkowski**: On the closest possible parallelopipedal piling of congruent solids.

July 23.—Eduard **Riecke**: Researches on the phenomena of discharge in Geissler tubes, i. On the exhaustion of Geissler tubes by the electric current.

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