# Nature

A WEEKLY

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*"To the solid ground*
*Of Nature trusts the mind which builds for aye."*—WORDSWORTH



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Reviews and Our Bookshelf.

RICHARD CLAY AND SONS, LIMITED,
BREAD STREET HILL, E.C., AND
BUNGAY, SUFFOLK.

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

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THURSDAY, NOVEMBER 3, 1904.

## APPLIED ELECTRICITY.

(1) *Wireless Telegraphy*. By C. H. Sewall. Pp. 229. (London: Crosby Lockwood and Son, 1903.) Price 10*s*. 6*d*. net.

(2) *Electricity in Agriculture and Horticulture*. By Prof. S. Lemström. Pp. iv+72. (London: The *Electrician* Printing and Publishing Co., Ltd., 1904.)

(3) *Modern Electric Practice*. Vol. iv. Edited by Magnus Maclean. Pp. viii+304. (London: The Gresham Publishing Co., 1904.)

(4) *The Theory of the Lead Accumulator*. By F. Dolezalek. Translated by C. L. von Ende. Pp. xii+241. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 10*s*. 6*d*. net.

(5) *Electric Motors*. By H. M. Hobart. Pp. x+458. (London: Whittaker and Co., 1904.) Price 12*s*. 6*d*. net.

(6) *Notices sur l'Électricité*. By A. Cornu. Pp. vii+274. (Paris: Gauthier-Villars, 1904.) Price 5 francs.

(7) *L'Année Technique* (1902–1903). By A. Da Cunha. Pp. 303. (Paris: Librairie Gauthier-Villars, 1903.) Price 3.50 francs.

(1) ALTHOUGH wireless telegraphy is of such recent development, it is apparently regarded by many as a legitimate subject for historical writing. The first volume before us is one of several which have appeared in the last three or four years in which the historical progress of wireless telegraphy is dealt with rather than its scientific principles. The book possesses to our mind the same faults which characterise all the other similar publications which we have read; there is a lack of discrimination in the selection of material which is likely to leave the untechnical reader in a state of considerable confusion. Wireless telegraphy as we know it to-day is wholly concerned with Hertzian wave telegraphy, and even if accounts of the experiments of Lindsay and others in telegraphy by earth or water conduction should be regarded as legitimate, we cannot see by what possible stretch of the imagination the achievements of, say, Marconi can be traced back to the prophecies of Galileo in 1632.

Mr. Sewall's method of compiling history appears to consist chiefly in making extracts from patents. Page after page of the book before us contains nothing more than reprints from the patents of Lodge, Marconi, Fessenden, and others, sometimes verbatim in inverted commas, at others with slightly altered context as original matter. We imagine it must be easier to write books in this way than it is interesting to read them. Mr. Sewall would have been much better advised, we think, to digest his material properly and present it to his readers in some more acceptable form. He could then have given a connected account of the remarkable developments that have followed the discoveries of Maxwell and Hertz which would have been of great practical use to students of the subject. At present we doubt if his book is intelligible to the amateur or useful to the expert.

(2) The late Prof. S. Lemström occupied himself for many years with experiments on the effect of electricity on growing plants, and this little book contains the results of his work. If the conclusions at which the author arrives are confirmed by the work of other investigators, the subject is one which merits the most careful consideration by all agriculturists. Practically only one type of experiment was tried; an influence machine was connected with one pole to earth and the other to a wire network over a field in which the crops were being grown. A discharge current could thus be passed either from the network to earth or *vice versâ* for any desired number of hours a day. The experiments were tried on a comparatively large scale in several different localities. The effect produced by this treatment was remarkable. There was an average excess of the crop of the experimental field over that of a control field of 45 per cent.; the excess varies considerably with the nature of the crop and the conditions, soil, weather, &c. Not only is this increase in quantity produced, but there is also often an improvement in quality and a diminution in the time taken for the plants to mature. This last is a factor often of great importance to the grower,

who can realise much higher prices by selling early in the season. Prof. Lemström calculated that in the case of wheat the outlay on a field of 25 acres will be repaid in two or three years, and that afterwards a net profit of 40*l*. a year or more can be realised. We cannot here enter into the details of the working, such as the best time of electrification, the effect of wet and dry weather, and so forth, but we should strongly advise those interested in the subject to study this book carefully; they will find it full of valuable suggestions, and the time spent in reading it will be amply repaid.

(3) We have already reviewed the first three volumes of this publication, so that it is only necessary here to refer briefly to the matter contained in the present volume. This is devoted to electric tramways, and is divided into seven chapters, dealing with overhead construction, feeders, surface contact systems, conduit systems, rolling stock, electric boats and motor cars, and electric traction on railways. The defects to which we alluded in our previous review are not so noticeable in this volume, which furnishes a good description of a very important branch of electrical engineering. The excellence of the illustrations is a characteristic of the whole production, and is a particularly valuable feature in the present instance, as the subjects are such that they cannot be effectually described without numerous photographs and diagrams.

(4) This exceedingly interesting monograph on the much debated theory of the chemical reactions taking place in the lead accumulator is probably already well known in the original German to those who have concerned themselves specially with this subject. Since the book first appeared the discussion has progressed a stage further, so that the English translation may be said to be out of date to a certain extent. This is, however, the penalty that the average English student has to pay for the neglect of his schoolmasters to teach him German, and he will probably therefore welcome the appearance of an English translation. Herr Dolezalek treats the subject from the standpoint of Nernst's osmotic theory, and shows that thermochemical considerations all point to the validity of the sulphate theory originally advanced by Gladstone and Tribe. Whether the author will succeed in satisfying others to the same extent as he has apparently satisfied himself may be regarded as open to question, but in any case the book is one which cannot be neglected by anyone wishing to study this complicated but fascinating problem.

(5) The design and construction of electric motors is becoming daily a matter of more importance to electrical engineers on account of the very rapid extension of the use of electricity for power purposes. When one considers the enormous number of tramcars, lifts, factories, &c., which are driven by electricity, it is easy to see not only how important the subject is, but also how very varied is the work which the electric motor is called upon to perform. If the development now is great, in a few years' time, when some of the numerous power schemes are more matured, it will be much greater still. The student of electrical engineering may find here ample scope for his abilities, and he cannot consult a better guide than the volume before us. The book is divided into two parts, the first dealing with continuous and the second with alternating current motors. The relative advantages of different types are considered in detail, and there are numerous calculations of motors of different types and capacities. In addition, there are a large number of curves, diagrams, and photographs.

(6) The essays which are comprised in M. Cornu's little book were written with a special and rather peculiar object, the author having been requested by some of his old pupils, who had been unable to keep touch with the rapid development of electrical engineering, to write for them something which would enable them to appreciate better the technical or semi-technical literature of to-day. These "Notices" are consequently of a somewhat elementary character, nor can the book be regarded in any sense as a text-book of electricity. But M. Cornu has succeeded in writing a book which should appeal to a very much larger audience than that for which it was originally intended; one cannot look through its pages without realising at every point that it is the work of a master, and such works repay study by all—the most advanced as well as the most elementary students. The beginner will find here ideas expressed clearly and concisely, and cannot fail to derive great benefit from the book as an introduction to more detailed treatises. The engineer will see well known facts expressed in new and suggestive language, and will doubtless have his own views enlarged in consequence. The subjects dealt with are the correlation of the phenomena of static and dynamic electricity, generators, transmission of power and polyphase currents, and we would strongly recommend anyone interested in any of these matters to spend a few hours reading M. Cornu's admirable booklet.

(7) We cannot help being conscious that the end of 1904 is rather late in the day to review a book which contains a *résumé* of the technical achievements of 1903. Still, as we gather that this publication is intended to appear annually, this notice may be of some service in directing readers' attention to the volume dealing with this year's progress, which we imagine will appear very soon; in addition, it may be pleaded that the lapse of time enables one to see matters more in the right perspective, and so to form a better estimate of the value of M. Da Cunha's work. The book ranges over a great variety of subjects. Thus we find at one place a mathematical calculation of the mechanical problems involved in "looping the loop," and in another a discussion of alcoholism and temperance worthy of the columns of a daily paper in the silly season. Between these extremes lie such subjects as the progress in wireless telegraphy, automobilism, aërial navigation, and the hundred and one other technical developments which are taking place in all branches of applied science. To the engineer the book can serve no other purpose than to while away an idle hour or so. The general reader who is interested in scientific and technical progress may read it with both profit and pleasure. He will find the descriptions clear, the style agreeable, and the illustrations and diagrams in many cases excellent. M. S.

## ADOLESCENCE.

*Adolescence: its Psychology and its Relations to Physiology, Anthropology, Sociology, Sex, Crime, Religion.* By G. Stanley Hall, Ph.D., LL.D., President of Clark University and Professor of Psychology and Pedagogy. Vol. i., pp. xx+589; vol. ii., pp. vi+784. (New York: D. Appleton and Co., 1904.) Price 31*s.* 6*d.* net.

THIS work is one of wide-reaching scope and interest. The subject of human growth has already been studied in relation to the earlier years and in its special features. The period intervening between childhood and adult life, which has been comparatively neglected, is the one to which Dr. Hall has directed his investigation. The work is thus of interest in focussing attention on an important section of human life; it is of value also in that the results of biology and anthropology are freely used in supplementing and interpreting the data which are gained from physiological and psychological investigation.

The first three chapters deal mainly with physical growth, taking up in order the increase in height and weight, the growth of parts and organs, and the growth in muscular power. The next two chapters deal with the physical and mental disorders of adolescence, and with juvenile faults and immorality. Sex is taken up in three chapters, one relating to boys and two to girls; of these two chapters one deals with the physiology of sex, the other with its bearing on education. Dr. Hall insists with great earnestness on the necessity of ceasing to mould woman's education on that of man, and of finding an education which shall be adapted to her nature, physical and mental. The volume closes with an account of adolescence in literature, biography, and history.

In the second volume, after a preliminary survey of changes in the senses and in voice, the emotional phenomena of adolescence are treated under the headings of adolescent love and adolescent feeling towards nature. Several chapters deal with social and historical relations; initiations in savage and classical times, confirmation as their correlative in modern religion, the social instincts and institutions of youth, ethnic psychology, and the treatment of uncivilised races, form the subject of successive discussions. In treating the subject of religious conversion, Dr. Hall points out that it is peculiarly a phenomenon of adolescence, and that it has close relations to the sexual life. "It is thus," he says, "no accidental synchronism of unrelated events that the age of religion and that of sexual maturity coincide." In the chapter on intellectual development and education there is a careful review of education in school and college, and a discussion of its value in the light of the results presented in preceding sections. Dr. Hall does not hesitate to condemn vigorously and comprehensively the studies and methods of schools for their aridity and want of vital relation to the developing individual, and though his criticisms are directed to American schools, they have a wider application.

It will thus be seen that we have in these volumes a text-book of adolescence in which scientific and practical interests are closely blended. Underlying the scientific treatment there may be said to be two leading principles. One principle is that of the intimate union, or rather the identity, of physiological and psychological processes.

"More summarily, then," he says, "the idea of soul we hold to is in its lower stages indistinguishable from that of life, and so far in a sense we revert to Aristotle, in holding that any truly scientific psychology must be first of all biological. . . . The first chapter of a scientific psychology, then, is metabolic and nutritive, and the first function of the soul is in food getting, assimilation, and dissimilation."

The other principle, of greater novelty and interest, is the application of the recapitulation theory to the mental as well as the bodily life of childhood and youth.

"Realising the limitations and qualifications of the recapitulation theory in the biologic field, I am now convinced that its psychogenetic applications have a method of their own, and although the time has not yet come when any formulation of these can have much value, I have done the best with each instance as it arose."

In his application of this theory Dr. Hall is undoubtedly original, but it is strange that among the many references to the literature of the subject there should be no mention of the work of Baldwin on "Mental Development in the Child and the Race," in which the same theory is applied in detail.

That the work took its origin in courses of lectures may perhaps explain in part the diffuseness and repetition which appear in these pages. There is an unnecessarily frequent use of strange words; one is at a loss to understand, for example, what is meant by the "solipsistic hopo" and by minds that are "rily." One meets with long lists of objects and with masses of facts which are not adequately correlated.

It is impossible to enter on a discussion of the many theoretical and practical questions which are raised. The treatment of the material, gathered from the most varied sources, is original and suggestive in a high degree; but among the wealth of new material and new conceptions one misses an exact discussion of the method by which the processes of psychogenesis are to be ascertained. Prominent among the data in the book are the results of the *questionnaires* which have been so much used by Dr. Hall and his pupils. We have, however, no presentation of the difficulties inherent in such a method of investigation, and of the precautions to be adopted in utilising its results. Apart from this special point there is the difficulty, which does not receive adequate attention, of distinguishing in any stage of adolescent development what is to be regarded as "palæopsychic," what is due to traditions and customs handed down from generation to generation of boys and girls, and lastly, what is conditioned primarily by the awakening mental and physical activity of the individual as he reacts on his experience. There is not sufficient treatment of the idea of individual growth in completeness and complexity, and of its relation to factors of development, the meaning of which is to be sought in past organic history; and one feels that some of the suggestions of racial influences are little more than

interesting fancies. We may illustrate these points by reference to the author's interpretation of the child's attitude towards water. Human infants, we are told in one passage, have an untaught horror of water, and man must learn to swim. This is part of the evidence that there are "psychic vestiges in man which are suggestive of former arboreal life." Again, we learn that "children are phyletically older than women, and after the first shock and fright most of them take the greatest delight in water." This, among other phenomena, may be interpreted as a "pelagic vestige." Do we need arboreal or pelagic vestiges to account for the fact that, while some children dislike water at first and others delight in it, most of them in the end find it an excellent plaything? W. G. S.

## A NATURALIST ON THE EAST COAST.

*Notes of an East Coast Naturalist.* By Arthur H. Patterson. Illustrated in colour by F. Southgate. Pp. xiv+304. (London: Methuen and Co., n.d.) Price 6*s*.

THE author of these notes, who has been in the habit of spending his spare time in a house-boat moored on Breydon Water and other East Anglian lagoons, has naturally enjoyed opportunities of making observations which are given to few people; for Breydon is a locality probably more famous than any other in the annals of British ornithology as a place where rare birds are in the habit of "dropping in." Moreover, as all field naturalists know, early morning and nightfall, ay, even night itself, are the times when the good things of their lives come to them. Hence the advantage of living on the field. In the latter part of the quarter of a century which these notes cover the author discarded the gun in favour of the field-glass, and could thus give undivided attention to observation without being distracted by the hopes and fears attendant on the wildfowler's efforts to obtain "a shot."

Breydon is a very carefully protected breeding area. A watcher has been stationed there for several years during the close season; but it will perhaps be disappointing (although we hope it may prove instructive) to ardent advocates of county council "orders" to find that Mr. Patterson writes, "I must, however, state that since stricter preservation has obtained, not nearly so many birds are to be seen on Breydon." It is impossible to deny the fact that no amount of preservation will bring back the *breeding* birds which left us with the spread of population and buildings, and the alterations in the system of agriculture. The spoonbills come and go in safety, but the late date at which they arrive shows that nesting is not the object of their visits. As a former east coast naturalist, remarkable for his common-sense views of such subjects, wrote years ago, "Unless England becomes dispeopled and uncultivated, nothing can ever bring back in numbers or variety the wealth of the ancient avifauna." But for all that the naturalist still "has his delights" on Breydon; as, for instance, on May 15, 1893, when the author, paddling up stream, saw on the "lumps" still uncovered by water "a congregation of no less than eighteen Black Terns, more than fifty Turnstones, several Common and Arctic Terns, a number of Dunlins, Grey Plovers, Whimbrel and Godwits, and not least worthy of a glance, three Spoonbills."

To one who is learned in the fishes of our seas, ready access to Yarmouth Market, and an extensive acquaintance among the fishermen have been a great advantage, and many a rare fish has the author rescued from oblivion and added to the east coast catalogue of fishes. Not the least valuable part of the book is that containing the fish notes, although the bulk of the volume deals with birds, their migrations and habits. Among the various interesting scraps of information here collected we find a record of the value of birds and the prices realised by the wildfowler and at the sales of noted collections; accounts of wildfowl brought into the market in hard winters, and incidents related by old-time wildfowlers, whose habits and customs, as well as their recollections of the hard winters and wildfowl of the "old days," are most amusing. Whales, crabs, lobsters, toads, insects, and rats all find a place in these very readable notes. Indeed, some of the most valuable paragraphs relate to the old English black rat, now extinct in most parts of the country, but so abundant in the malthouses and sail lofts of Yarmouth that Mr. Patterson can write of "a plague of Black Rats." This and many other of the records are well worth preserving as of permanent value, and the author is quite justified in thinking that some value may attach to these notes and observations "owing to their dealing with a period during which great changes have taken place in the habitat of the local fauna."

The twelve plates of bird-life reproduced in colours are among the most pleasing things of the kind we have seen, and these alone make the book one which all field naturalists will like to put on their shelves.

O. V. A.

## CHEMICAL ANALYSIS FOR BEGINNERS.

*Tables for Qualitative Chemical Analysis.* By Prof. A. Liversidge, M.A., LL.D., F.R.S. (London: Macmillan and Co., Ltd., 1904.) Price 4*s*. 6*d*. net.

THE introductory chapter of Prof. Liversidge's book makes it clear that it is only when analytical methods are used intelligently that the time devoted to qualitative analysis is well spent, and to that end the student must have some preliminary training in other kinds of simple practical work (not described in the book), and be frequently supervised, lectured to, and examined as his work progresses.

All this is very right and proper, and quite as it should be, but leaving out the excellent counsel of perfection set forth in the introduction, the book is very much like other books on this subject. That is to say, it describes a series of qualitative tests in which inorganic and organic bases and acids, rare metals, and alkaloids are treated individually, and then collectively in tables after the old-established manner and with the old-established purpose.

It should be stated, however, that some attempt is made to introduce quantitative notions into the qualitative methods by using roughly weighed amounts of the substances; but the effect is somewhat discounted by the frequent omission of the quantity and strength of the reagents. I refer more particularly to the use of "drops," which may vary considerably in bulk, and to the omission of the strength of the acids.

Prof. Liversidge attaches great importance to the study of qualitative analysis as a means as well as an end of chemical education. It is an opinion very widely held, and is well worth discussing.

The fact is sometimes lost sight of that chemistry is a handicraft as well as a science, and that its science is as yet not exact.

Perhaps there is no branch of chemistry wherein the skill of the craftsman is in greater demand, or the inexactness of the science more clearly emphasised, than in chemical analysis.

A student may study intelligently the reactions for individual elements, and so learn their properties; but he finds that when they are mixed they behave differently, and the more observant and careful he is the more will these subtle influences, which conform to no equation, become apparent.

No substance is insoluble; mass action is a powerful factor; a precipitate will carry down a substance which should, for all he knows, remain in solution, and a substance will retain another in solution which, for equally occult reasons, should form a precipitate.

Tables for the analysis of mixtures, which are based on the behaviour of single substances by a process of simple logic, become artificial and illusory, and give a sense of false security which subsequent experience alone can dispel.

Is this a subject for extended study on the part of a beginner in chemistry? In the opinion of the writer the preparation of simple substances and a careful study of their properties, into which the general principles of qualitative and quantitative analysis are introduced, is his proper sphere of work. The host of reactions and elaborate tables of separations, and still more the countless precautions, *Kunstgriffe*, and manipulative details of practical analysis are a part of the handicraft of the specialist in chemistry. To thrust this work upon a beginner who is not to be a specialist is almost equivalent to expecting a student of mechanics, who is not to be an engineer, to work a lathe or use a planing machine.

The crux of the whole question lies in this, that qualitative analysis is a branch of practical work, calling itself chemistry, which can be easily adapted to the process of examination. Were the practical examination banished from the syllabus and replaced by note-books supervised, signed and submitted by the responsible demonstrator or teacher of recognised standing, the mass of ill-digested analytical tests and tables would soon vanish from the curricula of schools and colleges, and its place supplied by a series of rational exercises. J. B. C.

## OUR BOOK SHELF.

*Les Lois naturelles.* By Félix Le Dantec. Pp. xvi+308. (Paris: Félix Alcan, 1904.) Price 6 francs.

JUST as "anyone can play the piano" with a piano-player, so anyone can write a book on the philosophy of science. The result gives satisfaction and pleasure to the performer in one case and to the writer in the other, but whether his particular interpretation is equally satisfying to an outsider is another question. The effects are, however, more lasting in the case of the author, for we are getting such an enormous accumulation of books on space, matter, force, the ether, and laws of nature that it is becoming a wonder who finds time to read them or even to cut their pages, if the publisher has failed to attend to his proper duties in this respect.

Let us examine how M. Le Dantec deals with thermodynamical considerations. In commencing he supposes bodies to have definite thermic masses, and he defines quantities of heat by the products of these masses into the changes of temperature. He also enunciates the principle of conservation of heat according to which the heat gained by one body is equal to that lost by another. But in the first place the quantities which he calls thermic masses are not constant for the same body between the same limits of temperature, but they also depend on whether the changes take place at constant pressure or constant volume; and, in the second place, his equation of conservation of heat is contrary to common experience of what happens when two rough bodies rub against each other. In the next chapter the author goes on a different tack, and speaks of the equivalence of quantities of work and quantities of heat, quite regardless (to all outside appearances) of the fact that the term "quantity of heat" is meaningless except in the case of passage of heat from one body to another. In the next chapter the author condemns the use of the term "quantity of heat" altogether. What ideas can a reader form of the nature of physical laws after perusing such a series of chapters as this?

*Nature Teaching.* By F. Watts and W. G. Freeman. Pp. xi+193. (London: Murray, 1904.) Price 3*s.* 6*d.*

THIS little book forms a welcome change from the many appearing under similar titles in that it is avowedly based upon experiments, and treats of things about which the writers really know and have not merely read up. Dealing in the main with the life of the plant, it describes a simple series of experiments within the capacity of an elementary school or an evening continuation class, illustrating the function of seed, root, stem, leaf, &c., and amplifying the knowledge thus obtained with further examples drawn from the practice of the garden or the farm. A certain lack of definiteness in the description of experiments militates at times against the spirit in which the book has been conceived; in a subject where everything depends upon the cultivation of accurate observation and rigorous scientific method the authors should not allow themselves to fall into the slipshod generalised accounts of things which are the bane of so much of the current teaching of this nature. For instance, in their account of striking cuttings, the authors do not direct attention to the differences in the management of herbaceous and woody cuttings, the time of year at which they should be struck, and so forth, so that the teacher without experience would be apt to fumble over the matter at first, and would in real life be discouraged from trying any experiments in this particular direction unless

he got hold of a gardener to give him some practical advice. However, with this slight drawback, the book is admirably designed for the teacher who wishes to work out an elementary course of instruction for a country school, either as an introduction to practical life or to a more special study of agriculture and horticulture.

I. *Clinical Lectures on Diseases of the Nervous System.* Pp. 279; price 7*s.* 6*d.* II. *Lectures on Diseases of the Nervous System.* Second series. Pp. 250; price 6*s.* net. By Sir William R. Gowers, M.D., F.R.C.P., F.R.S. (London: J. and A. Churchill, 1895 and 1904.)

In these two volumes Sir William Gowers has collected in revised form a number of clinical lectures which have appeared in various medical journals. In the latter volume he has also printed the Bowman lecture on subjective visual sensations delivered to the Ophthalmological Society, and the Bradshaw lecture on the subjective sensations of sound. The clinical lectures deal with many subjects in neurology; some are mainly descriptive, some speculative. In reading them one not only appreciates the original and suggestive way in which the facts are presented, but also the finished literary style. In a short notice it is impossible to deal with them in detail. The two lectures on the subjective sensations of vision and hearing are perhaps of wider scientific interest than the clinical lectures. In the first the visual phenomena experienced by sufferers from migraine are described and figured, and there is an admirable *résumé* of physiological teaching with reference to vision. In the second lecture the phenomena of tinnitus, of auditory vertigo, and other labyrinthine sensations are discussed in a luminous and attractive way. Both neurologists and physiologists will find much in these volumes to assist and to stimulate them in researches into nervous phenomena.

*Lectures Scientifiques.* A French Reader for Science Students containing Extracts from Modern French Scientific works in Chemistry, Physics, Mathematics, Physiology and Botany, with a Glossary of Technical Terms. By W. G. Hartog, B.A. Pp. vii+371. (London: Rivingtons, 1904.) Price 5*s.*

The University of London now insists that candidates for a degree in science shall be able to read and understand accounts in the original of French and German scientific work. In compiling this book Mr. Hartog has had the needs of such students in mind so far as French is concerned, and he has succeeded in bringing together a varied and representative collection of extracts from French scientific works and scientific periodicals. Among the latter the *Revue générale des Sciences* takes a very prominent position, contributing to Mr. Hartog's collection as many as fifteen extracts. The book should be of service not only to the undergraduates referred to, but also to students of science everywhere, for it is now more than ever necessary that the man of science should be able to acquaint himself at first hand with the results of fellow-workers abroad.

*L'Industrie oléicole* (*Fabrication de l'Huile d'Olive*). By J. Dugast. Pp. 176. (Paris: Gauthier-Villars and Masson et Cie., n.d.) Price 3 francs.

This little volume, which belongs to the Aide-Mémoire series, is a practical account of the manufacture of olive oil, and indicates several directions in which the results of scientific research have been utilised to improve technical processes. The formation and composition of olives are first explained, then the methods of extracting the oil are described and an account given of the appliances necessary for the purpose. The properties and methods of preservation of olive oil and the utilisation of the oil-cake are also considered.

## 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.*]

### A Note on the Coloration of Spiders.

It is well known that in a large number of animals, both vertebrate and invertebrate, the colour of the flanks and ventral side of the body differs from that of the dorsal. In the majority of cases the dorsal surface is most darkly tinted, the ventral palest, and the flanks intermediate in depth of tone between these two. This gradation of colouring has the effect of neutralising the shadows that are cast by the upper upon the lower portions of the body. Thus the animal does not stand out in prominent relief, but is, so to speak, artistically flattened, and thereby rendered less conspicuous.

To this general rule I have recently observed an interesting exception which affords strong evidence in favour of the truth of the above interpretation. The spiders belonging to the genus Linyphia are, almost without exception, darkly coloured upon the ventral surface; their flanks are variously slashed with oblique white bars and stripes, while their dorsal surface is yet more freely speckled with white or pale spots and lines. In these spiders, then, the scheme of coloration is the exact opposite to that which prevails elsewhere. Now the Linyphiidæ spin horizontal webs, in the centre of which they rest *inverted*, clinging to the lower side. Thus it is the ventral side of a Linyphia that is exposed to the strongest light, the dorsal side being in the deepest shadow. The inversion of attitude at once fully explains the inverted shading of the body.

Oswald H. Latter.

Charterhouse, Godalming, October 30.

### Sir J. Eliot's Address at Cambridge.

Against some of the main conclusions of Sir J. Eliot's opening address before Section A (subsection: cosmical physics) may be set the facts that south-east winds are rare on the south-east coast of South Africa, and that the rain of the greater part of the tableland and south-east coast comes mostly from some northerly direction.

My concern, however, is chiefly with the following remarks, reported in Nature of August 25 last:—

"The chief features of the rainfall of the period 1895–1902, in the Indo-oceanic region were as follows:— . . . . There was a marked tendency in each year for late commencement and early withdrawal of the monsoon currents, and for deficient rainfall throughout the whole season over the greater part of India. These features were very pronounced in the years 1896, 1899, and 1901. The most remarkable feature of the period was that the region to the south of the equator, including South and East Africa, Mauritius, and Australia, was similarly affected. . . . Mr. Hutchins, Conservator of Forests, Cape Town, states that drought prevailed more or less persistently over the Karroo region in South Africa from 1896 to 1903, and that cattle and sheep perished by millions. He also states that the drought extended to British Central Africa from 1898 to 1903. The previous statements evidence the continuity, extension, and intensity of the drought. . . . The preceding statements have shown that variations of rainfall for prolonged periods similar in character have occurred, and may hence occur again, over the very large area including the Southern Asian peninsulas, East and South Africa, Australia, and perhaps the Indian Ocean. The abnormal actions or conditions giving rise to these large and prolonged variations must hence be persistent for long periods, and be effective over the whole of that extensive area."

Now the question is, what is a drought? From one point of view there is nothing but drought over a very large area of South Africa. But I gather from the table you print, showing the variation of the mean actual rainfall from the normal in India, that by drought is meant unusual and prolonged general dryness setting up marked economic results such as "large loss of cattle and great loss of

capital," and so forth. If that interpretation is correct, then there has been no such drought in South Africa in the years stated.

This is proved by the accompanying table. It shows the average rainfall over each of the twenty rainfall districts of South Africa, during each year, in percentages of the means. These means have been computed for 160 stations having long records of twenty years, more or less, and are fully given and explained in my "Introduction to the Study of South African Rainfall." The information from which they are derived is open to all who take the trouble to look for it in the annual reports of the Cape Meteorological Commission.

*Percentages of Rainfall in the Various Districts of South Africa during the Years 1891 to 1902.*

| Sections | 1891 | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 | 1902 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | | | | | | | | | |
| I. Cape Peninsula ... ... ... | 101 | 135 | 87 | 82 | 92 | 80 | 97 | 118 | 106 | 86 | 98 | 142 |
| II. South-West ... ... ... ... | 85 | 137 | 107 | 93 | 105 | 69 | 89 | 117 | 110 | 106 | 108 | 149 |
| III. West Coast ... ... ... ... | 97 | 139 | 103 | 94 | 86 | 57 | 84 | 122 | 128 | 122 | 99 | 122 |
| IV. South Coast, W. ... ... ... | 104 | 131 | 104 | 95 | 82 | 100 | 81 | 80 | 68 | 105 | 116 | 142 |
| ,, ,, E. ... ... ... | 133 | 112 | 116 | 89 | 88 | 104 | 111 | 95 | 64 | 87 | 103 | 125 |
| V. Southern Karroo, W. ... ... | 98 | 104 | (105) | 110 | 78 | 99 | 80 | 79 | 80 | 118 | 123 | 144 |
| ,, ,, E. ... ... | 138 | 103 | 116 | 85 | 74 | 101 | 86 | 65 | 55 | 93 | 104 | 130 |
| VI. West-Central Karroo, W. ... | 73 | 122 | 92 | 94 | 87 | 72 | 92 | 84 | 66 | 125 | 123 | 128 |
| VI. West-Central Karroo, E. ... | 135 | 112 | 114 | 147 | 98 | 101 | 82 | 86 | 87 | 131 | 93 | 87 |
| VII. East-Central Karroo ... ... | 134 | 97 | 115 | 99 | 95 | 97 | 74 | 91 | 64 | 105 | 103 | 97 |
| VIII. Northern Karroo, W. ... ... | 111 | 91 | 121 | 123 | 92 | 81 | 60 | 88 | 116 | 135 | 107 | 66 |
| ,, ,, E. ... ... | 163 | 107 | 111 | 110 | 102 | 98 | 55 | 104 | 95 | 97 | 105 | 82 |
| IX. Northern Border, W. ... ... | 130 | 104 | 97 | 153 | 83 | 83 | 43 | 78 | 173 | 132 | 95 | 53 |
| ,, ,, E. ... ... | 162 | 93 | 99 | 155 | 97 | 83 | 51 | 105 | 106 | 89 | 111 | 94 |
| X. South-East ... ... ... ... | 138 | 103 | 127 | 93 | 94 | 103 | 83 | 95 | 75 | 82 | 92 | 96 |
| XI. North-East ... ... ... .. | 162 | 112 | 128 | 99 | 94 | 105 | 55 | 110 | 98 | 88 | 97 | 82 |
| XII. Kaffraria ... ... ... ... | 136 | 108 | 150 | 98 | 99 | 107 | 80 | 107 | 72 | 69 | 91 | 94 |
| XIII. Basutoland ... ... ... ... | 125 | 104 | 127 | 92 | 104 | 106 | 68 | 107 | 98 | 83 | 105 | 101 |
| XIV. Orange River Colony ... ... | 143 | 111 | 108 | 101 | 108 | 83 | 70 | 105 | 104 | 94 | 92 | 87 |
| XV. Natal... ... ... ... ... ... | 114 | 96 | 153 | 98 | 120 | 107 | 90 | 119 | 87 | 74 | 112 | 97 |
| *Summary—* | | | | | | | | | | | | |
| Area of Winter Rains... ... ... ... | 94 | 137 | 99 | 90 | 94 | 69 | 90 | 119 | 115 | 105 | 102 | 138 |
| ,, Spring and Autumn Rains ... | 109 | 114 | 107 | 95 | 82 | 95 | 90 | 81 | 67 | 106 | 114 | 134 |
| ,, Summer Rains ... ... ... | 138 | 103 | 121 | 114 | 99 | 96 | 68 | 100 | 98 | 98 | 100 | 86 |
| South Africa ... ... ... ... ... | 124 | 111 | 114 | 105 | 94 | 92 | 77 | 98 | 93 | 101 | 104 | 106 |

It is pretty plain that the area of winter rains, including the west coast and Cape Peninsula, was short of rain in 1896; that 1897 was a dry year over the area of summer rains, which comprises the greater part of South Africa; and that the south coast and adjacent districts, where the rainfall is fairly uniform throughout the year, had a dry year in 1899, and one not very wet in 1895. The area of summer rains, being so much greater than the rest, of course sets the tone of the mean rainfall of the whole country, making 1897 a dry year on the whole, and 1891 a very wet year.

There seem to be dry areas somewhere or other in pretty well every year. For example, the rainfall was short in the western part of the area of summer rains in 1902, although the fall was good enough further east. It was short over the east-central Karroo and south-east in 1899 in sympathy with the dryness of the south in that year. Even in 1891 there was a short fall over an extensive region.

I fancy that the impression of unusual dryness over South Africa in recent years arises from the misleading mean values used by the Meteorological Commission for comparative purposes. These are taken from Buchan's rather futile "Rainfall of South Africa," and average fully two inches (equal to perhaps 10 per cent.) too great. Buchan used only the rainfall of the ten years 1885–94 in constructing his results, and therefore got inflated averages in consequence of the heavy rainfall of 1891; whence the rainfalls of recent years are made to appear *minus* as compared with what is called the mean, whereas, as compared with the better means of longer periods, they would be often *plus*.

The great mortality among cattle and stock can be explained without assuming that there has been a prolonged drought. In farming matters we live from hand to mouth. Farmers of the Karroo prefer to pray for rain rather than take the trouble to store it up when it comes. Therefore, if the rain is short in the late summer, and late in coming in the next spring, they have no reserve to fall back upon, and their cattle die. One year's drought kills off the stock almost as surely as fifty years' would. For instance, there was great loss of stock in 1897. Yet what were the facts of rainfall? At my station, where the annual mean is about 18·5 inches, the fall in December, 1896, was 8·42 inches; in the whole of 1897 it was 8·85 inches, and in January, 1898, it was 8·43 inches. Thus there was a drought during 1897, many cattle died, and there was much praying for rain. The year 1903 was probably almost the same as 1897, the fall at Kimberley being only some 65 per cent. of the mean, whereas the fall during the last half of 1902 was good, and during the first half of 1904 excellent. But with the exception of these years there has been nothing that can properly be called drought, in the sense of Sir J. Eliot's address, over any extended region of South Africa within the past fifteen years at least. Thus there is nothing to justify the statement that we have been under the same influence as that which set up the prolonged drought in Australia and the dry years in India.

J. R. SUTTON.

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I TRUST to your courtesy to give my reply to Mr. Sutton's criticisms on certain portions of my address at the recent British Association meeting.

My address was in part based on an investigation I have had on hand for nearly two years, and which will be shortly published as a paper in the *Indian Meteorological Memoirs*. In that will be found a statement of the chief features of the meteorology of South Africa during the period 1892–1902. It is confessedly based upon very imperfect information—partly derived from newspaper reports, partly from data in certain meteorological reports received from Cape Town by the Calcutta Meteorological Office, and partly from data obtained from Mr. Hutchins, Conservator of Forests, Cape Colony, with whom I have been in correspondence for many years on the meteorology of South Africa and

its relation to that of India. Mr. Hutchins was for some years in the Madras Forest Department before he went to the Cape some fifteen or twenty years ago. He has made a special study of the rainfall of South Africa, and is a careful and enthusiastic investigator in rainfall problems. He is, from his double experience in India and South Africa and his present official work and position, eminently qualified to form a judgment on the abnormal features of rainfall distribution in either area, and on their economic effect. It is hence, as I hope to show later, very satisfactory that Mr. Sutton's figures confirm the general inferences I made about South African rainfall, based chiefly on Mr. Hutchins's information, in my address.

Before discussing Mr. Sutton's data and inferences, perhaps I may be permitted to deal with two or three important issues raised in Mr. Sutton's letter.

The first is contained in the opening paragraph, in which he says "south-east winds are rare on the south-east coast of South Africa, and the rain of the greater part of the tableland and north-east coast comes mostly from some northerly direction." If these casual remarks have any point at all, I think I am correct in assuming that they imply that Mr. Sutton considers the rainfall in the areas mentioned is not due to humid currents from the Indian Ocean, but from the dry interior to the north of the tableland. I have examined the rainfall charts of South Africa given in Bartholomew's "Meteorological Atlas," and they certainly indicate to me that the aqueous vapour, the condensation of which gives rainfall in the eastern half of South Africa, is brought up by air movement from the Indian Ocean, and occurs as a summer precipitation. Hence, so far as I can reasonably judge, that area forms a part of what I have termed the Indo-oceanic region. I might add, in further reply, that rain in certain parts of India during the south-west monsoon chiefly occurs with easterly and north-easterly, and even with northerly winds. But these facts have not yet been utilised by anyone to prove that the rainfall is not brought up from the adjacent seas and oceans by the south-west monsoon circulation.

Mr. Sutton in a later paragraph says he fancies that "the impression of unusual dryness over South Africa in recent years arises from the misleading mean values used by the Meteorological Commission for comparative purposes which are taken from Buchan's rather futile 'Rainfall of South Africa,' and average fully two inches (equal to perhaps 10 per cent.) too great." There is an air of certainty about this statement which I am unable to share without further proof. Buchan's means are based on ten years' data, Mr. Sutton's on twenty years' data. It does not necessarily follow that twenty years' means are better representatives of normal or average conditions than ten years' means. It depends entirely upon whether the ten years may or may not be accepted as representing the normal conditions, and whether the additional ten years' data are for an abnormal period or not. The fact that the two sets of means differ on the average of the whole area by 10 per cent. indicates to an outsider on South African meteorology like myself that it is quite as probable the ten years' additional data erred in defect as that the ten years' data employed by Dr. Buchan erred in excess. There hence appears to be (in the absence of any proof) an element of doubt in his means, just as he asserts to be the case in the "rather futile" means of Dr. Buchan.

Again, if I read Mr. Sutton's letter rightly, he considers that the question as to whether the crops have failed over large areas being due to drought is settled by a consideration of percentage variations. It is certainly not the case in India. A percentage variation gives no certain indication unless considered in relation to the normal fall, and also to its time-distribution. A deficiency of 25 per cent. is of absolutely no economic importance in such areas as Sind (with an average rainfall of about four inches) or such as Arakan (with an average of more than 200 inches). The former area depends solely on irrigation for cultivation, and the latter is so abundantly supplied for the rice crop that it bears a loss of fifty inches lightly. On the other hand, in the regions termed the dry zones in India, where the mean rainfall ranges between fifteen inches and thirty inches, a deficiency of 20 per cent. is usually a serious matter, more especially if it accompanies more irregular distribution than usual unsuited to the staple crops. Local knowledge of the agricultural and economic conditions is hence of the greatest importance in estimating the probable effect of a given variation of rainfall in any area. Mr. Hutchins, I have every reason to suppose, possesses such knowledge for South Africa, and hence I attach the highest value to his information on such matters.

The evidence I have collected, a small portion of which was given in my address, appears to me to have established that during the period 1895–1902 there was a marked tendency to more or less continuous deficiency of rainfall over the Indo-oceanic area, most pronounced in dry inland districts, and which in India intensified into severe droughts in the years 1896, 1899, and 1901, diminishing the crop returns over large areas to such an extent that it was necessary to resort to famine relief on a large scale during the twelve months succeeding each period of crop failure.

I was unable to make as precise statements for either Australia or South Africa, but the scanty facts and information at my disposal appeared to justify the statement that these areas were similarly affected. I also pointed out that this period stood in marked contrast to a preceding period of three years, 1892–4, when the precipitation was apparently in general excess over the same large area.

I give in the following table a comparison between the rainfall variations of India, and the area of spring, summer, and autumn rains in South Africa, which, so far as I can judge, is mainly dependent on the Indian Ocean supplies of aqueous vapour. I give, in the absence of the number of stations for each area, the arithmetic means of the second and third horizontal rows of figures in Mr. Sutton's summary of his data:—

| Period of general excess of rain | | | Period of general deficiency of rain | | |
|---|---|---|---|---|---|
| | Percentage variation | | | Percentage variation | |
| Year | India | S. Africa | Year | India | S. Africa |
| 1892 | +12 | + 8 | 1895 | − 5 | − 9 |
| 1893 | +22 | +14 | 1896 | −12 | − 5 |
| 1894 | +16 | + 4 | 1897 | normal | −21 |
| | | | 1898 | + 1 | − 9 |
| | | | 1899 | −27 | −18 |
| | | | 1900 | − 1 | + 2 |
| | | | 1901 | −10 | + 7 |
| | | | 1902 | − 5 | +10 |

These figures show that the eastern half of South Africa had heavier rain than usual during the same period (1892–4) as India, that it was steadily in defect during the first five years of the period of persistent deficiency of rain in India, and was especially deficient in the years 1897 and 1899, the former being the year and rainfall season following the first severe drought year of the period in India, and the latter the same year as that of the greatest drought experienced in India during the past 100 years at least. The parallelism between the two sets of figures is, indeed, more complete than I anticipated, and hence I consider not only that Mr. Sutton's conclusion to the effect that "there is nothing to justify the statement that South Africa has been under the same influence as that which set up the prolonged drought in Australia and the dry years in India" is neither in accordance with what I hold to be the general meteorological conditions and relations of the whole Indo-oceanic area nor even with the data which Mr. Sutton furnishes. The probability, so far as I can judge, is at least twenty to one that there is some relation such as I have suggested. The chief object of my address was, I may add, to urge the necessity for the coordination and intercomparison of the meteorological observations of the whole Indo-oceanic area and their discussion as a whole by an efficient scientific staff in London. The question at issue between Mr. Sutton and myself, for example, could be authoritatively settled by such an investigating office.

In conclusion, I hope that my remarks may not be interpreted as in any way depreciating the value of Mr. Sutton's work in collecting and discussing as a whole the rainfall data of South Africa, and in utilising the data to obtain normal means for purposes of comparison. His work will, I am confident, be appreciated by all interested in African meteorology from any point of view.

JOHN ELIOT.

Bon Porto, Cavalaire, Var, France.

### The Origin of Life.

ALTHOUGH to the evolutionist it must necessarily appear more than probable that at some time or other non-living matter has by evolution acquired the properties of life, and to him the only question is as to how this has come about, yet, for all that, he has been in the habit of admitting that the complete failure of all experiment in this direction makes the negative evidence very strong indeed. My present object is to suggest that the negative evidence, so far from being strong, is so weak that perhaps it can hardly be said to exist.

In the experiments the first step has always been, and, so far as one can see, must always be, to destroy all existing life and all existing germs of life. Suppose the agent to be heat. How does the experimenter know that the very means he employs to destroy in living matter the property of life are not equally efficacious in destroying the peculiar property or properties of matter that is just on the point of transmutation? For all that we certainly know to the contrary, dead matter may be changing into living every day in every pool, especially every warm pool, on the face of the earth. If so, the difference between the last state of the non-living and the first state of the living must, by the evolutionist's hypothesis, be extremely small; and it is probable—to my mind most probable—that both would be similarly affected by an unusual degree of heat, or whatever other agent is calculated to destroy life; the precaution eliminating life and its potentiality at one stroke. But the value of the negative evidence is precisely in inverse proportion to this probability. If the probability is thought great, the negative evidence will necessarily be thought small. I submit that the probability is very great indeed, and consequently that we are pretty much in the same position as to the possible evolution of life from non-living matter as we should have been if no experiments had been made. Certainly, so far as the logic of the matter is concerned, there is no need yet to consider the hypothesis of life having been imported here from another planet.

Birmingham, October 25. GEORGE HOOKHAM.

### Thinking Cats.

I HAVE known three cats which behaved as if they thought. The first, a large, sleek tabby, belonged to a private family living in the City. Between 1846 and 1858 the owner, Mr. I. S., was surprised by his manservant coming to his office at the back of the house in business hours and asking, "Did you ring, sir?" "No, I have not been into the house," was his answer. This occurred repeatedly. At last the man watched, and observed that, the family being in other rooms, the dining room bell rang, and when he answered it the cat ran out of the door. He then purposely shut her into the room. A leather easy chair was so placed that by getting on the seat, and then standing on the arm, she could reach the knob with her front paw; and she continued to practise this accomplishment as often as she was shut up in the room.

The second cat, also a large tabby, lived at Blackheath. Her master often sat up late writing. The cook, a "good old servant," also now and then sat late, sewing or reading, in the kitchen. One night after twelve Mr. H. F. was interrupted by the cat running into the library (the door being open), mewing and clawing him, then running towards the door, and repeating these acts. He got up and followed the cat, which now ran into the kitchen. The cook was sitting asleep close to the fender, a piece of coal had fallen on her dress, and it was burning. No harm happened, thanks to the cat.

The third was a very small, slight cat, white and tabby, a good mouser and bird catcher, and not at all afraid of a rat. On one occasion the servant, exasperated by the trouble caused by the cat's selection of a birthplace for kittens, drowned them *all*, for which she was duly rebuked. The next family arrived in a suitable corner, but, when two or three days old, disappeared, as well as their mother. As the cat was never allowed to go upstairs, it was supposed that, like another cat once before, she had made a lair in the garden, where she spent most of her time. At dusk the mistress of the house went up to dress for dinner. As soon as she entered her room she heard something fall, and it struck her that the noise was like a cat's jump from a height. Procuring light she found the cat standing by the door. She then saw that the curtains, where folded on the bed, had been a little disturbed, put in her hand, and found three soft warm kittens! They were immediately put into a basket with flannel, and set by the kitchen fire; but as soon as the lady had gone downstairs she met the cat, with a kitten in her mouth, on her way back to the bedroom. Why did she select that room? She was not petted by the lady, nor friendly to her. The housemaid was safe, busy waiting at table.

Debarred from this resource, she hid the kittens again while the family were at dinner, and apparently felt so sure that they were safe, that she went and sat by the kitchen fire, awaiting the usual scraps. Of course a search was made in all likely hiding places and corners frequented by the young people, who were very fond of this cat, and thought she was fond of them. A piteous, faint squealing betrayed the poor little creatures on the floor behind the largest folios in the library. The space above the books was so small that it is difficult to think how the cat got in with a kitten in her mouth, or even without it. This was the one room into which the housemaid seldom came, especially in the evening, as the master sat there. He did not pet the cat at any time, and she took no notice of him.

But though securely hidden, the kittens could hardly have lived in that cold place; their mother seemed to have overlooked their need of warmth. After this failure she submitted to have them kept in the basket in the kitchen.

Y. N.

### Fish-passes and Fish-ponds.

IN your issue of August 18, in an article dealing with fish-passes and fish-ponds, the following statement is made:—

"Much of the information as to the construction of ponds and their inlets and overflows is, of course, ancient, and can be found in such books as the 'History of Howietoun'" (by the late Sir James Ramsay Gibson Maitland, Bart.).

The above statement may easily cause the incorrect inference that the information in Sir James Ramsay Gibson Maitland's work is now obsolete. Perhaps you may care to make it known that this is, of course, not the case, although no doubt with lapse of time improvements and modifications are introduced. HOWIETOUN FISHERY CO.

Howietoun Fishery, Stirling, N.B., October 24.

### Average Number of Kinsfolk in each Degree.

I THANK Dr. Galton for his explanation (p. 626), which only shows how easy it is to make mistakes in things which appear perfectly trivial. The discrepancy can be accounted for, however, more simply still by the fact that families containing boys only have to be left out of account, and therefore in the families which contain *at least one girl* there are on an average more girls than boys altogether.

G. H. BRYAN.

### Misuse of Words and Phrases.

IT is quite true, as Mr. Basset says, that "in English considerable care is often required in the arrangement of a sentence, so as to avoid ambiguity"; but he seems to go too far when he says that "brevity ought always to be aimed at." Too much brevity will often, as we are warned by Horace, lead to obscurity: "*brevis esse laboro: obscurus fio*"; and the absence of inflections and genders renders it impossible to write English in the brief, epigrammatic style that is common in Latin.

To Mr. Basset's rules the following may be advantageously added: that new words of foreign origin should not be employed when English words will suit the purpose as well or better. For instance, *autotomic* and *anautotomic*, as applied to curves, are objectionable, because *self-cutting* and *non-self-cutting* express precisely the same ideas in simpler and more familiar words. I am at a loss to know on what ground Mr. Basset objects to the phrase "non-singular cubic curve"; does he think the epithet is "uncouth" or "inelegant" or "inaccurate"?

October 31. T. B. S.

## FLOODS IN THE MISSISSIPPI.

WE have on previous occasions directed attention to the reports issued by the Department of Agriculture of the United States, and to the valuable information they afford to the officers engaged in the different departments. We have now been favoured with a copy of a report issued by the Weather Bureau on the floods in the Mississippi watershed in the spring of 1903,[1] which gives an interesting and detailed account of the most disastrous floods in this district of which there is any record.

FIG. 1.—Kansas City, Missouri. Scene in the freight yard of the St. Louis and San Francisco Railway after subsidence of the flood.

These floods are described as marking a new epoch in the economic history of the country. When previous floods occurred they ran harmlessly over unbroken forests, and bottoms tenanted only by the beasts of the field, except over a limited area where there were small farms tenanted by French colonists. The floods of 1903 descended upon fertile and highly cultivated fields, and upon rich valleys filled to overflowing with vast industries devoted with never ceasing energy to the fulfilment of the insatiable demands of commerce. The resulting ruin and desolation were beyond description. Along the lower Mississippi 6820 square miles of country were inundated. In Kansas City five square miles of territory were overflowed; large portions of the manufacturing towns of Venice and Madison were flooded to a considerable depth; more than 3000 square miles of territory, one-half of which was under cultivation, were overflowed and the crops ruined.

The towns of Armourdale, Argentine, and Harlem were covered from 8 feet to 12 feet with water, and had to be abandoned. Twenty thousand people in this district were made homeless. All public utilities were put out of service; sixteen out of seventeen bridges over the river Kaw were washed away. The Missouri and Kansas remained no longer rivers, but became merged into an inland sea. When the flood subsided there was revealed a condition of general ruin and desolation. Holes had been gouged in the streets some 30 feet deep; railroad tracks had been torn to pieces; an oil tank, 50 feet in diameter and 30 feet high, made of iron plates, had been torn from its foundations and tossed about like a frail shanty; freight cars had been broken up and carried away down the river; heavy locomotive engines had been rolled over and were discovered lying in mud banks; and mud from 2 feet to 4 feet deep covered everything. An approximate estimate of the loss in this district was put at $3\frac{1}{4}$ million pounds. In the vicinity of Kansas City the losses were placed at upwards of three million pounds, while the value of the bridges destroyed was more than 150,000*l*. In previous floods the losses have fallen principally on the agricultural districts, but this time the loss to the farmers was less than one-third of the total, and about the same proportion was borne by the railroads.

But great as the losses were, they would have been far greater but for the property saved owing to timely warnings issued by the Weather Bureau. Owing to the careful records kept of previous floods the department was enabled to forecast the time at which the flow would reach the various towns situated on the river, and the height to which it would probably rise, and so could send out timely warnings. In the lower district alone the value of the property saved by removal to places of safety was estimated at 5 million pounds. The forecasts as to the probable height of the flood were issued in the higher districts at least four days in advance, and in the lower part, at New Orleans, twenty-eight days in advance. By these warnings the people were kept well informed of what they might expect in the way of high water. The work of the River and Flood Service in furnishing information regarding this flood was complete and satisfactory. By the use of the Post Office, telegraph and telephone lines, and the daily Press, and with the

FIG. 2.—Repairing levee at Lagrange, Mississippi.

[1] "The Floods of the Spring of 1903 in the Mississippi Watershed." By H. C. Frankenfeld. (Washington: Weather Bureau, 1904.)

cooperation of the various railway companies, every intelligent person in the district was made aware of the impending danger in ample time to make such preparations as they were able.

The floods of 1903 owed their inception to a series of heavy rainfalls caused by a succession of storms of the south-western type, the best rain-producing quarter, coming on the top of the water derived from the melting of the snow on the mountains in the upper reaches.

In the February flood in the lower Mississippi the water rose in one long swell from Cairo to the Gulf of Mexico from 17·5 feet on the gauge on January 28, passing the danger point of 45 feet thirty-nine days later, and 50½ feet, or 5½ feet above the top of the banks, eight days afterwards. It remained above the danger line for another twelve days, and then began to fall. It will thus be seen that the water in the river during the flood rose 33 feet.

Although excessive rainfall was the original cause of these floods, the effect was greatly increased by works that had been carried out for the improvement of the river and for providing means of inland transport, necessitating the frequent crossing of the river by railway bridges. Formerly a certain amount of relief to the floods was afforded by the water flowing through the numerous crevasses or breaches of the banks that occurred, but during recent years the banks have been systematically raised and strengthened. For example, in the St. Francis system the levees have been extended and raised 2 feet over a length of 173 miles, and the area originally subject to being submerged reduced 4000 square miles. The same operations have been carried on in other districts, so that the flooded area which previous to 1897 extended over 30,000 square miles in 1903 barely reached 7000 square miles. The fight against this flood was also the most extensive and persistent ever attempted in the history of levee engineering. When a breach was likely to occur all the help and material available was concentrated at the point of greatest weakness. At one place a force of more than 1000 men was employed both day and night, in spite of which the bank gave way for more than a mile.

At another part of the river, about 36 miles below New Orleans, a crevasse occurred at a place where the river is 120 feet deep. The bank was all washed away, and where it formerly stood a hole was scoured out 60 feet deep. Owing to the precautions taken, due to the warnings of the Weather Bureau, provision had been made to meet such a catastrophe, and workmen were at once concentrated on the spot, and trainloads of material which had been provided in readiness for such an emergency were brought to the place. By this means the breach was successfully closed, and the flooding of some of the finest sugar plantations in Louisiana averted.

Other causes that contributed to the greater rise of the flood were the numerous railway bridges that had been carried across the river without leaving sufficient waterway for floods. In one place, where the natural width of the river is 900 feet, the waterway had been contracted to 400 feet by a railway bridge, the velocity of the water through which rose to twelve miles an hour.

Encroachments by reclamation have also materially interfered with the free flow of the river, the original width of the channel in some places having been reduced one-half.

The report of these floods contains numerous illustrations which give a very graphic idea of the ruin caused in the flooded areas, and also of the works carried on in repairing the levees. There is also a map of the watershed of the Mississippi and of the flooded areas, and of the rainfall in the different districts.

Two other volumes issued by the Geological Department relate to the floods of the river Passaic in 1902 and 1903, when the loss to the inhabitants of the district was estimated for the two floods at about 3 million pounds. These two volumes also contain numerous very telling illustrations of the flooded areas and of the damage done to houses and factories.[1]

## *WHAT IS BRANDY?*

THIS question, which a few months ago greatly exercised analytical chemists in this country in consequence of the action of certain local authorities under the Sale of Food and Drugs Acts, has recently engaged the attention of the Technical Committee of Œnology, instituted by the French Minister of Commerce by decree of March 22, 1904, and the committee have adopted the conclusions of M. Rocques, the reporter of the subcommittee charged with the consideration of the matter, whose report is published *in extenso* in the *Moniteur Officiel du Commerce* of June 30. In view of the importance of the subject, it may be desirable to give a short summary of the facts and arguments which led the technical committee to adopt the conclusions of the special subcommittee.

In the first place the committee, for reasons which it is unnecessary to explain, object to the term *coefficient of impurities*, hitherto employed by French chemists, in conformity with a decree of the Minister of Commerce of May 26, 1903, to designate the aggregate proportion of the substances other than ethylic alcohol in brandy, and prefer to denote it by the term *coefficient non-alcohol*, or more simply *non-alcohol*, by which is to be understood the sum of the different volatile substances, other than ethylic alcohol, expressed in grams per hectolitre of absolute alcohol. These substances are the acids, aldehydes, ethers, the alcohols higher in the homologous series than ethyl alcohol, and the furfurol.

The causes which influence this coefficient are many, but in the main they may be said to depend upon (1) the nature of the wine, (2) the method of distillation, and (3) age.

As regards the first cause, it is found that the proportion, as well as the character, of the volatile matters vary according to the origin of the wine, the conditions under which its fermentation has been effected, the manner in which it has been kept, &c. The proportion of acids and ethers is considerably augmented if the wine becomes sour, and, speaking generally, the proportion of aldehydes is higher in white than in red wines.

But it is mainly in the method of distillation that we are to seek for the cause of the wide variations in this coefficient. This is readily understood if we examine the manner in which the various substances, which together constitute *non-alcohol*, behave during distillation. It is known that these substances pass over in very different proportion in the course of the distillation. Thus the aldehyde and the more volatile ethers are found mainly in the first runnings (*produits de tête*), whereas the taillings (*produits de queue*) contain in largest quantity the higher alcohols and the furfurol.

The separation of these various products—the *produits de tête*, the alcohol itself (*de coeur*), and the *produits de queue*—is effected in a manner more or less complete, depending upon the apparatus employed. In the larger distilleries this apparatus is of a very high order of perfection. But without further labour-

[1] The Passaic Flood of 1902, Water Supply and Irrigation Paper No. 88, and of 1903, Paper 92. (Washington : Government Printing Office.

ing this point, it is obvious that the aggregate amount and relative proportion of these products must depend very largely upon the means made use of, and hence perfectly genuine brandies must necessarily show wide differences in the *coefficient non-alcohol*.

In addition, it must be remembered that in the manufacture of brandy from wines of repute, the elimination of the substances constituting *non-alcohol* must be made with the greatest circumspection, since it is upon their bouquet that the value of these brandies depends, and this bouquet resides wholly in the *non-alcohol*.

On the other hand, if the brandy is being made from damaged wine the rectification must be most carefully conducted, and may have to be pushed to a point that the alcohol is obtained almost pure, that is to say, almost free from *non-alcohol*.

As regards the influence of age, it is observed that in those brandies which are found to improve on keeping there is an increase in *non-alcohol* due (1) to the formation of products of oxidation (acids and aldehydes), and (2) to *concentration* due to a loss of alcohol and water.

Brandies may be classified in the following manner :—

(1) The brandies of the two Charentes, which are habitually designated by the name of Cognac.

(2) The brandies of Armagnac.

(3) The brandies *de vin du Midi* and of Algeria (trois-six de Montpellier, &c.).

(4) Marc brandies.

The brandies of the Charentes are obtained by distillation of the wines of the district, and as the reputation of these brandies depends upon their bouquet they are submitted to a slight rectification only in order to preserve that bouquet.

The same may be said of the Armagnac brandies.

As to brandies made in other viticultural regions, and in particular in the middle of France, their nature is much more variable. These brandies require to be rectified in a manner, more or less complete, depending upon the nature of the wine or of the marc from which they are derived, and varying, too, with the quality of the brandy it is desired to produce. Certain wines require, in fact, to be most carefully rectified in order to produce merchantable brandy. Marc brandy is made in all viticultural regions, and that of Burgundy enjoys a special reputation.

As regards the value of the coefficient in different brandies, it is found that in those of Charente and Armagnac the coefficient is very high. Thus, as *minima*, a brandy of Clunis (1879, good, but not guaranteed) gave 259 (Girard and Cuniasse). A Cognac of 1892 gave 287 (Rocques). As *maxima* may be cited a Bois brandy of 1817, which gave 1174 (Lusson). This last number is exceptionally high. It may be said that, ordinarily, the value of the coefficient in Cognacs and *fine champagne* ranges between 275 and 450.

But little analytical evidence has been published respecting the Armagnac brandies, but, such as it is, it indicates that the coefficients in their case are less than are generally found in Cognacs.

The brandies obtained from the wines of the Midi and Algeria show much wider variations, ranging from 25 to 500.

Marc brandies have almost invariably a high coefficient. The numbers range from 555 to 1487, and it is interesting to note that the aldehydes frequently form a large proportion of the whole. Thus a Burgundy marc brandy was found to contain as much as 519 of aldehyde, and one from the Midi as high as 730 of aldehyde.

The question whether it is possible to fix minimum and maximum limits to this coefficient naturally received much consideration from the committee. The fixation of these presents a certain interest, and that from two different points of view. The fixation of a *minimum* limit has interest for the analyst, as guiding him in his inference as to the genuineness of the brandy or as to the amount of "silent" spirit with which it may have been mixed. The fixation of a *maximum* limit has an interest from the hygienic point of view, since it may become necessary if regulations are to be established in this sense.

The committee, however, are unable to recommend that any such limits should be fixed, owing mainly to the extremely variable character of brandy. Even in the case of brandies of a definite character, as, for example, Cognac, the non-alcohol coefficient is not the only element of value, and any conclusions as to character cannot be based solely upon it. Regard must be had to the proportions of the different volatile substances and their relations among themselves. Expert tasting (*dégustation*) must be considered as an indispensable complement of chemical analysis.

The hygienic point of view, involving the fixation of a maximum value for the non-alcohol coefficient, was brought to the notice of the International Congress of Chemistry in Paris in 1900, but the problem, as then stated, received no definite solution. To base conclusions on the value of the coefficient alone, with no regard to the factors which it comprises, seems illogical. For example, the acids, and in particular acetic acid, frequently make up a large proportion of this value, but it cannot be contended that these substances, at least in the proportion in which they are present in brandy, have any detrimental influence. Far more important are the aldehydes, ethers, the higher alcohols, and furfurol.

As regards the higher alcohols, the attempt has been made to establish a higher limit. Thus in Belgium, by a Royal decree of December 31, 1902, the sale is prohibited of spirituous liquors containing more than 1 gram of the higher alcohols and essences per litre of absolute alcohol when these liquors have an alcoholic content higher than 90°, and 3 grams when the alcoholic richness does not exceed 90°.

The committee remark that the effect of this regulation would be to exclude some of the most famous, and notably the oldest, brandies of the Charente, many of which exceed the maximum Belgian limit, which, expressed as a non-alcohol coefficient, is 300. Thus :—

| | Higher alcohols per hectolitre of abs. alcohol |
|---|---|
| Bois Brandy, 1817 (Lusson) ... ... | ... 612 |
| Saintonge, Cazes, 1896 (Lusson) ... | ... 372 |
| Gemozac, or de Fesson, 1893 (Lusson) | ... 345 |
| Clunis, 1875 (Lusson) ... ... | ... 345 |
| Cognac, 1873 (Rocques) ... ... | ... 304 |

From the hygienic point of view the ethers, furfurol, and especially the aldehydes, are undoubtedly of much greater importance than the higher alcohols, since admittedly the action of these substances on the organism is far more deleterious than that of the higher alcohols. From this point of view the attention of hygienists should be directed to the Marc brandies, which, as already stated, frequently contain considerable quantities of aldehydes.

Interesting and, no doubt, valuable as the report is, it is hardly calculated to facilitate the work of the unfortunate public analysts who may be called upon to express an opinion as to the genuineness of a sample of brandy. The question, What is brandy? analytically speaking, still awaits solution.

## NOTES.

SPEAKING at St. George's Hospital Medical School on Friday last, Lord Kelvin remarked :—The modern medical man must be a scientific man, and, what is more, he must be a philosopher. The fundamental studies of medicine are of a strictly materialistic kind, but they belong to a different world from the world which constitutes their main subject —the world of life. Let it not be imagined that any hocus-pocus of electricity or viscous fluids will make a living cell. Splendid and interesting work has recently been done in what was formerly called organic chemistry, a great French chemist taking the lead. This is not the occasion for a lecture on the borderland between what is called organic and what is called inorganic; but it is interesting to know that materials belonging to the general class of foodstuffs, such as sugar, and what might be also called a foodstuff, alcohol, can be made out of the chemical elements. But let not youthful minds be dazzled by the imaginings of the daily newspapers that because Berthelot and others have thus made foodstuffs they can make living things, or that there is any prospect of a process being found in any laboratory for making a living thing, whether the minutest germ of bacteriology or anything smaller or greater. There is an absolute distinction between crystals and cells. Anything that crystallises may be made by the chemist. Nothing approaching to the cell of a living creature has ever yet been made. The general result of an enormous amount of exceedingly intricate and thorough-going investigation by Huxley and Hooker and others of the present age, and by some of their predecessors in both the nineteenth and eighteenth centuries, is that no artificial process whatever can make living matter out of dead. This is vastly beyond the subject of the chemical laboratory, vastly beyond my own subject of physics or of electricity—beyond it in depth of scientific significance and in human interest.

MR. H. H. JEFFCOTT has been appointed assistant in the metrological department of the National Physical Laboratory.

BY permission of His Majesty the King, the Sanitary Institute will henceforth be known as the Royal Sanitary Institute.

AN International Gas Exhibition will be held at Earl's Court from November 19 to December 17 inclusive, under the auspices of the Institution of Gas Engineers.

AN exhibition of water colours, photographs, and other articles of interest belonging to the National Antarctic Expedition will be opened at the Bruton Galleries, Bond Street, on Friday by Sir Clements Markham.

A SKETCH of some of the results of the public works policy in India during the last fifty years was given at the Institution of Civil Engineers on Tuesday, in the address of the president, Sir Guilford L. Molesworth, K.C.I.E. In the course of the address, it was pointed out that there are available in India millions of potential horse-power, in the form of water flowing from the mountain ranges, capable of being converted into electrical energy at generating stations in the hills, and conveyed, with slight loss in efficiency, to centres even at a distance, where it can be utilised for industrial purposes. A generating station has been erected at the Cauveri Falls, with a head of 380 feet. The turbines drive six generators, each of 1000 electrical horse-power, and the current is transmitted, at a pressure of 30,000 volts, for a distance of ninety-one miles, to the Kolar goldfields, with an efficiency of nearly 80 per cent. At the cordite factory, Wellington, in the Nilgiri Hills, an effective fall of 660 feet is employed to work a turbine and alternators, generating about 1000 horse-power at a pressure of 5000 volts. As to irrigation, the amount of land irrigated in British India is about 44 million acres. Of these 17 million are irrigated by canals, 8 million from tanks, and 19 million from wells and other sources. In conclusion, the president remarked that although much has been done, far more yet remains to be done—in opening up the country, in the prevention of famines, in the regulation of the water supply, in the installation of works and factories, in the transmission of power generated by the hill falls to those centres where it can be profitably utilised, and in the general development of the resources of the Empire.

THE three articles in the October number of the *Zoologist* deal exclusively with local bird-faunas, namely, those of Oxfordshire, Donegal, and Jersey. The capture of a white-beaked dolphin (*Lagenorhynchus albirostris*) off Aberdeen is recorded.

THE director (Captain S. S. Flower) of the Giza Zoological Gardens, Cairo, has sent us a copy of a list of rare animals recently received from the Sudan, among which reference may be made to a female of the Niam-niam race of the chimpanzee (*Anthropopithecus troglodytes schweinfurthi*).

"GAMMARUS," otherwise the freshwater-shrimp (a name which, by the way, appears to be omitted from the text), forms the subject of the twelfth number of the *L.M.B.C. Memoirs*. Miss M. Cussans, the author, seems to have treated her subject in the same thorough manner which has been the rule in the earlier issues of this excellent series, and the four plates, although diagrammatic, are all that can be desired from the point of view of the student.

THE greater bulk of parts i. and ii. of vol. xxv. of *Notes* from the Leyden Museum is taken up by an article on the beetles of the family Paussidæ by Mr. E. Wasmann. These beetles, which are now definitely known to live in companionship with ants, are regarded by the author as the most interesting of all living creatures, since they show better than any other group the interdependence of morphology and biology. They are remarkable for the enormous size of their antennæ, and are believed to be the descendants of pre-Tertiary Carabidæ.

THE first of three lectures on the fossil vertebrates of Egypt was delivered at University College, Gower Street, by Dr. C. W. Andrews, of the British Museum, at 4.30 on October 31. This lecture was devoted to the Proboscidea. On November 7, at the same hour, the lecturer will discourse on Arsinoitherium and the Hyracoidea, while on November 14 he will take into consideration the sirenians and reptiles. Free cards of admission to these lectures may be obtained on application to the registrar at University College.

ACCORDING to the report of the Government biologist for 1903, the Government of the Cape of Good Hope is making every effort to develop the local fisheries. During the year four large steam-trawlers arrived from Europe; two of these were unfortunately wrecked, but the others have been doing good work, as have also certain vessels belonging to private owners. A new fishing-ground, much nearer to Cape Town than any of the old ones, has been discovered, and has been the chief attraction for the new trawlers. The report contains reprints (without the plates) of various memoirs by specialists on different sections of the South African marine fauna.

"THE Animals of Africa" forms the title of an article by Mr. Lydekker in the October issue of the *Quarterly Review*. While admitting the African origin of the mastodons, the author does not consider that there are sufficient grounds for rejecting Huxley's theory that the bulk of the modern mammalian fauna of Africa came from the north. In an article on fatigue, Sir W. R. Gowers points out that the study it has received has been chiefly at the hands of Italians. The facts known relating to both muscular and brain fatigue are passed in review, and the methods of prevention are considered in turn. Mr. D. G. Hogarth describes the palace of Knossos, and his account of recent researches is accompanied by a large plan. Two other articles also are of special interest to men of science—one dealing with the Panama Canal and maritime commerce, the other summarising what has been accomplished in Wales in the provision of higher education. Referring to Sir Norman Lockyer's calculation, that to place the Welsh universities on a footing of equal efficiency with the best universities of Germany and America a capital sum of four millions is required, the writer says it is clear that Wales herself cannot raise a tithe of this large sum, and emphasises the fact that it is to the State that Wales must look for the bulk of the money needed.

IN a brief *Bulletin* issued by the Michigan State Agricultural Experiment Station (No. 218) Mr. Fred Edwards reviews in popular language our present knowledge of soil bacteria in their relation to agriculture.

THE October number of *Climate* contains articles on malaria by Dr. Harford, the climate of Uganda and of Lovaleland by Mr. Cook and Mr. Fisher respectively, and medical articles, notes, and reviews.

THE *Journal* of the Royal Statistical Society for September (vol. lxvii., part iii.) contains the second and third reports of the committee appointed to inquire into the production and consumption of meat and dairy products in the United Kingdom, with remarks thereon by Mr. Rew, from which it appears that we are well ahead of other European nations in meat consumption (122 lb. per head as against Germany's 99 lb.), but appreciably behind our American cousins (150 lb. per head), and much less carnivorous than our Australian kinsmen (262 lb. per head). Mr. Thompson contributes a paper on local expenditure and indebtedness in England and Wales, and Mr. Adam a newly calculated life-table for Scotland.

PROF. A. E. WRIGHT'S system of anti-typhoid inoculation, introduced by him in 1896, after being applied to the British Army in India was forbidden by an army order in consequence of certain objections raised against it. During the South African War the inoculation of troops proceeding there was officially sanctioned, and Prof. Wright and his assistants injected some 100,000 men without the slightest mishap. At the termination of the war the advisory board of the reorganised Army Medical Department recommended that the practice of anti-typhoid inoculation should be suspended. Prof. Wright demurred to this decision, and in consequence Mr. Brodrick referred the matter to the Royal Society, and at their suggestion a special committee of the Royal College of Physicians was appointed to examine and report. This committee was composed of Dr. Rose Bradford, Dr. Gee, Dr. Howard Tooth, Prof. Simpson, and Dr. Caiger, and reported unanimously that, "after careful scrutiny of the statistics from both official and private sources which have been made available, we are of opinion that not only is a lessened susceptibility to the disease brought about as a result of the inoculations, but the case mortality is largely reduced. We are further of opinion that with due care the process of inoculation is devoid of direct danger, but that under special circumstances there may possibly be some temporary increase of susceptibility to infection immediately following inoculation; and it is therefore desirable that the preparation of the vaccine and the inoculations should be carried out under specially skilled supervision." In spite of this favourable verdict the advisory board still maintained its opposition, and Mr. Arnold-Forster therefore appointed another committee to advise him, consisting of Colonel Bruce and Dr. James Galloway, of the advisory board, together with Dr. C. J. Martin and Dr. A. Macfadyen, Lister Institute, Dr. Bulloch, London Hospital, Dr. Bruce Low, Local Government Board, Major Leishman, R.A.M.C., and Prof. Wright. This committee has reported unanimously "that the anti-typhoid inoculation has resulted in a substantial diminution in the incidence and case mortality from typhoid fever, and recommend that the system introduced by Prof. Wright should be resumed in the Army." The Army Council has adopted this recommendation, and is proceeding to carry out inoculations and to conduct investigations, by the agency of Major Leishman, on volunteers from the 2nd Battalion of Royal Fusiliers now proceeding to India.

A LIST of fresh-water algæ, collected by Mr. A. Howard in Barbados, Dominica and Trinidad, and described by Mr. G. S. West, appears in the *Journal of Botany* (October). This contains species, some new, which are additional to those recorded in papers previously published by the same author. A species of Glœotænium, a green alga, is figured, which is distinguished by the presence of a peculiar opaque cruciform zone. Biographical notes culled from Sir M. Grant Duff's "Notes from a Diary" and other sources include references to Sir James Paget, Brodrick, and John Ball.

THE success obtained with Para rubber in Ceylon has led to the experimental plantation of the tree in other countries. In India planters are wisely hesitating before they embark upon a venture which yields no return for five years or longer. It is obviously the duty of the superintendents of experimental gardens to investigate the possibilities, and in the Tennasserim circle, Burma, the scheme instituted by Mr. Manson for developing a large Para rubber plantation at Mergui is progressing. Up to the present serious depredations have been caused by deer and pigs which attack the seedlings, but by planting out two-year-old plants it is hoped that this may be to a great extent obviated. The experiment, which was started in 1901, will be followed with considerable interest by planters.

THE annual report of the Royal Alfred Observatory, Mauritius, for the year 1903, states that the rainfall of the island for the year (mean of fifty-one stations) was 68·8 inches, the average being 77·3 inches. The greatest falls in twenty-four hours were 9 inches at Constance d'Arifat on April 23, and 8·5 inches at Britannia on January 14. The number of ships which visited the island was 274, against 686 in 1882. From the observations contained in their logs, daily synoptic weather charts were prepared and tracks of cyclones laid down. Photographs of the sun were taken daily when the weather permitted; 173 negatives were sent to the Solar Physics Committee. During the year 117 earthquakes were recorded, particulars of which will be published in the annual volume of observations. Mr. Claxton states that much damage has been done to the library by white ants, and that it has been necessary to remove the books to another position.

THE U.S. Weather Bureau has issued its meteorological chart of the Great Lakes for the winter of 1903–4. This was the coldest winter in the lake region that has been experienced since the beginning of the Weather Bureau observations in 1871. Freezing temperatures commenced about the middle of November. The climax was reached in February, when the mean monthly temperature ranged about 10° below the normal in all districts. On Lake Superior the ice-fields did not disappear from the eastern portion until the last week in May, 1904. Several interesting photographs are given of vessels and ferries forcing their way through apparently impassable masses of ice as soon as a thaw set in. When navigation is practicable storm warnings are displayed by day and night, and at almost all stations a chart is issued showing the weather conditions at 8h. a.m. daily (except Sunday); masters of vessels are invited to obtain these charts, or any other information in connection with the weather, at any of the Weather Bureau offices.

APPENDIX iii. of a report upon the basin of the Upper Nile, with proposals for the improvement of that river by Sir William Garstin, contains an interesting account of the variations of level of Lake Victoria Nyanza contributed by Captain H. G. Lyons, the director of the Survey Department of Egypt. This lake has a water surface of about 68,000 square kilometres, and is situated about 1129 metres above sea-level. It is believed to be of shallow depth, and lies for the most part of the year in the region of the equatorial rain and cloud belt, the excess water draining off at the Ripon Falls by the Victoria Nile. After reference to the geology and climate of the region, a brief historical summary is given of the early lake levels as observed by travellers and others visiting or residing by it; this is followed by a detailed study and discussion of the various gauges. Some of the results obtained are as follows:—The annual oscillation of the lake is from 0·30 metre to 0·90 metre. Between 1896 and 1902 there was a fall of 76 cm. in the average level, since followed by a rise of 56 cm. The epochs of high and low levels are given as:—1878, high level; 1880–90, falling level; 1892–95, temporary high level; 1896–1902, falling level; 1903, rising level.

WE have received from Mr. W. J. Brooks, 33 Fitzroy Street, W., some of his patent flexible curves and a parabolic curve. One of the former is a strip of celluloid with tags at intervals along its length; when placed on paper it can be bent to any desired curve, the fingers being placed on the tags to keep the strip in position; the strip does not yield under the pen. A second form (pattern B) has a steel strip and is self-clamping and reversible; this ingenious device maintains the steel strip in any position by means of stiff-hinged linkwork attached to metal tabs. The shape of any curve thus formed by this strip can be transferred from one drawing to another, a desirable advantage to many workers. A third and longer form (pattern C), also self-clamping and reversible, has been designed for such special purposes as are required by ship and boat builders, but it will have a much wider field of adaptation, such as, for instance, in the construction of interpolation curves for wave-lengths in spectroscopic work, &c. This pattern, which can be obtained from one foot up to any length, consists of light wooden cross-bars hinged to tabs fixed to a steel strip. The strips slide through brass spring-clamps, and are thus held tight against a stout wooden bar running the length of the curve. Several patterns and sizes for all the curves are obtainable, and they may be usefully employed for a great number of manipulations, such as curve drawing, transferring outlines of mouldings, &c. The parabola is of celluloid and is accurately cut, and its axis, focus and latus rectum neatly engraved on it. In addition to its use for draughtsmen, teachers of mathematics will find it serviceable for the study of that curve.

A NEW general theory of errors has been contributed to the *Proceedings* of the American Academy of Arts and Sciences, xi., 3 (August), by Mr. William Edward Story. The author's object has been to develop the theory in such a way as to avoid the usual assumptions, the legitimacy of which, as approximations, may be questioned. It is claimed that the present theory is based upon such simple principles as will be generally admitted to be necessary for the mathematical treatment of any theory. The fundamental assumptions are as follows:—Possible errors form a practically continuous sequence from a certain lower limit to a certain upper limit. The probability that the error of an observation lies between $x$ and $x+dx$, where $dx$ is infinitesimal, is $\phi(x)dx$, where $\phi(x)$ is an analytical function of $x$, developable by Taylor's theorem throughout the whole range of possible error. The probability that the error lies between given limits is independent of the unit of measurement.

ATTENTION has already been directed in these columns to the important innovation introduced into this country by the Drapers' Company in granting a sum of 1000*l.* to University College, London, for the furtherance of research in applied mathematics. No better testimony to the value of this grant could be adduced than is afforded by a reference to the pages of Nos. 1 and 2 of the technical series of the *Drapers' Company Research Memoirs*, edited by Prof. Karl Pearson. In the first of these Mr. E. S. Andrews discusses the stresses in crane and coupling hooks by means of the theory of elasticity, and describes experimental tests in verification of his theory. The present investigation shows not only that the existing theory is unsatisfactory, both theoretically and practically, but that improvements can well be made in existing types of hooks by following lines laid down in the paper. In the second paper Mr. L. W. Atcherley directs attention to certain very serious defects in the theory of masonry dams. It is shown that the stresses across vertical sections of a dam are far more important than those across horizontal sections, and that in many existing dams not only do shearing stresses exist in the vertical sections which are far in excess of any considered safe by engineers, but considerable tensile stresses also occur, which form a serious source of danger. These two papers are fitting illustrations of the many important practical problems now awaiting solution, which could be solved at a very small cost by the provision of further endowments for mathematical research.

THE third revised edition of "The Scope and Method of Political Economy," by Dr. J. N. Keynes, has been published by Messrs. Macmillan and Co., Ltd., at 7*s.* 6*d.* net.

MESSRS. ROUTLEDGE AND SONS, LTD., have added to their series of "Country Books" a profusely illustrated edition of Charles Kingsley's "Glaucus, or the Wonders of the Seashore." The volume is published at 3*s.* 6*d.*

SINCE the advent of the Nernst lamp, every physicist has recognised that it would ultimately be very serviceable for lantern purposes. Any lecturer interested in the matter may see a well designed lantern provided with Nernst filaments, in actual use, at Mr. R. W. Paul's, High Holborn.

MR. H. G. WELLS returns to the more serious side of his work in "A Modern Utopia," which is being published month by month in the *Fortnightly Review*. As in "Anticipations" and "Mankind in the Making," Mr. Wells concerns himself with sociological problems, and pictures the probable manners and customs of society in a Utopia, situated on a distant planet, which is the natural outcome of continued development on modern lines.

A REVISED edition of Mr. H. N. Chute's "Physical Laboratory Manual" has been published by Messrs. D. C. Heath and Co. In this edition sound and light have been made to follow mechanics, because, the author says, "there seems to be a consensus of opinion among teachers that . . . the grade is less steep than it is where these subjects follow electricity." A few of the problems of the first edition have been omitted, and new ones added.

THE first number of the *Journal of Agricultural Science*, edited by Messrs. T. H. Middleton, T. B. Wood, R. ... Biffen, and A. D. Hall, in consultation with other gentlemen, will be published in January next by the Cambridge University Press. The journal will publish only definitely scientific work in agricultural science, and will not include the results of the ordinary trials of manures and varieties for demonstration or commercial purposes. Papers for publication should be sent to Mr. T. B. Wood, University Department of Agriculture, Cambridge.

THE seventh edition of Dr. J. Frick's "Physikalische Technik," enlarged and completely revised by Prof. O. Lehmann, is in course of publication by Messrs. F. Vieweg and Son, Brunswick. The first half of vol. i. has been received, and the second half is promised shortly. The second volume will be published in a year or two, and will complete the work. In the part before us there are 629 pages and 2003 illustrations of lecture and laboratory apparatus for demonstrations and experiments in various branches of mechanics and physics.

A CHEAP edition (1*s*. net) of Mr. G. F. Chambers's "Astronomy for General Readers" has just been published by Messrs. Whittaker and Co. The book contains 268 pages and 134 illustrations, most of which represent the pictorial efforts of bygone days. As instances of the worst of these figures, reference may be made to Figs. 29, 104, 105, 106, 109, and 112. Before issuing this cheap edition an attempt should have been made to bring the text and the illustrations in line with the present position of astronomy, instead of leaving them as they were in the original volume.

THE *Journal of Anatomy and Physiology* for October (xxxix., part i.) contains a number of valuable papers, but of purely anatomical interest. The principal contribution is by Dr. Huntington on the derivation and significance of certain supernumerary muscles of the pectoral region, illustrated with fourteen excellent coloured plates.

THE new illustrated catalogue of physical apparatus just issued by Messrs. F. E. Becker and Co. (Messrs. W. and J. George, Ltd.) is likely to prove indispensable in the physical laboratories of all our schools and colleges. It runs to 628 large pages, and is strongly bound in cloth. Full particulars are provided, not only respecting the apparatus required in elementary and advanced physical teaching, but also concerning that necessary to the physicist in his research work. All branches of physics are included, and the instruments throughout are explained by excellent illustrations and concise descriptions, and, what is of prime importance, the figure and its appropriate text are close together.

## *OUR ASTRONOMICAL COLUMN.*

ASTRONOMICAL OCCURRENCES IN NOVEMBER :—

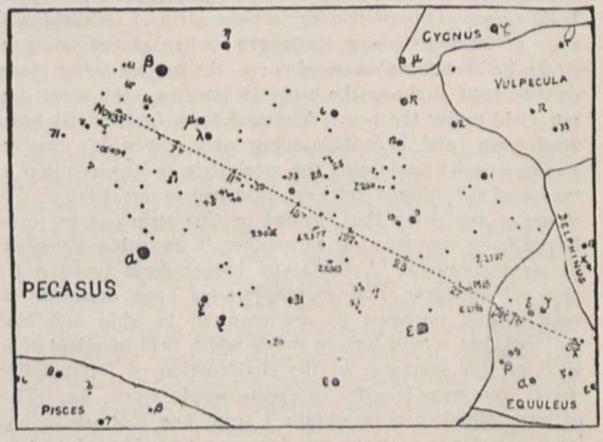
Nov. 5. Saturn. Outer major axis of outer ring = 39″·42.
,, ,, Outer minor axis of outer ring = 11″·01.
8. 11h. 50m. Minimum of Algol (β Persei).
9. 13h. 0m. Venus in conjunction with Moon (Venus, 6° 30′ S.).
11. 8h. 39m. Minimum of Algol (β Persei).
13. 21h. 0m. Juno in conjunction with Moon (Juno, 0° 8′ N.).
14. 0h. 0m. Saturn in conjunction with Moon (Saturn, 3° 53′ S.).
,, 5h. 28m. Minimum of Algol (β Persei).
,, 16h. Epoch of November meteors (Leonids, radiant 150° + 22°).
15. Venus. Illuminated portion of disc = 0·832, of Mars = 0·936.
16. 15h. Venus and Uranus in conjunction (Venus, 1° 28′ S.).
17. 5h. 5m. Transit of Jupiter's Sat. III. (Ganymede), egress.
19. 11h. Jupiter in conjunction with Moon (Jupiter, 1° 31′ N.).
20. 10h. 24m. to 11h. 44m. Moon occults ξ′ Ceti (mag. 4·5).
23. 5h. 20m. Near approach of Moon to α Tauri (mag. 1·1).
24. 6h. 39m. to 8h. 34m. Transit of Jupiter's Sat. III. (Ganymede).
25. Vesta in opposition to Sun (Vesta, mag. 6·5).

ENCKE'S COMET 1904 *b*.—In No. 3973 of the *Astronomische Nachrichten* M. M. Kaminsky gives a further ephemeris for Encke's comet, which he has corrected in accordance with the observation made at Heidelberg on September 11. The ephemeris gives the daily positions of the comet from October 14 to December 5, and the following is an abstract therefrom :—

*Ephemeris* 0*h*. (*M.T. Berlin*).

| 1904 | α app. h. m. s. | δ app. ° ′ | log. r | log. Δ |
|---|---|---|---|---|
| Nov. 3 ... | 23 10 34 ... | +24 9 ... | 0·1510 ... | 9·7380 |
| ,, 5 ... | 23 1 3 ... | +23 21 ... | 0·1424 ... | 9·7305 |
| ,, 7 ... | 22 51 37 ... | +22 29 ... | 0·1335 ... | 9·7237 |
| ,, 9 ... | 22 42 19 ... | +21 33 ... | 0·1243 ... | 9·7178 |
| ,, 11 ... | 22 33 11 ... | +20 36 ... | 0·1147 ... | 9·7125 |
| ,, 13 ... | 22 24 17 ... | +19 35 ... | 0·1048 ... | 9·7080 |
| ,, 15 ... | 22 15 34 ... | +18 33 ... | 0·0946 ... | 9·7040 |
| ,, 17 ... | 22 7 5 ... | +17 29 ... | 0·0840 ... | 9·7008 |
| ,, 19 ... | 21 58 49 ... | +16 24 ... | 0·0730 ... | 9·6978 |

The accompanying chart shows, approximately, the apparent path of the comet through the constellation Pegasus into Equuelus from now until December 5.




SIMULTANEOUS OCCURRENCE OF SOLAR AND MAGNETIC DISTURBANCES.—Writing in No. 3, vol. xx., of the *Astrophysical Journal*, Herr A. Nippoldt, of the Potsdam Magnetic Observatory, disagrees with Father Cortie's conclusion (published in *Astrophysical Journal*, pp. 287–293, vol. xviii., 1903) re-

garding the absence of any allied magnetic disturbances during the appearance of a vigorous sun-spot from May 19 to June 26, 1901.

Herr Nippoldt questions the advisability of introducing statistical gradations of the magnetic disturbances, and contends that the magnetic effect at any one place or at a number of places in approximately the same latitude is, possibly, not a measure of the solar cause. That is to say, an instrument near the poles might register a "great" when the Potsdam or Stonyhurst recorders only registered a "small" disturbance. Consequently, he would urge that when the magnetograph trace shows any marked divergence from the normal one might consider that a disturbance had taken place, and he shows, by a reproduction of the "horizontal-intensity" curve obtained at Potsdam on May 30–31, 1901, that a disturbance *did* take place during the time that the spot which Father Cortie especially discussed was on the sun.

Finally, he confirms M. Deslandres's opinion that in the future the solar observations should be continuous, and thereby become more strictly comparable with the magnetic records.

THE THIRD BAND OF THE AIR SPECTRUM.—In No. 16 (1904) of the *Comptes rendus* MM. H. Deslandres and A. Kannapell publish the results of a study of the third air band, which occurs in the more refrangible part of the ultra-violet end of the spectrum (λ 3000 to λ 2000), under a large dispersion.

The apparatus used consisted of a capillary vacuum tube closed with a plate of quartz under a pressure of less than 1 mm. of mercury, and a spectrograph containing two calcite prisms of 60° and two quartz lenses of 1·3 metres focal length. The latter produced a dispersion which, in the neighbourhood of N=42,189 (λ 2370), gave a separation of 0·005 mm. for a difference of 0·06 N.

The wave-lengths of the lines were obtained by reference to a spectrum of iron, using Kayser's fundamental values for the wave-lengths of the latter, and the authors state that in the individual values obtained for N the first six figures are correct.

In the results it is seen that, although the lines of the band may be separated into four series of doublets according to Deslandres's law, so that the difference of wave-lengths in each series advances in arithmetical progression, yet the variations from the computed values are greater than may be accounted for by errors of measurement, and, what is more remarkable, the sign of these variations for series i. and ii. is opposite to that obtained for series iii. and iv.

## *PRE-GLACIAL TOPOGRAPHY.*[1]

THE beautifully illustrated memoir by Messrs. Wright and Muff, recently issued by the Royal Dublin Society, directs attention to an ancient rock-platform on which Glacial deposits were laid down in southern Ireland. The importance of such observations is clear when we consider the possibility of the preservation of a pre-Glacial, and perhaps Pliocene, fauna in favoured localities beneath the drift. At Courtmacsherry Bay, for example, south-west of Cork Harbour, a well marked rock-shelf occurs about 5 feet above high-water mark. On this rests a raised beach, with ferruginous sand and rows of pebbles, succeeded by the blown sand that accumulated when the uplift first occurred. Blocks from the adjacent cliff slipped down over the sand, and the series was then preserved by the Boulder-clay of the Glacial epoch. The wide stretch of coast, from Carnsore Point in co. Wexford to Baltimore in the west of co. Cork, over which this raised platform has been traced, affords ample opportunities for comparing the modern with the ancient features. The authors show that the pre-Glacial sea worked against a cliff about 100 feet in height, and consequently advanced slowly, leaving a denuded surface remarkably free from stacks and irregularities. This surface commonly lies about 12 feet above the modern beach. Unfortunately, no trace of fossils has yet appeared in the old beach-deposits, and the authors believe that even pebbles of limestone have been removed by percolating water. The Boulder-clay above contains the usual molluscs, including northern species.

The pre-Glacial beach is traced into the estuaries of the rivers of southern Ireland; consequently these inlets are still older. Since they have arisen from the submergence of river-valleys, the river-system and the submergence are of pre-Glacial age. This simple but important observation seems effectually to negative the views of the late Prof. Carvill Lewis and Mr. James Porter (*Irish Naturalist*, 1902, p. 153), who argued that deposits of glacial drift might have turned the lower portions of these rivers into their present north-and-south direction. We are thrown back, then, upon the view of Jukes in accounting for the courses of the Blackwater and the Lee, and may see, as the drift is slowly washed away, further and further developments of the pre-Glacial topography of Ireland. We have been apt to assume that the western fjords and rias originated when the glaciers retreated from them and the land sank upon the Atlantic side. It now becomes possible that the tongues of ice spread into pre-existing inlets, banking out the sea, and again admitting it in warmer times. Messrs. Wright and Muff even conclude, from British as well as Irish indications, that "a considerable portion of the coast-line of Southern Britain is of pre-glacial age. The approximation over so wide an area of the sea-level in pre-glacial times to that of the present day renders it very probable that Ireland was already insulated before the Glacial Period."

FIG. 1.—Section in Courtmacsherry Bay, co. Cork, showing beach-gravel and sand resting on shore-platform, and overlain by Boulder-clay.

This only increases the difficulty of assuming an extinction of the fauna and flora of Ireland during the maximum extension of the ice. Many points of cheerful controversy lurk behind this straightforward and descriptive paper.

GRENVILLE A. J. COLE.

[1] "The Pre-Glacial Raised Beach of the South Coast of Ireland." By W. B. Wright and H. B. Muff. *Scientific Proceedings of the Royal Dublin Society*, vol. x. part ii. (Dublin: University Press, 1904) Price 3s.

## THE SALMON FISHERIES OF ENGLAND AND WALES.[1]

THIS report, although the first issued by the Board of Agriculture and Fisheries, is on the same lines as the forty-three previous annual reports of the Inspectors of Fisheries of England and Wales issued by the Board of Trade. It embodies the reports of the three Inspectors of Fisheries of England and Wales, Messrs. Archer and Fryer and Dr. Masterman. Besides these reports there are twelve appendices.

It is pleasing to learn from Mr. Archer's report that the salmon and trout season of 1903 was on the whole a good one. Mr. Archer refers to the long-standing difficulty of getting accurate statistics, and has made inquiries of the various boards of conservators as to the possible methods of obtaining them. The answers from these boards are not encouraging, and it is apparent that legislation is necessary in order to compel the recording of fish caught.

As usual, the want of funds by the boards of conservators, and the impossibility of their carrying out their proper work without such funds, is discussed. The present system by which the boards derive their revenue solely from the net and rod licences granted annually is obviously inadequate, and Mr. Archer quotes a resolution adopted unanimously by the Wye Board of Conservators, which is as follows :—

"That as the present system, by which the income of Fishery Boards in England and Wales depends entirely upon the amount realised from licences paid for nets and rods, has proved inadequate for the proper protection of the Fisheries, this Board is of opinion that legislation is urgently required to enable any Fishery Board, with the consent and subject to conditions formulated by the Board of Agriculture and Fisheries, to assess the annual value of all the Fisheries in its district and to levy a rate upon each Fishery for the purpose of providing the Board with a sufficient income for the proper protection and management of the Fisheries in the district under its charge."

We quote this, not because it is new, for the suggestion that some form of assessment of fisheries was probably unavoidable was made by the Salmon Fisheries Commission in their report in 1902, but because this move on the part of the Wye Board is worthy of commendation, and seems to us to be a move in the right direction. Too often our Royal Commissions make valuable reports which are pigeon-holed, and perhaps if the various boards of conservators pass similar resolutions to that passed by the Wye Board, and thus show some common agreement in the matter, it will go some way towards making those in authority take the matter up seriously. We have heard rumours of new salmon legislation, and let us hope that the financial side of the question will have full consideration.

Mr. Archer discusses further evidence brought forward by those who believe in the advantages of artificial propagation of salmon to show the success of the experiments upon the Weser in Germany, and he shows quite clearly that "not proven" must still be the verdict on the question of their success.

We are very glad to see from Mr. Fryer's report that salmon-marking experiments, which have now been carried on for some years in Scotland and Ireland and in Norway, have been undertaken in England. The percentage of returns of marked salmon is not very high, and the more the experiment is extended the better chance there is of gathering data which will throw some light upon the migratory habits of the species.

At last steps are being taken to alter the anomalous state of the law as to the English and Scottish sides of the Solway, as recommended by the Royal Commission on Tweed and Solway Fisheries, which sent in its report eight years ago.

There is a *résumé* of the various local questions with which Mr. Fryer has had to deal, and it is in reading this that one sees the futility of our present fishery laws. While inspectors or boards of conservators are corresponding with this manufacturer or that company or corporation as to the steps to be taken to mitigate some nuisance, the seasons slip by and nothing is done, often because there is insufficient power given under existing Acts to enforce those Acts being carried out.

Dr. Masterman, who was appointed only just before the end of the period with which the reports are required to deal, submits a short but interesting paper upon fish scales and upon the method of distinguishing the species of Salmonidæ. He refers to the work so far done upon fish scales as a means of recording the age of fishes, and in this connection we are glad to learn that the salmon scale is being studied at the present time by Mr. H. W. Johnston. The salmon scale is particularly interesting, as a number of rings—roughly about thirty—immediately surrounding the nucleus of the scale, and occupying roughly about 0·5 mm. or 0·6 mm., are much finer, and are situated much closer together, than the rings outside this area, perhaps representing the fresh-water life period of the individual.

We notice that the gross revenue returned during 1903 was 7504*l*., as against 6606*l*. in 1902. There were more rod licences issued than in any previous years since the commencement of the statistics, although the revenue therefrom, amounting to 3294*l*., was not equal to that realised in 1892, when it was 3386*l*. Revenue from nets was also slightly better than in 1902, being 3994*l*. as against 3905*l*., but in 1902 these licences realised less than in any year since 1867, the first year of the statistics, when only 3851*l*. was obtained.

Trout licences produced more in 1903 than in any previous year.

The report is published at His Majesty's Stationery Office, and is obtainable from Messrs. Eyre and Spottiswoode, or through any bookseller, price 8*d*.

FRANK BALFOUR BROWNE.

[1] Board of Agriculture and Fisheries. Annual Report of Proceedings under the Salmon and Freshwater Fisheries Acts, &c., for the Year 1903.

## THE ANATOMY OF CORALS.[1]

THE classification of corals based upon the structure of the hard or skeletal parts alone, such as has been used by zoologists in general since the publication of Milne-Edwards and Haime's "Histoire Naturelle des Coralliaires" (1857–1860), is clearly not satisfactory. Some consideration in the system of the general anatomy of the soft tissues of the living coral polyps is clearly necessary if our classification is intended to indicate at all the natural grouping of the genera and species.

The startling discoveries made by Moseley during the voyage of the *Challenger*, that the coral Heliopora and the corals of the family Stylasteridæ do not belong even to the same order as the Madrepores, was an important, if not the principal, stimulus to the investigations of the anatomy of these zoophytes that have been published in recent years. Moseley himself, and his pupils Bourne, Fowler, and Sclater, and abroad von Heider and von Koch, contributed valuable memoirs on the anatomy of different species of Madreporaria, and slowly but without any further startling effects our knowledge grew. The result of these investigations was to confirm the belief in the close relationship of the Madrepores to the sea anemones, and to show that in the structure of the mesenteries, tentacles, and other organs there are differences between the genera of great systematic importance. But still our knowledge remained insufficient to suggest any permanent improvement on the Edwardsian system.

Some years ago Mr. Duerden, when stationed in the island of Jamaica, commenced a series of investigations upon the living corals of Kingston harbour and its neighbourhood. He took advantage of his opportunities for observing them alive on the reef and in his aquarium; he was equipped with a profound knowledge of the structure of the Actiniaria and of the modern methods of anatomical investigation. A series of papers and notes marked the period of his residence in Jamaica; but he reserved for this magnificent memoir of 200 quarto pages a general and detailed account of his work.

To say that the memoir is brilliant is to express an opinion, but to say that it is important is but to state a fact. Zoologists who are interested in the structure of corals must refer to this memoir as a great store of first-hand

[1] "West Indian Madreporarian Polyps." By J. E. Duerden. *Memoirs* of the National Academy of Sciences, vol. viii. (Washington, 1902.)

facts, and whoever attempts in the future to classify the Zoantharia must base his conclusions upon many of the anatomical details which are here for the first time adequately recorded.

No less than twenty-six species of corals, distributed among twenty genera, formed the materials of Mr. Duerden's investigations, and, although the descriptions are not exhaustive, there is a very full and interesting account of the general structure of all these forms.

The brilliancy of the colours of many corals in the living state has excited the interest and admiration of the naturalists and travellers who have visited coral reefs. These colours appear to be due to a variety of causes. In many cases the cavities of the polyps and the adjacent canals bear large numbers of the symbiotic algæ called Zooxanthellæ. The colour of these cells accounts for most of the prevailing brown and yellow-brown tints. In some few instances, such as *Astrangia solitaria* and *Phyllangia americana*, the Zooxanthellæ are nearly or wholly absent, and the polyps then are remarkably transparent and almost colourless. But there are in many cases definite pigment cells, both in the ectoderm and endoderm, which may add to or give the only colour effect of the expanded polyps. A third cause of colour is to be found in the boring filamentous red and bright green algæ with which many corals are infested.

The chapter dealing with the structure and arrangement of the tentacles is one of exceptional interest. To investigators in this country the tentacles have always offered difficulties and uncertainties. However carefully the

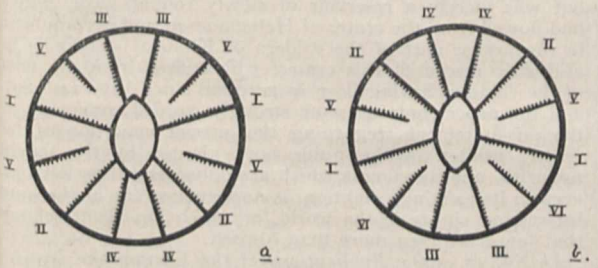



FIG. 1.—Diagrammatic figures showing the arrangement of the first six pairs of mesenteries in (*a*) Madrepora; (*b*) most other species of Madreporaria. The upper side of each is the side turned towards the axis (axial), and the lower is away from the axis (abaxial). The axial side of Madrepora is ventral, whereas in most other species it is dorsal. (The upper of the bilateral pairs marked v, v in *a* should have been vi, vi).

material they can obtain is preserved, it is impossible to prevent a great deal of retraction and shrinkage. Mr. Duerden's careful observations, therefore, of the fully expanded tentacles of his living corals form a particularly welcome addition to our knowledge.

The most elaborate, and perhaps we may say the most important, part of the author's work deals with the number and arrangement of the mesenteries. This is not the place to relate or to criticise details which are necessarily highly technical and somewhat intricate; but it may be said that it is upon the results of this part of his investigations that the suggestions he has to offer for the classification of the order very largely depend.

If we regard the Madreporaria as an order, we may divide it into two suborders:—(1) the Entocnemaria, (2) the Cyclocnemaria. In the former the mesenteries always arise in bilateral pairs, and beyond the protocnemic stage the increase takes place within one or both of the directive entocœles. In the latter the mesenteries, beyond the protocnemic stage, arise in isocnemic unilateral pairs within the primary exocœles. The Entocnemaria are represented only by the single section Perforata, the Cyclocnemaria by the two sections Aporosa and Fungacea. The arrangement of the families of the Aporosa into two groups, the Gemmantes and the Fissiparantes, based upon the method of asexual reproduction—by gemmation or by stomodæal fission—supported as it is by Mr. Duerden's later researches, can be regarded as only tentative and suggestive at present; but the facts upon which it is based are among the most interesting and important of his many results.

It is a matter for regret, which many will share with the reviewer, that in the introduction to the systematic part of the memoir Mr. Duerden has not given us his views as to the relation of the Actiniaria to the Madreporaria, a difficult matter upon which no one is more competent to express an opinion.

There are some points in the terminology employed by Mr. Duerden that appear to me to be open to some objection. "By universal acceptation," he says, "Cœnenchyme is the calcareous deposit originating from the cœnosarc." This is most unfortunate. The word was introduced by Milne-Edwards and Haime to signify the common tissue which precedes the existence of the polyps and plays a considerable part in their constitution. In a similar sense Kölliker uses the expression as the tissue that gives rise to the axis of the precious coral. It was for the soft, not the hard, parts of the "common tissue" that the word was introduced. But to say that by "universal acceptation" the word is used for the calcareous deposit is not accurate, for the writers on Alcyonarians invariably use the word to signify both hard and soft parts, other than the axis, which lie between the neighbouring zooids.

Again, the use of the word "gastro-cœlom" for the general body-cavity of the Cœlenterate, suggesting as it does a compromise with the old-fashioned gastro-vascular cavity, is to be regretted. Either of the words "enterocœl" or "cœlenteron" is preferable.

On the other hand, the discussion (pp. 443–4) on the use of terms referring to the aspects of the cœlenterate body is excellent. The aspect of the body towards which the faces bearing the musculature of the two complete bilateral pairs of mesenteries, i, ii, are turned was called by Haddon the "sulcar" aspect, and the opposite the "sulcular" aspect. This terminology was adopted by Bourne in his "Anthozoa" of Lankester's "Treatise on Zoology." Marshall, in writing upon certain Alcyonarians, had previously used the terms "abaxial" and "axial" respectively, and these terms were introduced to supersede the "ventral" and "dorsal" of Moseley, Kölliker, and others. It is quite clear now from Mr. Duerden's remarks that the use of the newer sets of terms can lead to nothing but confusion. Anything that can be called a "sulcus" occurs only in Alcyonaria and a few Zoantharia; the "sulculus" is a myth.

But of more importance is the fact that, as shown by Carlgren, the "sulcus" is dorsal in Cerianthus and ventral in the other forms where it occurs. The axial-abaxial relationship, moreover, is not constant. In the Alcyonaria and in the majority of Zoantharia the dorsal aspect of the polyp is turned towards the axis of the colony, and the ventral aspect away from the axis; but in Madrepora this arrangement is reversed. In the solitary Anthozoa the use of the terms "axial" and "abaxial" has no meaning.

The conclusion is then that, although they are open to some objections, the use of the terms "dorsal" and "ventral" for the two aspects of the bilateral anthozoon must be retained.

In conclusion, Mr. Duerden may be congratulated on the production of a really great work which marks an important step forward in the history of our knowledge of the Cœlenterata.

SYDNEY J. HICKSON.

## SEISMOLOGICAL NOTES.

IN No. 10, vol. ix., of the *Boll. Soc. Sismol. Italiana*, Dr. Agamennone records the fact that his idea of taking photographs, at intervals, from fixed points, in regions suspected of bradiseismic movements, was independently suggested by F. Salmojraghi. The object is to detect slow or rapid changes of relative level in the interior of a continent, where there is no such convenient datum level as is afforded by the sea, and the paper is specially devoted to showing that the effects of refraction, being irregular, would not prevent the detection of a bradiseismic change of relative level in a regular series of photographic records.

No. 23 of the *Mittheilungen* of the Austrian Earthquake Commission is a paper by Prof. Láska on the application of earthquake observations to the investigation of the constitution of the interior of the earth. From a consideration of the observations of the Caraccas earthquake of

October 29, 1900, in Europe and Japan, he arrives at the conclusion that if the earth consists of a central core and an outer shell, each of uniform composition, the outer shell must have a thickness of not more than 500 km. This result would fall in with Milne's hypothesis, but as this is considered to be inconsistent with the facts of astronomy, he adopts the conclusion that there is a continuous increase in the rate of propagation from the surface to the centre of the earth, this increase being much more rapid near the surface than at greater depths; this condition would result in the wave motion being propagated along curvilinear paths, and give rise to a small apparent rate of propagation near the origin as compared with that found at greater distances. The value of Prof. Láska's conclusion is diminished by the fact that it is based on the consideration of only a single earthquake, the time of origin of which is not known by direct observation.

In the *Boll. dell Accademia Gioenia di Scienze Naturali in Catania* of February, 1904, Prof. Ricco returns to the consideration of the gravitational anomalies he has detected under Mount Etna, and shows that they are accompanied by corresponding irregularities in the course of the lines of equal magnetic force. Prof. Ricco merely records the fact of these magnetic irregularities, but the observation is important in its bearing on the explanation of the gravitational anomaly, which is equivalent to the removal of more than 1000 metres in thickness of rock, at sea level, from under the summit of the mountain. It is inconceivable that this can be due to the existence of huge cavities in the earth; more probably the effect is due to the existence of a "root" of the mountain, depressed into a denser magma, by the buoyancy of which the visible mountain is supported. There is independent geological evidence that Mount Etna lies over a region of special subsidence, the basis of sedimentary rock on which it was heaped up having been depressed during its formation, and if we suppose this depression to have caused the displacement of denser by less dense rocks to a considerable depth, we get an explanation of both gravitational and magnetic anomalies. A rough calculation shows that the buoyancy of the downward protuberance would, on the most favourable supposition, be inadequate to support the whole weight of the mountain, and it must be concluded that Mount Etna is not in a condition of complete isostacy, but partially supported by an upward force.

In No. 1 of the tenth volume of the *Bolletino* of the Italian Seismological Society Prof. Grablovitz discusses the vexed question of the nature of the wave motion in the third phase of the record of a distant earthquake. The occasion is the series of earthquakes which originated in the Balkan peninsula on April 4, 1904; as registered at Ischia, the great waves had a period of about 8 seconds, and, if the records of the horizontal pendula are interpreted as due to tilting, they indicate angular movements of as much as 100 seconds of arc, and this means a vertical movement of more than 2 metres; in the same earthquakes the instrument for recording the vertical component of the movement gave only negative results. From this Prof. Grablovitz concludes that the records obtained from the horizontal pendula and the *vasca sismica* are not due to tilting; he admits that there may have been a small amount of vertical movement which the instrument failed to record, but this must have been much smaller than that obtained by calculation in the ordinary way.

The same number contains a description, by Dr. Agamennone, of a new form of very delicate seismoscope, adapted for the detection of both near and distant earthquakes; and an account, by D. Vassalo, illustrated by a sketch plan, of the condition of Stromboli in June, 1904.

Dr. R. von Kövesligethy, of Budapest, has made an ingenious calculation of the work done by great earthquakes. Regarding the observed irregularities in the displacement of the poles as compounded of a regular epicycloid movement, and an irregular movement, which has been shown by Prof. Milne to vary with the frequency of great earthquakes, he calculates that each of the 200 great earthquakes registered during the eight years 1895–1902 caused an average displacement of the pole through $-0''{\cdot}00275$; the negative sign is interesting, as showing that the tendency of great earthquakes is to diminish the departure of the instantaneous from the mean axis of revolution. The work done by this displacement is calculated as equivalent to that which would be required to raise a mass equal to that of the earth through 1.2 mm. at its surface (*Die Erdbebenwarte*, iii., 1904, pp. 196–202).

Prof. Omori contributes a note on the variations of sea level on the east coast of Japan to part xiii. of vol. ii. of the reports of the Tokio Physico-Mathematical Society. The curves of barometric pressure and sea level are very similar, and approximately reversed; the maximum sea level is in September and the minimum in February, while the minimum barometric pressure is in July and the maximum in November. The range of barometric pressure is 9·3 m., corresponding to 126 mm. of sea level, while the range of sea level amounts to 276 mm. at Misaki and 219 mm. at Ayukaua; these figures show that while the local variations of barometric pressure doubtless influence the level of the sea, this is also dependent on the variations of barometric pressure over the Pacific Ocean. The net result is that the variations of pressure on the bed of the sea are the opposite of those on the adjoining land, and Prof. Omori correlates this fact with the observed variations in frequency of earthquakes originating off the east coast of Japan.

The *Deutschen Rundschau*, vol. xxvii., part i., contains an interesting note, originally printed in the Honolulu *Evening Bulletin* of June 21, 1904, by Dr. Otto Kuntze on the present condition of Kilauea, which he describes as being now dormant or extinct. There are no longer any "lakes of fire"; the old lake of lava has cooled, and is covered by a sheet of rock, and though steam issues from some of the cracks in this, no molten, or even red-hot, rock is now visible. A remarkable statement in the note is that the lava lake, formerly visible, did not mark an active vent, but was merely a reservoir of slowly cooling lava, which had flowed from the crater of Halemaumau and accumulated in the lowest part of the caldera of Kilauea. There is no authentic record of this crater, which rises from the floor of the caldera, having been in eruption since June 24, 1897, and the paper contains some strongly worded comments on the mis-statements regarding the present condition of the crater, printed in the guide books issued by the tourist agencies, mis-statements which are unnecessary, as Kilauea, even in its existing condition, is nevertheless one of the most interesting sights in the world, of which Dr. Kuntz claims that few have seen more than himself.

In No. 17 of the *Publications* of the Earthquake Investigation Committee in Foreign Languages, Mr. S. Kusakabe continues his investigations of the modulus of elasticity of rocks, and publishes some interesting results. He finds that all rocks show a marked hysteresis, that is to say, when exposed to a stress they go on yielding, apparently to an indefinite extent, though after a while the effect is masked by that due to changes of temperature, and when released from the stress the recovery takes place at a continuously decreasing rate, but apparently is never complete. Rocks in a state of strain have a higher modulus of elasticity than in the unstrained condition, and if exposed to a series of alternating stresses, increasing and decreasing in opposite directions, the mean modulus for the whole cycle is distinctly greater than that obtained by the usual method of determination. The mean modulus of elasticity decreases with the increase in amplitude of the cycle, from which it is concluded that the rate of transmission of earthquake waves is a function of their amplitude, and is less for a larger than for a smaller amplitude. The modulus of elasticity was found to have a maximum value at about 9° C., and to decrease by about half per cent. of its value for each rise of one degree of temperature; from this it is inferred that there is a tendency towards a decrease in the rate of transmission as the depth of the wave path increases. On the other hand, the average rate of transmission is higher in Archæan and Palæozoic than in the newer rocks, and from these two considerations the deduction is drawn that there is a level of maximum velocity of transmission. We may point out that in arriving at this conclusion no account is taken of the increase in pressure with depth, and the consequent increase in compression of the rocks.

Prof. Imamura, in the Tokio *Sugaku-Butsurigakkwai* (Tokio Physico-Mathematical Society), vol. ii., No. 13, adopts the same notion that there is a level of maximum rate of propagation, and places this level at a depth of a few hundred kilometres. The estimate is based on the

high rate of transmission, as much as 16 km. per second, obtained for near earthquakes by a calculation from the observed duration of the preliminary tremors, on the assumption that their rate of propagation is uniform. In another part of the paper he gives the results of direct calculation in the case of ten earthquakes the time of origin of which was known; for Tokio, at a mean epicentral distance of 665 km., the rates were 7·5 km. per second for the first, and 5·5 km. per second for the second, phase of the preliminary tremors, while Osaka, at a mean epicentral distance of 856 km., gave 8·2 km. and 5·8 km. per second respectively. These values may be accepted as more trustworthy than those obtained by the other method.

*Globus* of September 15 contains a note by Wilhelm Krebs on the distribution of submarine earthquakes, illustrated by a map of the world, on which all the recorded instances are plotted. Many of these are submarine volcanic eruptions, and their great concentration in the middle of the narrowest part of the Atlantic Ocean, between Africa and South America, is very striking. The utility of charts of this description would be much increased if they bore on their face indications of the principal trade routes of the oceans; as it is, some doubt may be felt as to whether the much greater frequency of recorded seismic phenomena in the Atlantic Ocean may not be due to a very large extent to the fact that this ocean is, proportionately, much more frequented than the Pacific. The other centres of activity, according to the map, are the West Indian islands, the west coast of South America, the south of the Bay of Bengal, the Malay Archipelago, the east coast of Japan, and the Mediterranean.

## THE RACIAL ELEMENTS IN THE PRESENT POPULATION OF EUROPE.[1]

THE lecturer opened his discourse with a graceful acknowledgment of the honour conferred upon him by the Anthropological Institute, and paid a respectful tribute to the memory of Huxley, who was the first to make the two-fold division of the peoples of Europe into xanthochroid and melanochroid races. With the name of Huxley he coupled the names of Beddoe and Broca as pioneers in European ethnographical research. To the two races mentioned above a third was soon added—the Mediterranean race—and the lecturer himself had in 1897 made a further step by dividing the population of Europe into six main races. He then dealt with criticisms which had been passed upon his own theories, chiefly by the American ethnologist Ripley, and stated that the further researches upon which he had continually been engaged since that date, and of which he was about to lay the results before the audience, had confirmed him in his first opinion. During a considerable number of years he had been diligently collecting statistics concerning the stature, colour of eyes and hair, and head measurements of the various nationalities, and now, in spite of certain *lacunae*, some of which he regretted to observe occurred in Britain, he was able to say that he possessed data covering the whole of Europe.

In no part of the world does there exist such a blending of races, such an intermixture of somatic characters, as amongst the ethnic groups which constitute the present populations of Europe, even when we make abstraction of the "national" groupings, such as Austro-Hungarian monarchy, for instance, and consider only the properly called ethnic or linguistic groups, like Slavic, Roman, Germanic, &c.

In an anthropological study of the European populations it is impossible to proceed in the same way as in the case of the majority of the so-called uncivilised peoples, where the measurements of a small series of individuals (often twenty or fifty) suffices to give an idea of the whole population.

Another method is required for the study of complicated ethnic groups. It is the combination of the statistical and the cartographical methods, in which the observations taken on many thousands of individuals permit the investigator to exclude the influence of accidental variations, and to deduce one or several racial types in the population of a given region.

Such measurements concerning the principal racial characters, for instance, the stature, the colours of the hair and the eyes, the shape of the head (expressed principally by the cephalic index, *i.e.* the centesimal relation between the length and the breadth of the head), &c., have been made in nearly all the parts of Europe—especially by the examination of conscripts for the military service.

The only countries in which such measurements are now absent are Montenegro, some provinces of European Turkey and of Caucasus. Some other countries, and not of the least civilised, have not yet furnished sufficient information. For instance, there is no data concerning the cephalic index and the stature for Prussia and some other States of northern Germany; concerning cephalic index and pigmentation for Hungary, Roumania, and Servia; concerning the cephalic index for some parts of Switzerland, of Holland, of Russia, and, the lecturer regretted to have to mention that, for some parts of the United Kingdom.

The lecturer expressed then the hope that in a short time all these *lacunae* would disappear; considering this fact, that many serious efforts are made now for studying the populations in Germany, Roumania, Russia, and Great Britain. In every case this *lacunae* represent only a small part of Europe. For the rest, the details are sufficient, and furnish a basis for general deductions.

Taking the whole mass of these results (about 20,000, expressing the observations on more than 3,000,000 of individuals), and correcting them as to be comparable with each other, the lecturer explained how he put on the maps of Europe, of a comparatively large scale (1/10,000,000), district by district, this different data, and obtained in this way the distribution of every one of the principal somatic characters throughout the different regions of Europe.

Concerning the cephalic index, Europe can be divided into four regions:—

(1) A region of long-headed people with medium-headed areas in the north-west (Scandinavia, north of Germany, Holland, Great Britain).

(2) A region in the south-west (Portugal, Spain, south of Italy, east of Balkan Peninsula), characterised by even greater length of head.

(3) A very short-headed region in western Central Europe (south-eastern France, southern Germany, northern Italy, Switzerland) and in the immediate west of the Balkan Peninsula.

(4) A region comprising Russia and Poland subdivided into three, moderately long-headed in the centre, and medium-headed on the east and west.

After discussing these regions in detail, he proceeded to the subject of stature. He remarked that the great mass of his data was compiled from measurements taken on conscripts, and explained an ingenious method by which these measurements could be modified so that they represented fairly the typical stature of the full-grown male population. In Europe there are no people of very short stature according to the classification invented by Topinard (under 1,600 mm., or 63 inches); on the other hand, this continent is distinguished by the tallest race known, the Highlanders of Scotland. Hence, for the purpose of this lecture, he would speak of statures ranging between 1650 and 1675 mm. (65 inches to 66 inches) as *medium*, those below these measurements as *short*, and those above as *tall*. Tall statures are, with a very few exceptions, particularly well represented in the north-west; the rest of the population of Europe is, again with certain exceptions, chiefly in the Balkan Peninsula, of medium or short stature. People of medium stature are found grouped round the regions where the tall peoples occur, and connect the tall races of the north-west with those of the south-east. Short statures he divided into three groups, eastern (Russia), western (France), and southern (Spain and Italy), and showed how the eastern zone communicated by narrow "channels" with other centres of short stature.

In grouping the peoples of Europe with regard to colour of complexion, eyes and hair, he had taken as the basis of his classification the *brunette* type (eyes and hair *dark* brown or black), as the most easy of recognition. Those peoples among whom are found from 17 per cent. to 30 per cent. of brunettes may be called *intermediate*. Where less

[1] Summary of the Fifth Huxley Memorial Lecture, delivered before the Anthropological Institute of Great Britain and Ireland, on October 7, by Dr. J. Deniker, president of the Anthropological Society of Paris, to whom was presented the Huxley Memorial medal.

than 17 per cent. occur the population is termed *blond*, where more than 30 per cent. dark.

According to this grouping the two extremes are the Swedish (3 per cent. brunettes) and southern Italy (70 per cent.). From this point of view the map showed that north Europe was mainly blond, South Europe dark, and Central Europe intermediate. He traced the southern limit of the blond races through the various countries, showing that it nowhere reached below the 50th parallel in Central Europe, and below 55th parallel in Britain and Russia. The northern limit of the dark peoples is more irregular. In the intermediate zone blond areas are rare (one of these occur in south England, *i.e.* Berkshire, Oxfordshire, Hampshire, Sussex and Middlesex), dark areas fairly numerous, but individually very small. Intermediate areas in the blond zone are only found in the British Isles, but in the dark zone are fairly frequent in western Europe.

From these data and certain other considerations relating to shape of face and nose, character of hair, &c., Dr. Deniker had been confirmed in his theory that the present population of Europe is composed of six main races. These he proceeded to enumerate, giving their typical characteristics, tracing their positions throughout the map, and indicating the proportions in which they had intermingled to form the existing populations of the various countries. The following is an abbreviated sketch of his classification :—

(1) A race, blond, wavy-haired, long-headed, very tall, with long face, a straight prominent nose; the *northern race*, so called because its representatives are confined almost exclusively to North Europe. This is the *Cymric race* of Broca, the *Germanic* or *Reihengräber* race of German authors, the *Teutonic race* of Ripley, or the *Homo Europaeus* of Lapouge.

With this race is connected a subrace, blond or intermediate, straight-haired, medium-headed, of tall or medium stature, angular face, and *retroussé* nose, the *subnorthern race*, found in the neighbourhood of the *northern*.

(2) A race blond, straight-haired, moderately short-headed, and of short stature, broad square face, nose often *retroussé*; the *Eastern race*, so named since its principal home is in eastern Europe.

Connected with this is a subrace, blond or intermediate, medium-headed, of very short stature, named the *Vistulian race*, occurring in Poland, parts of Prussia, and probably Saxony and Silesia.

(3) A race dark, hair sometimes curly, long-headed, of very short stature, straight or *retroussé* nose; the *Iberoinsular race*. This is the *Mediterranean race*, or *Homo Mediterraniensis* of certain authors, found chiefly in the Iberian Peninsula and the islands of the western Mediterranean.

(4) A race dark, very short and round headed, of short stature, round face, broad nose, and thick-set body; the *Cevenole* or *western race*. This type occurs in its greatest purity in the extreme west of Europe, though found sporadically elsewhere. This is the race called variously by other authors *Celtic, Celto-Ligurian, Celto-Slavonic, Sarmatian, Rhetian, Ligurian*, or *Homo Alpinus*.

(5) A race very dark, moderately long-headed, and fairly tall; the *Littoral*, or *Atlanto-Mediterranean race*, situated on the coast of the Mediterranean, from Gibraltar to the Tiber, and in occasional groups on the Atlantic Littoral, but never more than 150 miles from the sea.

(6) A race dark, short-headed, tall, nose slender and straight or arched; the *Adriatic* or *Dinaric race*, which is found grouped round the northern Adriatic, particularly in Bosnia, Dalmatia, Croatia, and the centre of the Balkan Peninsula, but found also sporadically and with somewhat modified characteristics in Central Europe.

With the last two races are connected two secondary races, which are perhaps no more than types, produced by the admixture of the two former with each other or with the *northern, subnorthern*, and *western* races.

(*a*) The north-western, long- or medium-headed, situated between the *northern* and *Atlanto-Mediterranean* races, spread chiefly in Ireland.

(*b*) The sub-Adriatic, moderately short-headed, more rarely short-headed, of medium stature, found in many parts of Central Europe, probably the result of admixture between the *Adriatic* and *subnorthern* and *western* races.

## *REPORT OF THE SURVEY OF INDIA.*

THE Indian Survey report is a full record of useful work and widespread progress, but it lacks some of the interest which used to attach formerly to the very varied character of the work undertaken by the Survey department. The scientific section of the report is included within the limits of a few pages; and the narratives of individual surveyors (which always formed a most interesting chapter or two) have entirely disappeared.

The main work of the department, now, is the revision of old mapping in districts which have been sorely in need of such revision for many years. The plains of India, in fact, are being re-surveyed, and, on the whole, the work of the department is increasing, rather than diminishing, on purely utilitarian lines. It would almost seem as if the days of Indian geodetic triangulation, which once took such a strong lead amongst the scientific triangulations of the world, were numbered. Only one first-class series is in progress at present, and this is to connect the great meridional Mandalay series of Burma with a future extension following the Salwin valley. It is, however, satisfactory that the practice and training necessary for surveyors in this class of work is well maintained so far, for it is impossible to say what the future may demand in the way of similar extensions in Persia, Tibet, or even in China.

One subject of special interest dealt with in the report is the deflection of gravity. In 1901 a theory was advanced by Major Burrard that deflections of gravity in India could be classified by regions. Astronomical determinations of latitude have therefore been carried systematically through considerable arcs to prove whether this theory were sound. The results undoubtedly support Major Burrard's prediction, and it is expected that the substitution of this regional law for the old theory of local attraction will exercise a profound influence on future investigations.

The report on geographical or reconnaissance surveys (on the scale of 1/500,000) includes an out-turn of 38,000 square miles of survey of this class by one native assistant in western Tibet. This seems a remarkably large out-turn for one surveyor to secure during the progress of a "shooting expedition"; but it is only one instance amongst many of the remarkable capacity of well trained native explorers for work of this nature. In reasonably easy country there seems to be hardly any limit to their power of producing fairly accurate geographical maps so long as they have a few fixed points to work upon.

In this connection it is well to note the remarks of the Surveyor-General (Colonel St. G. Gore) on the difficulty that constantly faces him of finding qualified native assistants to meet the demands of military or political missions or geographical expeditions. He most justly observes that in the first place it is difficult to find the men who possess the necessary qualifications, and in the second that, having found them, it is impossible to train them efficiently in country which is unsuitable for instruction. It is due to a combination of natural aptitude with perfect educational environment that the native explorer of the Indian Survey becomes so extraordinarily efficient as a topographer. If these men are wanted (and they *are* wanted) for Imperial duty over half of the continents of Africa and Asia, it seems but fair that the Imperial Treasury should contribute something towards maintaining a sufficient staff to meet all demands. T. H. H.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

CAMBRIDGE.—The State Medicine Syndicate reports that during the current year there were 57 candidates for the diploma in public health, of whom 34 were successful. For the diploma in tropical medicine and hygiene there were 12 candidates, of whom 8 were successful. The syndicate has resolved to hold two examinations for the latter diploma in 1905, the first beginning on January 10, the second on August 8.

Applications for the vacant readership in botany (annual stipend 300*l*.) are to be sent to the Vice-Chancellor by Tuesday, November 15.

Mr. R. H. Lock, late Frank Smart student in botany, has been elected to a Drosier fellowship at Gonville and

Caius College. Dr. A. C. Haddon, university lecturer in ethnology, has been elected to a senior fellowship at Christ's College.

A DEPARTMENT of experimental psychology has been established, says *Science*, in the Western University of Pennsylvania, under the charge of Dr. Edmund B. Huey.

THE new medical buildings of the University of Liverpool will be opened by the Chancellor, Lord Derby, on Saturday, November 12, and on the same day Lord Kelvin will formally open the new George Holt Physics Laboratory.

THE council of the University of Liverpool has just appointed Dr. J. H. Grindley lecturer in engineering, Mr. A. Leitch assistant lecturer in engineering, and Mr. G. E. Piper demonstrator in applied mechanics and engineering design and drawing.

WE regret to learn of the death of Prof. D. W. Fiske on September 17. The bulk of his estate, including the great book collections, has been left to Cornell University. It is stated in *Science* that the bequest amounts to between 100,000*l.* and 200,000*l.*

DR. E. G. COKER, of the McGill University, Montreal, has been appointed to the professorship of mechanical engineering and applied mathematics at the City and Guilds Technical College, Finsbury, vacated by the appointment of Prof. Dalby to the professorship of engineering at the institute's Central Technical College.

MR. FRANCIS GALTON, F.R.S., has endowed a research fellowship in the University of London for the promotion of the study of "national eugenics," defined as "the study of the agencies under social control that may improve or impair the racial qualities of future generations either physically or mentally." The fellowship is of the annual value of 250*l.*, is tenable for one year in the first instance, and is renewable for two subsequent years. The person appointed to the fellowship will be required to devote the whole of his time to the study of the subject, and in particular to carry out investigations into the history of classes and families, and to deliver lectures and publish memoirs on the subject of his investigations.

THE report on the work of the department of technology of the City and Guilds of London Institute for the session 1903-4 has now been published. The general introduction to the report points out that the encouragement now offered by the Board of Education to the teaching of technology is among the causes contributing to the increase in the number of students in the institute's registered classes. Compared with the figures given in last year's report, those for the past session show a decided improvement. In the different branches of technology, the number of students in November last attending classes in the United Kingdom was 41,089 as compared with 38,638 in the previous year, and the number of examinees was 20,051 as against 17,989. The closer connection of the work of the department with that of the Board of Education is shown, also, not only by the recognition of the City and Guilds of London Institute as an organisation for the inspection of classes in technology, manual training, and domestic economy, but also by the stamping by the Board of Education of full certificates granted by the institute to students who pass in technology and have "qualified in the cognate science or art subjects required by the institute." It is interesting to find that the question of arranging courses of instruction adapted to the requirements of operatives engaged in shipbuilding is under consideration; it is intended to extend the syllabus in ship carpentry and joinery so as to make it suitable for artisans engaged in other branches of the industry. Care is to be taken not to overlap the syllabus in naval architecture of the Board of Education, and it is expected that the new examination will appeal to a different class of candidates from those who have hitherto presented themselves for examination. It should be noted that the department of technology of the institute occupies an intermediate position between the central and local education authorities and the several trade societies. The latter bodies have shown a growing interest in technical instruction, and year by year the department has grown into more intimate relationship with these trade organisations.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Entomological Society,** October 19.—Prof. E. B. Poulton, F.R.S., president, in the chair.—Dr. T. A. **Chapman** exhibited a series of *Lozopera deaurana*, Peyr., bred last spring at Hyères, a species regarded as lost, or mythical, until he re-discovered it three years ago at Ile Ste. Marguerite, Cannes. He also exhibited on behalf of Mr. Hugh Main a specimen of *Pieris brassicae*, the anterior and posterior wings of which had been symmetrically injured, probably by the girdle when in the pupal stage.—Mr. G. C. **Champion** exhibited specimens of *Nothorrhina muricata*, Dalm., from Las Navas, Spain, found trapped in the earthenware cups used to collect the exuding resin on the trunks of pines.—Mr. H. St. J. **Donisthorpe** exhibited specimens of the rare beetle, *Cis bilamellatus*, Wood, taken at Shirley on October 10 last.—Mr. W. J. **Lucas** exhibited a ♀ specimen of the rare dragonfly *Agrion armatum*. He said that a ♂ and a ♀ were taken in the Broads by Mr. F. B. Browne last year, and this year about ten more, probably all ♀♀, were taken in the same district. Besides these there are possibly no other examples in Britain. It is quite distinct from our other six blue Agrionines in form and colouring.—Mr. W. J. **Kaye** exhibited five specimens of *Dianthoecia luteago*, var. *ficklini*, from North Cornwall, taken during the first week of July, 1901, and remarked that while the typical *D. luteago* of the Continent was tolerably constant, wherever it occurred in Britain it assumed a special local form.—Prof. E. B. **Poulton,** F.R.S., exhibited a number of specimens of the genus Sphecodes, five species in all, and of *Ocyptera brevicornis*, a Tachinid, their mimetic fly, illustrative of Mr. Edward Saunders's recent paper on the aculeate Hymenoptera from the Balearic Islands and Spain.—Mr. C. A. J. **Rothney** sent for exhibition a series of the Indian ant *Myrmicaria fodiens*, from a colony established thirty-two years in the big banyan tree in Barrackpore Park; and specimens of *Monomorium salomonis*, Lin., and *Solenopsis geminata*, Fab., successfully encouraged in Madras as a protection against white ants—termites.—Mr. E. E. **Green** exhibited a spider from Ceylon mimetic of some coccinellid beetle, at present unidentified.—Colonel J. W. **Yerbury** exhibited specimens, and read notes upon, deer gadflies taken by him this year in Scotland.

### MANCHESTER.

**Literary and Philosophical Society,** October 18.—Prof. W. Boyd Dawkins, F.R.S., president, in the chair.—Dr. W. A. **Bone** read a paper entitled "The Mode of Combustion of Hydrocarbons," in which he gave an account of researches carried out by Messrs. R. V. Wheeler and W. E. Stockings and himself, at the Owens College, on the slow combustion of hydrocarbons below their ignition points.—Dr. Charles H. **Lees** exhibited a modification of the U-tube used in electrolysis which he had devised, and which diminishes to about one-half the correction for pressure due to the column of liquid in the unsealed limb of the tube.

### PARIS.

**Academy of Sciences,** October 24.—M. Mascart in the chair.—Stereoscopy without a stereoscope: J. **Violle.** In a camera, furnished with two objectives, directly in front of the plate is placed a grating, ruled with 100 black lines to the inch. The negative from this contains the two sets of images, each crossed with a set of fine bands. When this is looked at through a similar ruled plate the picture appears in relief.—On the modifications of glycolysis in the capillaries caused by local modification of the temperature: R. **Lepine** and M. **Boulud.** The experiments were made on dogs. Relatively to the arterial blood, the venous blood of the warmer part always contains a little more sugar. In the case of the paw kept cool, this difference is increased to about double, and is in the same direction.—On integral functions of finite order: L. **Leau.**—On certain partial differential equations of the second order: S. **Bernstein.**—On the period of antennæ of different forms: C. **Tissot.** On account of the high value of the deadening, the rotating mirror method does not give accurate figures for the period, and the author describes another method which is free from this objection. It is

shown that, independently of the principal period, the antennæ give rise to oscillations of a higher order, the laws for which have been experimentally worked out.—Study of the sea bottom of the North Atlantic; the Henderson and Chaucer Banks: M. **Thoulet.** The examination of the deposits obtained from the bed of the North Atlantic by the Prince of Monaco renders the existence of the Henderson and Chaucer Banks improbable. The proportion of lime found was remarkably uniform, whilst the amount of sand was very variable. It results that the usual method of classification by sand, although very useful near the coasts, is useless for the study of great depths.—Remarks on a recent series of calorimetric determinations: P. **Lemoult.** Some recent calorimetric determinations with the Krœker bomb by E. Fischer and F. Wrede are re-calculated to constant pressure, and the results compared with the original figures of Berthelot and some later unpublished ones of Landrieu. The numbers given by the formulæ of the author are also tabulated in parallel column.—The extraction of vanadium from the natural lead vanadate and the manufacture of some alloys of this metal: H. **Herrenschmidt.** The mineral is treated in a reverberatory furnace with carbonate of soda and carbon, and a slag obtained containing the vanadate, aluminate, and silicate of soda along with oxide of iron. This is again melted, and air blown through until the vanadium is completely oxidised, and the sodium vanadate lixiviated.—On a new anhydride of dulcite: P. **Carré.** The new anhydride is obtained by heating dulcite with phosphoric acid at 135° C. It is isomeric with mannide, and is named dulcide.—A new method for preparing organic derivatives of phosphorus: V. **Auger.** The solution obtained by dissolving granulated phosphorus in alcoholic soda is heated with an alkyl iodide or bromide. An alkylphosphine is formed, recognised after its oxidation to the corresponding alkylphosphinic acid.—The influence of the products of the breaking down of albuminoid materials on the saponification of oils by cytoplasma: Ed. **Urbain,** L. **Perruchon,** and J. **Lancon.**—On the tyrosinase of the fly: C. **Gessard.** In *Lucilia Caesar*, in both stages in the life of the insect, the coloration of the integument is due to the reaction of the tyrosinase.—On a parasite of *Audouinia tentaculata, Angeiocystis audouiniae*: Louis **Brasil.**—Oscillations of coast-line animals synchronous with the tide: Georges **Bohn.**—On the geology of the Lower Engadine: Pierre **Termier.**—On the toxicity of the chlorohydrate of amyleine: L. **Launoy.**

## DIARY OF SOCIETIES.

*THURSDAY*, NOVEMBER 3.

CHEMICAL SOCIETY, at 8.—Note on the Action of Nitric Acid on the Ethers: J. B. Cohen and J. Gatecliff.—The Condensation of Formaldehyde with Acetone (Preliminary Note): E. A. Werner.—Union of Hydrogen and Chlorine. Rate of Decay of Activity of Chlorine: J. W. Mellor.—The Action of Phthalic Anhydride on α-Naphthylmagnesium-bromide: S. S. Pickles and C. Weizmann.—The Constitution of Nitrogen Iodide: O. Silberrad.—The Available Plant Food in Soils: H. Ingle.—The Combustion of Ethylene: W. A. Bone and R. V. Wheeler.—The Decomposition of Methylurea: C. E. Fawsitt.—The Influence of Certain Salts and Organic Bodies on the Oxidation of Guaiacum: Miss E. G. Willcock.—The Influence of Potassium Persulphate on the Estimation of Hydrogen Peroxide: J. A. N. Friend.—The Dynamic Isomerism of α- and β-Crotonic Acids (Preliminary Note): R. S. Morrell and E. K. Hanson.—The Influence of Sunlight on the Dissolving of Gold in an Aqueous Solution of Potassium Cyanide: W. A. Caldecott: (1) The Fractional Hydrolysis of Amygdalinic Acid; (2) Isoamygdaline: H. D. Dakin.

RÖNTGEN SOCIETY, at 8.15.—The Presidential Address: C. Thurston Holland.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Presidential Address, The Effect of Patent Law on Modern Civilisation: C. T. Hanssen.

*FRIDAY*, NOVEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—Conversazione.

*MONDAY*, NOVEMBER 7.

ROYAL GEOGRAPHICAL SOCIETY (Albert Hall), at 8.30—The Work of the National Antarctic Expedition: Captain R. F. Scott, R.N.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Trend of Invention in Chemical Industry: J. Fletcher Moulton, F.R.S.

*TUESDAY*, NOVEMBER 8.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Coast Erosion: A. E. Carey.—Erosion on the Holderness Coast of Yorkshire: E. R. Matthews.

*WEDNESDAY*, NOVEMBER 9.

GEOLOGICAL SOCIETY, at 8.—On the Occurrence of *Elephas meridionalis* at Dewlish, Dorset. No. II. Human Agency Suggested: Rev. Osmond Fisher.—Notes on Upper Jurassic Ammonites, with Special Reference to Specimens in the University Museum, Oxford. No. II.: Miss Maud Healey.—Sarsen-Stones in a Clay-Pit: Rev. E. C. Spicer.

*THURSDAY*, NOVEMBER 10.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The premiums awarded for papers read or published during the session 1903–4 will be presented, and the president, Mr. Alexander Siemens, will deliver his inaugural address.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Presidential Address on the Theory of Waves on Liquids: Prof. H. Lamb.—Note on the Application of the Method of Images to Problems of Vibrations: Prof. V. Volterra.—On the Zeros of Certain Classes of Integral Taylor's Series: G. H. Hardy.—The Linear Difference Equation of the First Order: Rev. E. W. Barnes.—Curves on a Conicoid: H. Hilton.—Remarks on Alternants and Continuous Groups: Dr. H. F. Baker.—On the Expansion of the Elliptic and Zeta Functions of $\frac{2}{3}K$ in Powers of $q$: Dr. J. W. L. Glaisher.—Examples of Perpetuants: J. E. Wright.—Two Simple Results in the Attraction of Uniform Wires obtained by Quaternions, with, for comparison, their Verification by the Geometry of the Complex: Prof. R. W. Genese.—On the Reducibility of Covariants of Binary Quantics of Infinite Order: P. W. Wood.—On some Properties of Groups of Odd Order: Prof. W. Burnside.

*FRIDAY*, NOVEMBER 11.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—Descriptions of Three New Species of Opisthostoma from Borneo: E. A. Smith, I.S.O.—Two Apparently New Species of Planispira from the Islands of Java and Gisser: Rev. R. Ashington Bullen.—The Anatomy of *Siliqua patula*, Dixon: H. Howard Bloomer.—On the Genus Tomigerus, with Descriptions of New Species: H. von Ihering.—Notes on Some New Zealand Pleurotomidæ: Henry Suter.—Notes on Some Species of Chione from New Zealand: Henry Suter.

SOCIOLOGICAL SOCIETY, at 4.—Relation between Sociology and Ethics: Prof. Höffding.

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